Co-funded by the Erasmus+ Programme of the European Union

CCSAFS
Climate Change, Sustainable Agriculture & Food Security

University of Crete

MSc Degree
Climate Change, Sustainable Agriculture and Food Security

eBook
Collection of Course Syllabi/Modules

MSc Degree "Climate Change, Sustainable Agriculture and Food Security"

The MSc Programme in Climate Change, Sustainable Agriculture and Food Security (CCSAFS)[1] funded by the Erasmus+ Programme Capacity Building in the Field of Higher Education [**Ref. No. 573881-EPP-1-2016-1-EL-EPPKA2-CBHE-JP (2016-3770-001-001)]** is the first post-graduate programme in the MENA region (Middle East and North Africa). It was conceptualized, initiated and coordinated by Prof. Dr. Vassilios Makrakis at the University of Crete, Greece with the participation of four Universities from Egypt, namely Aswan University, Al Azhar University, Heliopolis University and Suez Canal University and four Universities in Jordan namely, Jerash University, Jordan University, Jordan University of Science and Technology and Mutah University. Besides University of Crete, Frederick University, Cyprus and University of Padova, Italy were also part along with two NGOs, namely, RCE (Regional center of Expertise) Crete on Education for Sustainable Development and Sustainable Development Foundation (SDF/SEKEM) from Egypt.

The MSc in CCSAFS is being implemented by Jerash University and Suez Canal University with the support of all other partner Universities both conventionally and blended, using a Moodle-type Learning Management System (LMS). 43 students are currently enrolled in both programmes. A multi-stakeholder and participatory course curriculum development has been applied in a way to reflect the real needs nationally and regionally.

The MSc. in CCSAFS consists of 6-9 compulsory courses ranging from 7 to 10 ECTS each and 6-9 optional or electives of 5-10 ECTS each. In total, the course work amounts 90 ECTS during the three semesters and 30 ECTS for the thesis during the 4th semester. In total, the MSc. consists of 120 ECTS. All the courses are inter/multidisciplinary combining aspects from the field of Climate Change, Sustainable Agriculture and Food Security.

In this eBook, a detailed description of the course modules can be accessed through the codes and titles of the MSc in CCSAFS in each partner country.

[1] The content in this eBook expresses the views of the authors and the CCSAFS Consortium and does not necessarily reflect the views of the European Commission. The European Commission is not liable for any use that may be made of the information contained herein.

Suez Canal University, Egypt

Compulsory Courses

Course Code	Course Title	ECTS
CSAF801	Climate Change: Adaptation and Mitigation	8
CSAF860	Applications of GIS and Remote Sensing	8
CSAF802	Sustainable Management of Soil and Water	8
CSAF880	Statistics and Design and Analysis of Biological Experiments	7
CSAF803	Economics of Climate Change	7
CSAF820	Sustainable Livestock Management	7
CSAF870	Applications of Biotechnology in Sustainable Agriculture	7
CSAF890	Social Entrepreneurship in the Organic Food Industry	7
CSAF875	Sustainable Fisheries and Food Security	7

Elective Courses

Course Code	Course Title	ECTS
CSAF830	Sustainability Justice of Food Security and Climate Change	5
CSAF835	Small-Scale Farming and Local Knowledge	5
CSAF840	Risk Analysis in Food Chain	5
CSAF845	Precision Farming	5
CSAF850	Consumer Behaviour, Marketing and Food Security	5
CSAF855	Environmental Governance	5

Jerash University, Jordan

Core Courses

Course Code	Course Title	ECTS
604 710	Climate Change, Sustainable Agriculture and Food Security	10
604 712	Climate Change: Adaptation and Mitigation	10
604 718	GIS Applications in Climate Change, Sustainable Agriculture and Food Security	10
603 719	Sustainable Management of Soil and Water	10
604 716	Economics of Climate Change, Sustainable Agriculture and Food Security	10
604 714	Research Methods and Advanced Statistics Analysis	10

Elective Courses

Course Code	Course Title	ECTS
604 726	Sustainability Justice and Food Security	10
604 722	Small Scale Farming, Indigenous Knowledge and Local Food Supply	10
604 728	Social Entrepreneurship in the Organic Food Industry	
604 723	Risk Analysis in the Food Chain	10
604 724	Precision Farming	10
604 720	Consumer Behavior, Food Security and Marketing	10
604 727	Sustainable and Ethical Livestock Management	10
6 04 721	Sustainable Fisheries and Food Security	10
6 04 725	Unsaturated Soil in Arid and Semi-arid Region	10

Course Syllabus

Course Name: Climate Change Mitigation and Adaptation

Suez Canal University

Faculty of Agriculture

Fall Semester, 2018

Instructor Information

Instructor: Khalid El-Sayed Abd El-Hamed Ibraheim and Marwa Samir Kamel
Office Location: Faculty of Agriculture, SCU, New Campus
Telephone: 01285142310- 01005759406
Office Hours: Monday, 10-12
Wednesday, 11-1
E-mail: isaoscu@gmail.com , marwa.samir@yahoo.com
Website: ----------

Course Identification

Course Name: Climate Change Mitigation and Adaptation

Course Location: Center of Excellence in Climate Change, Sustainable and Food Security

Class Times: Sunday: 10 am-1.00 pm

Prerequisites: None

Faculty Web Page: http://agri.scuegypt.edu.eg/?page=pages&page_id=479

Course Description/Overview

The impacts of climate change on agriculture could be devastating in many areas. Adaptation and mitigation measures are urgently needed to reduce the adverse impacts of climate change.

Mitigation – reducing climate change – involves reducing the flow of heat-trapping greenhouse gases into the atmosphere, either by reducing sources of these gases or enhancing the "sinks" that accumulate and store these gases. The goal of mitigation is to avoid significant human interference with the climate system, and stabilize greenhouse gas levels in a timeframe sufficient to allow

ecosystems to adapt naturally to climate change and ensure that food production is not threatened .

Adaptation – adapting to life in a changing climate – involves adjusting to actual or expected future climate. The goal is to reduce the vulnerability to the harmful effects of climate change (e.g. sea-level rising, more intense extreme weather events or food insecurity).

Course Learning Objectives

This course is designed to provide students with comprehensive knowledge and skills concerning climate change adaptation and mitigation approaches. This course examines issues related to the impacts of climate change on agriculture and adaptation responses and to the mitigation of greenhouse gases. In particular, the course analyses achieving reductions in greenhouse gas emissions through the implementation of different actions in the agricultural sector. The overall goal of the course is to evaluate the strategies for adaptation and mitigation and in particular strategies related to agriculture and ecosystems as well as recommend mechanisms and their potential benefits.

Course Content Learning Outcomes

At the end of this course participants will be able to:

- Analyze the impacts of climate change on the agricultural sector.
- Explain the main factors that affect agricultural productivity.
- Examine adaptation and mitigation measures needed to reduce the adverse impacts of climate change on agriculture.
- Explain the major sources of greenhouse gas emissions, and how agriculture can help in reducing emissions through specific agricultural practices.
- Identify the factors that affect the yield and quality under unsuitable climate conditions.
- Evaluate new genotypes and strains to overcome biotic stresses.
- Evaluate and compare crop pests and climate change and risk.
- Recognize insects' adaptation and mitigation**.**
- Apply practice control pests in the field.

- Explain the evolution Arthropod diversity and extinction.
- Apply Integrated Pest Management techniques**.**

Course Resources

Required Course Texts and Materials:

- **Course Notes (Class note will be prepared and distributed at the beginning of the lectures).**
- Reddy P.P. (2015) Impacts of Climate Change on Agriculture. In: Climate Resilient Agriculture for Ensuring Food Security. Springer, New Delhi.
- Tubiello, F. (2012). Climate change adaptation and mitigation: challenges and opportunities in the food sector. Natural Resources Management and Environment Department, FAO, Rome.
- Altieri, M. A., and Nicholls, C. I. (2017). The adaptation and mitigation potential of traditional agriculture in a changing climate. Climatic Change, 140(1), 33-45.
- Howden, M., Soussana, J.F. & Tubiello, F.N. 2007. Adaptation strategies for climate change. Proc. Nat. Ac. Sciences 104:19691-19698.
- IPCC. 2007. *Mitigation of Climate Change*. Assessment Report 4, Working Group III, Inter- Governmental Panel on Climate Change.
- Bakkegaard, R. K., Møller, L. R., & Bakhtiari, F. (2016). Joint adaptation and mitigation in agriculture and forestry (No. Working Paper 2). Copenhagen, Denmark: UNEP DTU Partnership.
- Petzoldt, C. and A. Seaman. (2007). Climate Change Effects on Insects and Pathogens. Fact Sheet.
- http://www.climateandfarming.org/clr-cc.php.
- Petzoldt, C. and A. Seaman. (2007). Climate Change Effects on Insects and Pathogens. PowerPoint file. http://www.climateandfarming.org/clr-cc.php
- Wolfe, D. W., Ziska, L., Petzoldt, C., Seaman, A., Chase, L., & Hayhoe, K. (2008). Projected change in climate thresholds in the Northeastern US: implications for crops, pests, livestock, and farmers. *Mitigation and Adaptation Strategies for Global Change*, *13*(5-6), 555-575.

Optional Course Texts and Materials

- Mendelsohn, R. (2008). The impact of climate change on agriculture in developing countries. *Journal of Natural Resources Policy Research*, *1*(1), 5-19.
- Climate change adaptation and mitigation: challenges and opportunities in the food sector. Food and Agriculture Organization of the United Nations (FAO) Natural Resources Management and Environment Department Rome, September 2012
- Pathak H, Aggarwal PK and Singh SD (Editors). 2012. Climate Change Impact, Adaptation and Mitigation in Agriculture: Methodology for Assessment and Applications. Indian Agricultural Research Institute, New Delhi. pp xix + 302.
- Rosenzweig, Cynthia and Tubiello, Francesco Nicola, "Adaptation and mitigation strategies in agriculture: an analysis of potential synergies" (2007). *NASA Publications*. 25. http://digitalcommons.unl.edu/nasapub/25

- Whitney, S, J. Whalen, M. VanGessel, B. Mulrooney. 2000. Crop Profile for Corn (sweet) in Delaware. http://www.ipmcenters.org/CropProfiles/docs/DEcorn-sweet.html
- Das, S. B. 2015. Impact of climate change on insect pests and future challenges. National Training on Climate Resilient Soil Management Strategies for Sustainable Agriculture, 14 October to 3 November, 2015, pp.78-84.Assignments and Grading Scheme

Grading Policy

Assignments	**20%**
Oral Exam	**20%**
Final Exam	**60%**
Total Points	**100**

Course Schedule

Week	Date	Topics
1		Unit 1.1: Climate change terminology.
2		Unit 1.2: Historical overview of climate change.
3		Unit 1.3: Climate change: evidence and causes.
4		Unit 2.1: Climate Change Impact on Agriculture I.
5		Unit 2.2: Climate Change Impact on Agriculture II.
6		Unit 3.1: Climate change adaptation. I
7		Unit 3.2: Climate change adaptation. II
8		Unit 3.3: Climate change adaptation. III
9		Unit 4.1: Climate change mitigation. I
10		Unit 4.2: Climate change mitigation. II
11		Unit 4.3: Climate change mitigation. III

12		Unit 5.1: what is Phenology? Unit 5.2: Effect of climate change on insect migration Unit 5.3: Impact of climate change on pests adaptation and mitigation
13		Unit 6.1: Change geographic distribution and population dynamics of insect pests. Unit 6.2: The Diversity of Arthropods
14		Unit 6.3: Effects on expression of resistance. Unit 6.4: Adaptation of integrated pest management to future pest risks.
15		Final Exam

Course	**Climate Change Mitigation and Adaptation** **Developed by Dr. Khalid El-Sayed Abd El-Hamed, and Dr. Marwa Samir Kamel, Suez Canal University**
Module 1	**Climate change terms, concepts and the physical science basis**
Key Concepts	Global warming, greenhouse gas, carbon footprint, fossil fuel, vulnerability.
Overview	The module examines climate change from an international perspective, with particular emphasis placed on Egypt case. The course opens with a brief review of the latest scientific findings and the most recent developments in climate change. The module covers the terminology, history and evolution of climate change. This module is an introductory step for student to the other advanced modules and courses and helps pave the road for studying climate change impacts on agricultural sector.
Aim	Introduce student to a comprehensive knowledge on causes and impacts of climate change with a special emphasis on agricultural and natural resources systems.
Learning Outcomes	At the end of this module participants will be able to: - Understand climate change meaning from global viewpoint. - Recognize the most important terminology and history of climate change. - Recognize the scientific evidence for climate change.
Units	Unit 1.1: Climate change terminology. Unit 1.2: Historical overview of climate change. Unit 1.3: Climate change: evidence and causes.
Readings	- Course Notes.

	- The United Nations Framework Convention on Climate Change glossary of climate change acronyms and terms (http://unfccc.int/essential_background/glossary/items/3666.php). - NASA global climate change (https://climate.nasa.gov/evidence/). - Le Treut, H., R. Somerville, U. Cubasch, Y. Ding, C. Mauritzen, A. Mokssit, T. Peterson and M. Prather, 2007: Historical Overview of Climate Change. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.(https://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter1.pdf). (https://royalsociety.org/~/media/Royal_Society_Content/policy/projects/climate-evidence-causes/climate-change-evidence-causes.pdf).
Activity	**Overview**
	Assignment 1: 1. Search for 5 possible terms dealing with climate change (other than what were listed in the lecture) 2. Then consider whether these terms are important/used in our community 3. From your list, choose one and write 3-4 paragraphs telling more about it. Why it is a suitable climate change term? How does it fit into our community's and personal interest? Explain why it is applied in the current climate change context? Assignment 2: Design a power point presentation that addresses the history of the climate change you should use resources from both suggested readings and alternative resources. Assignment 3: Using the internet, search for educational video clips addressing climate change evidence and cause (using your solid knowledge, decide which of these clips were more convincing to you and in turn the public about climate change awareness) - Video viewing (https://www.youtube.com/watch?v=rxbQDXhZ4fs) (https://www.youtube.com/watch?v=ReR8Tv--5jQ). The video is about Climate change: evidence and causes which will open a discussion after viewing on how do scientists know that recent climate change is largely caused by human activities?
Project Work:	**Project Title: How do Humans Impact Climate Change?** Students need to have an understanding of the greenhouse effect and how the atmosphere is heated, and then they will examine various forces that impact the climate change. In this project, students will not only learn how the greenhouse effect works on Earth, but they will also examine how the greenhouse effect is impacted by various human related phenomena. They will research drivers of climate such as carbon dioxide (both natural and anthropogenic). Finally, students will discuss how changes in the poles will have impacts on the global climate system in terms of rising sea water levels, and

	they will finish the project with how they can personally reduce their impact on Earth in substantial and meaningful ways. Students will be learning valuable science content, as well as research skills, writing, defending an argument, and analyzing scientific information. Students will discover new information about climate change and its impact on Earth. Process includes examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage, land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land) **Project Steps:** 1. Students brainstorm ways humans impact the Earth 2. Students will research various climate drivers 3. Students will use website to calculate their own personal footprint http://www.footprintcalculator.org/ There will be work as individuals, in pairs, in small groups, and as a whole class. **Assessment of Students** The students will be assessed through: collaborative work skills, research and reporting.

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
		X											**X**		**X**		

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	9h	**8h**	**-**	**8h**	**12h**	**8h**	**-**	**-**	**45h**

Module 2	**Climate change impact on agriculture and natural resources.**
Key Concepts	Rising global temperatures, less precipitation, intense droughts and floods, salinization.
Overview	The impacts of climate change on agriculture could be devastating in many areas. Many regions already feel these impacts, which will get progressively more severe as mean temperatures rise and the climate becomes more variable. Scientific evidence about the seriousness of the climate threat to agriculture is now unambiguous, but the exact magnitude is uncertain because of the complex interactions and feedback processes in the ecosystem and the economy. Five main factors will affect agricultural productivity: changes in temperature, precipitation, carbon dioxide fertilization, climate variability, and surface water runoff.
Aim	This module is designed to provide students with comprehensive knowledge and skills concerning the impacts of climate change on agriculture and adaptation responses and to the mitigation of greenhouse gases.
Learning Outcomes	At the end of this module participants will be able to: - Show understanding of the impacts of climate change on agricultural sector - Explain the main factors that affect agricultural productivity.
Units	Unit 2: Impacts of climate change on agriculture
Readings	- Course Notes.

<table>
<tr><td></td><td>

- Reddy P.P. (2015) Impacts of Climate Change on Agriculture. In: Climate Resilient Agriculture for Ensuring Food Security. Springer, New Delhi.
- Mendelsohn, R. (2008). The impact of climate change on agriculture in developing countries. *Journal of Natural Resources Policy Research*, *1*(1), 5-19.

</td></tr>
<tr><td>Activity</td><td>Overview</td></tr>
<tr><td></td><td>

Storytelling activity:

Climate change impacts and adaptation: Story from my Nepalese village:

Madan Poudel, a youth agriculture activist and student from Nepal, personal story on how climate change is affecting his community, and how farmers are trying to adapt to an increasingly variable climate.

(https://ccafs.cgiar.org/blog/climate-change-impacts-and-adaptation-story-my-nepalese-village#.WjLl-fVrxdg)

The story won the Climate Change, Agriculture and Food Security (CCAFS) open blog competition for the South Asia region.

Video viewing:

Climate Change and Agriculture: Impacts, Adaptation, and Mitigation(https://www.youtube.com/watch?v=QAg-g5VhxGs)

Assignment 1:

Design a power point presentation that addresses the impact of climate change on agriculture you should use resources from both suggested readings and alternative resources.

Assignment 2:

Using the internet, search for video clips addressing impact of climate change on agriculture (using your solid knowledge, decide which of these clips were more robust to you as agricultural specialist)

Project Work: In this module Student still work in the project.

</td></tr>
<tr><td>SDGs</td><td>

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	X				X							X		X		

</td></tr>
<tr><td>ECTS WORK LOAD</td><td>

Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
6h	4h	-	4h	6h	4h	-	-	224h

</td></tr>
<tr><td>Module 3</td><td>Adaptation to and mitigation of climate change in agriculture</td></tr>
<tr><td>Key Concepts</td><td>Adaptation, mitigation, deforestation, ecosystem</td></tr>
<tr><td>Overview</td><td>Climate change will have far-reaching consequences for agriculture that will affect the poor. Greater risks of crop failures and livestock deaths are already imposing economic losses and undermining food security and they are likely to get far more severe as global warming</td></tr>
</table>

<table>
<tr><td></td><td>continues. Adaptation and mitigation measures are needed urgently to reduce the adverse impacts of climate change, facilitated by concerted international action and strategic country planning. As a major source of greenhouse gas emissions, agriculture also has much untapped potential to reduce emissions through reduced deforestation and changes in land use and agricultural practices.</td></tr>
<tr><td>Aim</td><td>This module is designed to provide students with comprehensive knowledge and skills concerning climate change adaptation and mitigation approaches. This module examines issues related to adaptation responses and to the mitigation of greenhouse gases.</td></tr>
<tr><td>Learning Outcomes</td><td>At the end of this module participants will be able to:
- Examine adaptation and mitigation measures needed to reduce the adverse impacts of climate change on agriculture.
- Explain the major source of greenhouse gas emissions, and how agriculture can help in reducing emissions through specific agricultural practices.</td></tr>
<tr><td>Units</td><td>Unit 3: Climate change adaptation
Unit 4: Climate change mitigation</td></tr>
<tr><td>Readings</td><td>Course Notes.
-Tubiello, F. (2012). Climate change adaptation and mitigation: challenges and opportunities in the food sector. Natural Resources Management and Environment Department, FAO, Rome. High-level conference on world food security: the challenges of climate change and bioenergy, Rome, 3-5 June 2008.
-Altieri, M. A., and Nicholls, C. I. (2017). The adaptation and mitigation potential of traditional agriculture in a changing climate. Climatic Change, 140(1), 33-45. https://link.springer.com/article/10.1007%2Fs10584-013-0909-y</td></tr>
<tr><td>Activity</td><td>Overview
Brainstorming activity:
This activity is designed to generate creative ideas about adaptation to and mitigation of climate change in agriculture through group discussion. Every participant will be encouraged to suggest as many ideas as possible.
Assignment 1: Similar to the ones introduced to you in the lectures; prepare a poster representing a mind map about several adaptation to and mitigation of climate change in agriculture techniques.
-Video viewing:
Linking Climate Change Adaptation And Mitigation In Agriculture And Forestry (https://www.youtube.com/watch?v=Y6UF9i7yllM)
Project Work: In this module Student still work in the project.</td></tr>
</table>

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	X	X			X			X		X					X		

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	18h	8h	-	10h	18h	4h	-	-	58h

Module 4	Changes in Arthropod pests Phenology
Key Concepts	Phenology , Migration, Athropoda and Natural enemies
Overview	We being our discussion with two difficult questions: What are the arthropod pests , and what is a Phenology? At first these question seem easy. Anyone, after all, can tell the relation between the climate change and pests, or impact of climate change on arthropoda . However, absolute definitions are not nearly as easy. Questions to be addressed in this module include the following: Why study Insect Migration? What are the insects Adaptation and mitigation? .
Aim	The overriding aim of this module is to turn students able to discourse on complex balance of phenology. How climate change could impact plant pests management practices.
Learning Outcomes	At the end of this module learners will be able to: • Describe and install of the Phenology • Evaluate and compare crop pests and climate change and risk. • Recognize insects adaptation and mitigation
Units	Unit 5.1: what is Phenology? Unit 5.2: Effect of climate change on insect migration Unit 5.3: Impact of climate change on pests adaptation and mitigation
Readings	Whitney, S, J. Whalen, M. VanGessel, B. Mulrooney. 2000. Crop Profile for Corn (sweet) in Delaware. http://www.ipmcenters.org/CropProfiles/docs/DEcorn-sweet.html Shelton, A.M., W.R. Wilsey, and D.M. Soderlund. 2001. Classification of insecticides and acaricides for resistance management. Dept. of Entomology, NYSAES,Geneva,NY14456.315-787-2352. http://www.nysaes.cornell.edu/ent/faculty/shelton/pdf/res_mgmt.pdf
Activity	**Overview** Assignment 1: The scientific study of some crop pests You will be observing prepared slides and living specimens using the compound light microscope. Insects and spiders representing each of living organisms are available. Your lab report should include microscopic drawings and answers to the questions found at the end of the lab. Your drawings should be complete with titles, magnification and labels. Draw the cells you observe at a magnification that best represents the cell or organism. It is always helpful to use your book, lab manual, or other reference material while making observations and writing up your lab report. Assignment 2: Changes in insect phenology can be studied through long-term experiments with variable Sowing dates for observing the appearance of pests on crops. Likewise, the timing of arrival of insect species can also be recorded through light traps, suction traps or pheromone traps. Analysis of long-term data on phenology would reveal changes in the timings of pest appearance under the climate change. Assignment 3: Design a power point presentation that addresses the Phenology and relation with pests you should use resources from both suggested readings and alternative resources Assignment 4: Brainstorming activity: This activity is designed to generate creative ideas about Adaptation, mitigation of pests and relation with climate change in agriculture through group discussion. Every participant will be encouraged to think aloud and suggest as many ideas as possible. **Project Work: In this module Student still work in the project.**

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	X	X		X		X		X		X			X		X		

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	6h	4h	-	6h	6h	6h	15h	-	43h

Module 5	Pest Managements strategies in the face of climate change
Key Concepts	Diversity, Climate change- pest Management
Overview	Integrated Pest Management (IPM) is a systematic plan which brings together different pest-control tactics into one program. It reduces the emphasis on pesticides by including cultural, biological, genetic, physical, regulatory, and mechanical controls. To carry out an IPM program, you need to scout and monitor your fields, recognize abnormal conditions and identify their causes, understand the different control methods available, and determine the economic costs and climate change effects. A good IPM program requires planning, monitoring and evaluation finally Adaptation of integrated pest management to future pest risks. **Climate change will expose crops and pests to higher temperatures. Predictions until the year 2050 assume an increase of 2°–3°C, if CO_2 emissions cannot be reduced (Fig. 1)**
Aim	The overriding aim of this module is to the climate change and Pest Managements strategies
Learning Outcomes	At the end of this module learners will be able to: • Apply that knowledge as they practice control pests in the field • Explain the evolution Arthropod diversity and extinction

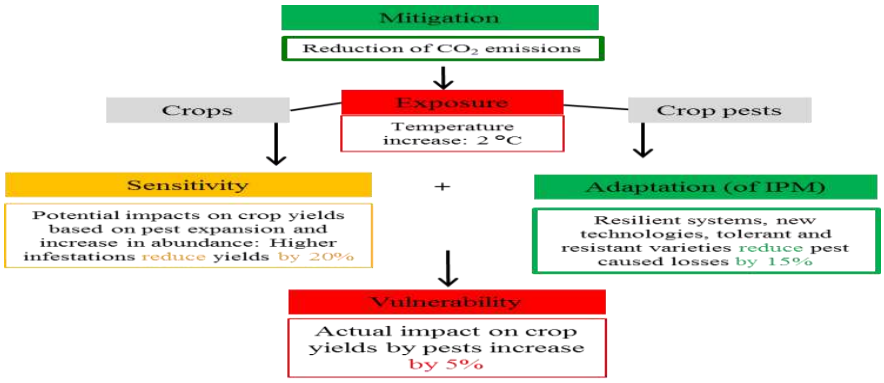

Fig1: Reducing crop vulnerability to new and emerging pests by adaptation of IPM. Figures given on yield reductions are only examples to highlight the importance of adaptation in order to reduce the magnitude of higher pest infestations due to climate change.

	• Recognize of some meaning like IPM
Units	Unit 6.1: Change geographic distribution and population dynamics of insect pests. Unit 6.2: The Diversity of Arthropods Unit 6.3: Effects on expression of resistance . Unit 6.4: Adaptation of integrated pest management to future pest risks.
Readings	Joshi S and Viraktamath C A 2004.The sugarcane woolly aphid, Ceratovacuna lanigera Zehntner (Hemiptera:Aphididae): its biology, pest status and control. Current Science 87:307-316. Kaiser J 1996.Pests overwhelm Bt cotton crop. Nature 273: 423. Petzoldt, C. and A. Seaman. 2007. Climate Change Effects on Insects and Pathogens. FactSheet. http://www.climateandfarming.org/clr-cc.php 2) Petzoldt, C. and A. Seaman. 2007. Climate Change Effects on Insects and Pathogens. PowerPoint file. http://www.climateandfarming.org/clr-cc.php 3) Wolfe, D. W., Ziska, L., Petzoldt, C., Seaman, A., Chase, L., & Hayhoe, K. 2008. Projected change in climate thresholds in the Northeastern US: implications for crops, pests, livestock, and farmers. Mitigation and Adaptation Strategies for Global Change, 13(5-6), 555-575.
Activity	**Overview**
	Assignment1: Each learner carries out several tasks and the results are shared in a collaborative learning project. **Task 1**: research on integrated pest managements **Task 2**: 300-word summary of each control, including defenders (authors), period, application, several examples, and limitations of the control **Task 3**: sharing by email or through a forum, chat room, or mailing list **Task 4**: shared two-page paper **Task 5**: production of a reflective report. For example: task 5 Each member of the group produces a reflective report that answers the following ,questions, among others: - What have I learned about the design, technical aspects, and individual and group organization of work in collaborative learning? - How did I learn? - What helped me to learn?

- How much time did I spend on this activity?

Assignment 2:

Design a plan taking into consideration As a group of organisms is being classified, each sorting stage gives us a new level in the system of classification. At the first level, sorting results in the kingdom level, for instance' animal' kingdom or' plant' kingdom. The groups that result from the second sorting make up the phylum level, the third sorting gives us the class level and further sorting gives us the order, family, genus and species levels in turn. In this way most organisms are sorted into plant and animal kingdoms. Animals can then be classified into a number of phyla and each phylum in turn may then be classified into several classes, each class into several orders and so on. As we do this and move from a higher to a lower level of Classification, we find the animals in groups become more and more alike in structure

The community-based or service-learning activity:

After introducing the IMP concept to student during classes and practical work, they will be asked to transfer their scientific knowledge to farmer's field through field trips organized by the course staff members. The location where the activity will be applied will be chosen wisely as it should be within low income, small farmers who lack the access to agricultural extension. The activity will be down under the supervision of course instructors.

The damage caused by pests is one of the primary factors leading to the reduced production of major crops. The economic impact related to the direct damage caused by pests is to the purchase of expensive pesticides. For small scale farmers any strategies which will reduce their expenses such as IPM, will be highly beneficial. For more effectiveness, the activity will be coordinated with the other agencies which are more familiar with applying such action. For example, the university community convoy and the directorate of agriculture in Ismailia governorate are among those agencies.

Integrated Pest Management (IPM) is a major component of climate change adaptation and mitigation course curriculum and it occupy a separate module. The module will provide the student with knowledge, skills and tools for developing agricultural practices that meet IPM. The activity will help merge the theoretical background gained through curriculum with real world situation in farmer's field. Practical skills will be gained through engaging in such activity. Again the choice of activity location is a key point in its success. The location should reflect local community needs. It can be selected within the local communities where the students reside. In this case the student will have the opportunity to work with their local people and bring a great help to close society.

It's suggested as part of the activity that student should design a flyer in simple non-scientific langue which will be distributed through their field visits. In this way, the knowledge gained by the students will be able to transfer and shared with the local farmers.

	Again, the damage caused by pests is one of the main factors leading to the reduced production of main crops. This community-based activity is absolutely providing the student the chance to contribute in resolving a real community need. **Project Work: In this module Student will report project outcomes.**

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
	X	**X**			**X**			**X**		**X**					**X**		

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	3h	**4h**	**-**	**4h**	**6h**	**6h**	**15h**	**2h**	**40h**

Course Workload

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**					**Workload**
				1	**2**	**3**	**4**	**5**	
Lectures (face-to-face)	14	3	42	9	6	18	6	3	42
Online	14	2	28	8	4	8	4	4	28
Reading articles (3 pages per hour)	120	0.25	30	8	4	10	4	4	30
Reading book chapters (5 per/h)									
Preparing course activities	8	6	48	12	6	18	6	6	48
Project work	6	5	30	8	4	4	6	8	30
Preparation for exam	2	15	30	-	-	-	15	15	30
Writing the exam	1	2	2	-	-	-	-	2	2
Total			**210**	45	24	58	43	40	**210**

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Course Syllabus

Applications of GIS and Remote Sensing

Suez Canal University, Faculty of Agriculture
Course No: CSAF860

Semester I

Instructor Information

Instructor: **El-Sayed Ewis Omran, Professor**
Office Location: **Suez Canal University, Faculty of Agriculture**
Telephone: 01098353956
Office Hours: Monday- Wednesday: 10 am-14 pm
E-mail: ee.omran@gmail.com
Website:

Course Identification

Course Number: CSAF860
Course Name: Applications of GIS & RS
Course Location: Laboratory of CoE in CCSAFS
Class Times: Will be identified for each semester
Prerequisites: None
Faculty Web Page:

Course Description/Overview

This course focuses on the geographic information systems technology (GISs) and remote sensing (RS), which are powerful data visualization, data analysis, and image processing tools. This course is designed to introduce students to advanced concepts of geographic information science in climate change, sustainable agriculture and food security for the purpose of spatial analysis and geo-visualization of environmental issues. Students will learn to understand and apply GIS and RS technologies and methodologies to important topics in environmental studies. Students will learn the fundamentals of mapping, photogrammetry, GIS, and RS. Students will learn to acquire and prepare data for analysis related to environmental research, model and analyze data, and interpret and map environmental data they might encounter in their careers. Students will also read, assess, and discuss peer-reviewed literature to become familiar with the latest methodologies and techniques to examining environmental issues.

Topics include exploring geoscience methods, geoscience methods for climate change, sustainable agriculture and food security, casting climate variability and change, relating information from different sources, data collection for environmental management, water footprints, irrigation and groundwater mining, impacts of land use, soil characteristics and their relationship to land use practices, predicting the effects of climate change on soil loss, global food security, systems thinking and the wicked problem of global food security, climate change and food security.

The course is designed for students with background in Agricultural, Environmental, biological and related disciplines.

Course Learning Objectives

By the end of this course, students will be able to:

- Identify GIScience concept and how it is used to gather, manage, check, process, analyze, model, and interpret environmental spatial data.
- Learn scientific knowledge and practical experience of geographic information systems technology and remote sensing.
- Evaluate environmental GIS data and information produced by government agencies, industry, academia, and popular media
- Identify environmental spatial data needed for particular tasks used in climate change, sustainable agriculture and food security
- Use commonly available GIS and remote sensing software (e.g. ArcGIS, Google Earth) to view, assess and present spatial datasets (e.g. shapefiles, satellite imagery).
- Develop, analyze, and produce research to apply GIS and RS in climate change, sustainable agriculture and food security
- Present products of their environmental analyses in written and oral/visual form as maps, interactive graphics, videos, etc.

Course Content Learning Outcomes

1- Knowledge and concepts:

- Describe the fundamental concepts of Geographic Information Science and Technology.
- Demonstrate proficiency in the basic functions of QGIS, SAGA, and ArcGIS Pro software.
- Give an overview of remote sensing instruments and platforms, ENVI software, as well as analysis and visualization methods in GIS.

2- Intellectual and mental skills

- Display own results and write scientific reports.
- Demonstrate awareness of fundamental remote sensing and spatial analysis techniques.
- Carry out digital image processing of remote sensing data with analysis and visualization in GIS.

3-Professional and practical skills:

- Apply good practices in GIS and RS software.
- Demonstrate basic proficiency in map creation and design principles, including thematic map display, employment of map projections, and cartographic design.
- Demonstrate proficiency in the creation and acquisition of spatial data.
- Perform different analysis (e.g. raster and vector models, geoprocessing problems, sampling design with GIS, vegetation indices in RS, optical RS, and classification).
- Execute a project based on remote sensing and GIS.

4- General and transferable skills:

- Communicate effectively with others.
- Use appropriate audiovisual aids in a presentation.
- Deal with information and interpret phenomena verbally by report writing.
- Improve self- assessment.
- Identify the personal learning needs.
- Define rules for assessing the performance of others.
- Develop indicators for assessing the performance of others.
- Work in a team and understand group behavior.
- Manage time efficiently.
- Demonstrate self and continuous learning.

Course Resources

Course Website(s)

Websites and Internet articles

1. http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html
2. ESRI, 2013. ArcGIS II: Essential Workflows (Student Edition), ESRI Press, Redland, California.

A. ENVI and ENVI EX, http://www.ittvis.com

B. ESRI website: http://www.esri.com

C. ESRI ArcLessons: http://gis2.esri.com/industries/education/arclessons/arclessons.cfm

Required Course Texts and Materials

- PowerPoint presentations prepared by the instructor for the participants.
- Handouts will be distributed at the beginning of each lecture.
- Hands outs prepared by the instructor for the class

Textbooks:

1. Bolstad, P., 2012. GIS Fundamentals: A first text on Geographic Information Systems (4th edition), Eider Press, White Bear Lake, Minnesota. (http://www.paulbolstad.net/gisbook.html).
2. Aronoff, S., 2005. Remote Sensing for GIS Managers. ESRI Press.
3. Chang, K., 2013. Introduction to Geographic Information Systems, 7th edition, McGraw Hill, New York.

Other equipment/software/websites/online resources

This course requires the use of the following software: ArcGIS Pro

Google Earth

Optional software requirements: R, QGIS

Assignments and Grading Scheme

Writing assignments are required and may include, but are not limited to, the following:

I. Writing short answer responses given questions related to remote sensing.

II. Documenting the workflow involved in acquiring and processing earth images for data analysis appropriate to intended users..

III. Writing and then presenting a final semester project, which includes a demonstration of problem solving and incorporates imagery acquisition, data processing and formal written presentation.

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading Policy

Grades can be based on the following: (Example)

Final Examination	60%
Oral Examination	10%
Semester Assignments and class participation	10%
Practical Examination	20%
Total Points	**100**

Course Policies

Late Assignments

It is essential that papers and assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come to ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assigned material before you come to class.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by-case basis.

Course Schedule

Week	**Date**	**Topics, Reading, and Assignments (Details on assignments and more bibliography are available in the course modules)**
1		Exploring Geoscience methods
2		Introduction to Geoscience methods and climate change
3		Introduction to Geoscience methods and sustainable agriculture
4		Introduction to Geoscience methods and food security
5		Forecasting Climate Variability and Change: A Matter of Survival
6		Relating information from different sources
7		GPS data collection for environmental management
8		What is Sustainability in the Context of Water? Water Footprints
9		Irrigation and Groundwater Mining
10		Impacts of Land Use
11		Soil Characteristics and Their Relationship to Land Use Practices
12		Predicting the Effects of Climate Change on Soil Loss
13		Systems Thinking and the Wicked Problem of Global Food Security.
14		Climate Change and Food Security
15		**Oral and Final Examination**

Course	**GIS & RS Applications in Climate Change, Sustainable Agriculture and Food Security**
Module 1	**Introduction and definitions of key concepts**
Key Concepts	Geoscience, Climate change, Sustainable agriculture, Food security
Overview	The module is designed to introduce students to geoscientific thinking and to utilize these techniques in solving a climate change, sustainable agriculture and food security problem through a systems approach. Parts of this module may be done outside of class time and some aspects may be adaptable to online use. Climate change, sustainable agriculture and food security are problems that were chosen as the vehicle for exploring the methods of geoscience owing to the importance of the topic for society and because of the tremendous volume of data available for building lessons and activities. This module gives students the opportunity to use and reflect on geoscientific thinking. The module begins with an exploration of how geoscience methods are similar to and different from the stereotypical experimental scientific method. Then, students use methods of geoscience (e.g., systems thinking, multiple converging lines of evidence, developing spatial and temporal frameworks) in a data-rich, interdisciplinary exploration of the human impacts of global climate change. They will use spatial and temporal data, data visualizations and Google Earth to address the climate change, sustainable agriculture and food security problem. Finally, students explore high-quality, freely available curricular resources to develop a standards-based, interdisciplinary lesson that embeds geoscientific thinking and content as part of biology, chemistry, Earth science, physics or social science instruction.

Aim	Students explore geoscientific thinking in comparison to the generalized (experimental) scientific method, investigate global climate change and its impact on human systems, explore high-quality resources for geoscience, and prepare interdisciplinary lessons that address geoscience methods and content along with other scientific or social science content.
Learning Outcomes	At the end of this module learners will be able to: • Develop a deeper understanding of the process of science and how to foster that understanding in their students • Engage in a data-rich activity that is well-aligned with the Next Generation Science Standards • Make an argument about the development of coastal communities based on evidence from sea level rise and tropical storm intensity • Become familiar with high-quality, online resources
Units	• Unit 1.1: Exploring Geoscience methods • Unit 1.2: Introduction to Geoscience methods, sustainable agriculture, climate change and food security
Readings	• Tang, H., Li, Z., 2014. Quantitative Remote Sensing in Thermal Infrared • Chang, K., 2013. Introduction to Geographic Information Systems, 7th edition, McGraw Hill, New York. • DeMers, M. N., 2009. Fundamentals of Geographical Information Systems, 4th Edition, John Wiley and Sons. • Gorr W.L. and Kurland K. S., 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, Redland, California, ESRI Press.
Activity	[Overall Time: 20 hours] Activity 1 Linked to Learning Outcome Motivates and engages students through the issue of climate change in a socio-scientific context. This activity first assesses students' prior knowledge and then familiarizes students with a data-rich, interdisciplinary exploration of the human impacts of global climate change by watching a video about climate change, analyzing CO_2 and temperature data, and critically reading an editorial about Hurricane Sandy. By the end of this activity, students will be able to Describe climate change and its impact on the human-built systems such as coastal communities. **Description and Teaching Materials** ***Materials:*** Provide students with the After the Storm handout (student directions) (Microsoft Word (.docx)) or the electronic version of the student page. Provide students with Table 1: The Issue from the Tables 1, 2, and 3 (student work) (Microsoft Word (.docx)). NOTE: If you print Table 1, it may need to be expanded so that students have more room to record their responses. Another suggestion is to use Google Docs. Students then can share and edit the document with all group members. Other materials for Activity 1 include the following: • Environmental Protection Agency (Climate Change Indicators in the United States) (Acrobat (PDF)) • Rising Sea Levels • Earth System Research Laboratory (Trends in Atmospheric Carbon Dioxide) Students should also have a print copy of After Sandy: Why We Can't Keep Rebuilding on the Water's Edge, an article from *Time* magazine. **Activity Outline:** **Interpret Air Temperature and CO_2 Data**

First, display (e.g. a projector) the temperature and CO_2 data using the links below. For each data set, have students record and analyze the air temperature and CO_2 data in the "observed" row of Table 1: The Issue (OWL chart). The instructor should guide what data sets students record and analyze in Table 1. In the second row of the OWL chart, have students record what they "wondered" regarding both data sets. If students do not elicit a possible correlation between the data sets, then it is recommended that the instructor prompt them to do so.

- Environmental Protection Agency: Climate Change Indicators (Acrobat (PDF)): Use figures 1, 2, and 3.
- Earth System Research Laboratory: Trends in Atmospheric Carbon Dioxide: Examine all tabs.

Watch the Video: Rising Sea Levels
Next, have students watch Rising Sea Levels. This engaging and dramatic six-minute video highlights the effects of climate change on coastal communities. As students watch the video, have them record what they "observed" and "wondered" in the first column of Table 1: The Issue (OWL chart). Then, discuss their responses with the class.

Read the Editorial: After Sandy, Why we Can't Keep Rebuilding on the Water's Edge
Finally, give students a hard copy of a short editorial from *Time* magazine titled: After Sandy: Why We Cannot Keep Rebuilding on the Water's Edge, by Brian Walsh. You may also choose other motivating articles (see resources below) for students to read. As they read the article, have them complete the third column of Table 1: The Issue (OWL chart). Again, students record what they "observed" and "wondered" about. Then, students discuss their responses with the class.

Activity 2.1 Formative Assessment Linked to Learning Outcome

To conclude, have students record what they learned from the video, the article, and the data in the in the second to last row of Table 1. Discuss their responses with the class.
Note: The entire OWL chart is really one large formative assessment, not just the last row. However, this row will provide the instructor with information about students' overall knowledge and understanding of the topic before they conduct their research and help the instructor identify possible student misconceptions.
In addition, have students describe what they feel is their "muddiest point" about the data (e.g., Does an increase in global CO_2 concentration increase global air temperature?). This will provide the instructor with evidence of what students do and do not understand.
Teaching Notes and Tips
The following modifications can save in-class instructional time:
Have students complete the first row of Table 1 as well as the "observed" and "wondered" rows of Table 1 independently outside of class. Then, review students' responses in class. It is suggested to complete the "Learned" row of Table 1 and the muddiest point in class. This adjustment could save 40 minutes of class time.

Module 1	**Time-load**
Directed Learning Online ❑ Viewing presentations and reading articles as specified in the activities	3 hours
Dynamic Interaction online ❑ Discussing or engaging with the e-tutor and/ or peers	1.5 hour
Assessment ❑ Individual and Group Contributions and Discussion Forum	Expected from 25-55 hours for this module, as the student may be directly working on the creation of for assessment.

	[Note: Time allowed for preparing Assessment work can vary from 1-7 hours on average per module]	
	Independent Learning ❑ Private online or offline engagement with readings, peers or experts [Note: Time available to spend on Independent learning can vary from 7-30 hours in final weeks]	At the discretion of the student
	Total Time for Module 1	Approximately 29.5- 59.5 hours required for engagement within this module, plus an additional 7-30 hours for independent learning at your own discretion.

SD Pillars	**environment**	**economy**	**social**	**culture**
21st ESD	Learning to know ✓ Learning to be ✓ Learning to do ✓		Learning to live together ✓	Learning to transform oneself and society ✓ Learning to give and share ✓

SDGs Sub goals	1	2	3	4 ✓	5	6	7	8	9 ✓	10	11	12	13	14	15	16	17

Vision 2030	Through a systems approach, geoscientific thinking techniques utilize solving a climate change, sustainable agriculture and food security problem. This will ensure that all economic, social and technological progress occurs in harmony with nature.

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6 h	**3 h**	**2 h**	**11 h**	**20 h**	**-**	**-**	**-**	**42**

Module 2	**Climate Change**
Key Concepts	GIS, Climate variability, Climate data, Climate change survey, Data collection
Overview	In this three-week module, students use QGIS to explore short-term climate variability resulting from atmosphere-ocean-ice interactions. The module promotes awareness of past and contemporary cultures and regions strongly affected by permanently altered or increasingly uncertain climates as students consider human adaptation to climate fluctuations. Students investigate the dynamics and impacts associated with climate variability by examining and analyzing atmosphere, and ocean data; completing a series of readings; and engaging in group discussions. Materials and teaching descriptions for gallery walks, interactive discussions, group work, and lab exercises are provided.
Aim	• Use QGIS to analyze climate data and evaluate how interactions between climate system components lead to climate variability that impacts human societies. • Identify to which climate change opinion group they belong (alarmed, concerned, cautious, disengaged, doubtful, or dismissive) using a climate change survey instrument. • Compare the class distribution of climate change opinions to the national distribution. • Determine their own and their community's social vulnerability to climate change based on demographic factors. • Distinguish between climate change mitigation and adaptation and the potential pros and cons of each strategy.

	• Summarize several methods of 21st-century adaptations to climate change, including agroforestry, floodplain reclamation, and response to extreme heat waves.
Learning Outcomes	This module has a **positive focus on adaptations to climate change**. Activities provide students opportunities to think locally, regionally, and globally. They drive thinking about climate change and social vulnerability. **Students use real, current ocean and atmosphere data** to learn about climate change. Activities provide concrete ways to learn abstract concepts like uncertainty, anomalies, and feedback. Students consider questions about climate and society for which they cannot Google the answer. **Activities get students out of their chairs.** A diverse suite of activities (gallery walks, games, discussions, lab exercises, and small-group activities) provides students opportunities to be involved. This engages quieter students, and both professors and students have fun!
Units	• Unit 2.1: Forecasting Climate Variability and Change: A Matter of Survival • Unit 2.2: Relating information from different sources • Unit 2.3: GPS data collection for environmental management
Readings	Chang, K., 2013. Introduction to Geographic Information Systems, 7th edition, McGraw Hill, New York. Allen, D. W., 2010. GIS Tutorial 2: Spatial Analysis Workbook, 2nd Edition for ArcGIS 10. Redland, California, ESRI Press. Gorr, W.L. and Kurland, K. S., 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, Redland, California, ESRI Press.
Activity	Overall Time: 24 hours This unit is designed to engage students in the topics of climate variability and climate change by introducing them to impacts of changes on human society and cultures. A class discussion focuses on examining the differences between climate change and climate variability, the impacts on different cultures, and the causes of climate change.
	Case Study 1- Adapting to a Changing World Linked to Learning Outcome My goals in creating this activity were to: • Provide an understanding of current national attitudes about climate change. • Illustrate the difference between climate change mitigation and climate change adaptation strategies. • Provide structured opportunities to identify effective 21st century climate change adaptation efforts. • Encourage reflection about one's own beliefs about the existence of climate change, humans' contribution to climate change, and the potential impacts of climate change on society. • Provide opportunities for reflection about the inequity of climate change and the need for climate resilience in industrialized and developing countries. Context for Use **Class format:** This activity is suitable for use in a lecture or lab setting but can also be done outside of class as a homework assignment. If this activity is done in class, the desired format is a gallery walk, during which groups of two to four students read several examples of climate change adaptation case studies, followed by a compilation of ideas about personal and local adaptations to climate change in the future. Alternatively, students may read the case studies individually outside of class and write a response to personal and local adaptations to climate change in the future. **Time required:** approximately 50 minutes, including a discussion on public opinion about climate change, climate change adaptation vs. mitigation, and the adaptation case studies. **Description and Teaching Materials**

- Adapting to a Changing World: Climate Change and Agriculture (Microsoft Word (.docx)) (student handout)
- Adapting to a Changing World: Flooding (Microsoft Word (.docx)) (student handout)

Gallery walk questions: (these will also be posted as a downloadable file) Linked to Learning Outcomes

Post each question on a piece of poster paper or whiteboard. In groups, students will be provided with a marker and copies of the climate adaptation case studies. Start each group at a particular topic, and after students have read the climate adaptation case studies for that topic, allow each group time to make notes under each question. After each group has visited each question, each group will verbally summarize, for the rest of the class, the information on the first poster that they visited. In low-enrollment classes, each group (depending on group size) could summarize the results of two questions. In high-enrollment classes, each group will likely summarize the results of one question.

Adaptation to Flooding

1. How does the Dutch strategy for adapting to climate change-related flooding differ from flood adaptation strategies in Egypt? Which country's strategy do you believe is more effective?
2. How has the government differed in its approach to adaptation in rural areas compared to adaptation in urban areas?
3. How do you feel about the government relocating individuals, whose land lies in a designated flood zone, and widening areas along the River, allowing some communities to flood?
4. The Netherlands is a wealthy, industrialized country. Which of their adaptations would be feasible in poorer, developing countries? Which of their adaptations would not?

Teaching Notes and Tips

- In getting students to differentiate between mitigation vs. adaptation, there are many geologic and nongeologic analogies that may be utilized other than "the aging starlet" story provided in the PowerPoint slides. For example, faculty using this case study in an environmental geology or natural hazards course could discuss public response to debris flow hazards. The instructor could present two debris flow response scenarios and ask students to consider which is an adaptation strategy, which is a mitigation strategy, and pros and cons of each.
- There are several methods that may be used in implementing the climate change adaptation examples activity:
  - Gallery walk #1:
    - Each student is given a handout with all of the climate change adaptation examples.
    - Questions about each set of examples are displayed on large pieces of paper, whiteboards, etc., around the classroom.
    - In groups, students visit each station, read the climate change adaptation examples from their handout, and write their responses to the questions directly on the large pieces of paper/whiteboards.
    - If the instructor chooses/if time allows, a group discussion summarizing the answers to the questions may follow.
  - Gallery walk #2:
    - Enlarge the font for the climate change adaptation examples and display the examples on large pieces of paper, whiteboards, etc. around the classroom.
    - Each group is given a handout with questions for each climate change adaptation strategy.
    - In groups, students rotate around the classroom and read the climate change adaptation examples.
    - In groups, students answer the questions (on their handout) for each set of examples.
  - Virtual gallery walk: if students have computer access, they may read the climate change adaptation examples online on the climate change adaptations page.

- Seated, small-group discussion: same procedure as gallery walk #1, only rather than students answering the questions on large pieces of paper/whiteboards around the classroom, they answer the questions on their handout in small groups.

- If possible, the audio clips on flood adaptation in the Netherlands would be an excellent addition to this activity during class. In a gallery walk setting, students could be prompted to listen to the audio clips before their group answers the flood adaptation questions. Alternatively, the clip could be played for the entire class at once.

Case Study: Uses of GIS & RS in Climate Change Detection

This case will offer a set of methods and techniques that use GIS and Remote Sensing for analysis and monitoring of climate change, with applications in climate change impacts and adaptation.
Climate change is major problem in recent years and it is a geographic problem. In addition, we can solve it by providing geospatial solution. Skillful expertize is required for the climate change detection through GIS techniques. Different information, ex pests, plant genetic resources and crop production and then these data united with the environmental datasets, such as land cover, weather for measurement of their current distribution and potential future estimated distribution under various scenarios of climatic change. Many environmental analysts using this technology for understanding such climatic complex issues and offering some important solutions.

Module 2	**Time-load**
Directed Learning Online ❑ Viewing presentations and reading articles as specified in the activities	2.5 hours
Dynamic Interaction online ❑ Discussing or engaging with the e-tutor and/ or peers	1 hour
Assessment ❑ Individual and Group Contributions and Discussion Forum [Note: Time allowed for preparing Assessment work can vary from 1-7 hours on average per module]	Expected from 30-50 hours for this module, as the student may be directly working on the creation of for assessment.
Independent Learning ❑ Private online or offline engagement with readings, peers or experts [Note: Time available to spend on Independent learning can vary from 7-30 hours in final weeks]	At the discretion of the student
Total Time for Module 2	Approximately 33.5- 53.5 hours required for engagement within this module, plus an additional 7-30 hours for independent learning at your own discretion.

SD Pillars	**environment**	**economy**		**social**		
21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓

SDGs Sub goals	1	2 ✓	3	4	5	6 ✓	7	8	9	10	11	12	13 ✓	14 ✓	15	16	17

Vision 2030	The module promotes awareness of past and contemporary cultures and regions strongly affected by permanently altered or increasingly uncertain climates as students consider human adaptation to climate fluctuations. This will lead to protect the environment through sustainable consumption and production, sustainably managing its natural resources.								
ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	8 h	**3 h**	**4 h**	**13 h**	**24 h**	**-**	**-**	**-**	**52**

Module 3	**Water Resources for Sustainable Agriculture**
Key Concepts	Water resource, Freshwater availability, Virtual water amounts, Water footprints, Geographic variability, Irrigation, Groundwater mining, Ecosystem impacts
Overview	Water is *the* most critical substance for the sustenance of life, but the prognosis for the quality and supply of water resources in much of the world is somewhere between troubling and dire. This module provides a framework for students to learn about how people interact with water, peer into our water future, and consider ways we might foster more sustainability in water management.
Aim	The students learn about the concepts of water sustainability, virtual water trade, and water footprints. The focus then turns to the interplay between agriculture and water resources, as agriculture has the greatest impact on freshwater consumption and quality. The module allows students to use several types of data to understand the patterns of crop irrigation in Egypt and link this to groundwater levels in different parts of the country. The module also helps students assess how agriculture impacts the quality of freshwater resources and employ systems thinking as it relates to nutrient runoff.
Learning Outcomes	At the end of this module students will be able to: - Evaluate the sustainability of fresh water resource use on global and regional scales. - Explain how freshwater availability and management practices pose threats to ecosystem integrity, human well-being, security, and agricultural production. - Explain what goes into the calculation of virtual water amounts and water footprints and the application of these concepts. - Explain what controls geographic variability in irrigation, groundwater mining, and ecosystem impacts of agriculture in Egypt. - Apply geoscience information and methods in interdisciplinary assessments of the sustainability of water systems.
Units	Unit 3.1: What is Sustainability in the Context of Water? Unit 3.2: Water Footprints Unit 3.3: Irrigation and Groundwater Mining This unit kicks off the Water, Agriculture, and Sustainability module. It is broken up into three sub-units, each designed to take one 60-minute class period. • In Unit 1.1 students are confronted with the problems associated with water availability, access, equity, and quality from a global perspective. They are also challenged to work together to evaluate statistics and communicate quantitative information in a graphical way. • In Unit 1.2 students learn about sustainability as a concept and water management objective. After the readings and participation in the class activity of this sub-unit, students should understand that sustainability is a contestable concept and different approaches to fostering a more secure and just *water* future are part of a larger ideological conflict.

	• Unit 1.3 focuses on case studies of unsustainable water use in agriculture. This provides a segue into the following units, which largely focus on the challenges and options associated with agricultural use of water. **Class Format:** The in-class activities of this unit are designed for working in small groups of 4-6 students. The instructor provides materials such as handouts, flip chart paper, and colored markers and moderates the activities. PowerPoint presentations are provided for class instruction. **Time Required:** The in-class activities associated with this unit are designed to take three 1-hour class periods. If the instructor opts to work through the optional slide presentations of Units 1.1 and 1.2, that could stretch out Unit 1 to four 1-hour class periods. **Special Equipment:** Unit 1.1 calls for small groups to make graphs using large sheets of paper and colored markers. Units 1.1 and 1.2 recommend that instructors foster online discussions of readings prior to the class periods for those sub-units. If instructors do not have access to online teaching platforms like Blackboard or Canvas, they could try out free online chat services like Google Hangouts. **Skills or concepts that students should have already mastered before encountering the activity:** Students can start the module with no shared preparation. Before each in-class activity of this first unit, each student will need to do the assigned readings, participate in the online discussions and (for unit 1.3) complete a homework assignment. This will give them the background necessary to analyze and critique the unit concepts and data. This unit can stand on its own, if desired. It is appropriate for college students at all levels and majors. It is of particular value in introducing Earth Science majors to the concept of sustainability and the roles of culture, politics, economics, and agriculture in the watery aspects of the Earth system.
Readings	• Brown, A. and Matlock, M., 2011. A Review of Water Scarcity Indices and Methodologies. The Sustainability Consortium, White Paper #106. University of Arkansas. • Di Nunzio, J., 2013. Conflict on the Nile: The Future of Transboundary Water Disputes over the World's Longest River. Future Directions International. Conflict on the Nile (Acrobat (PDF)) • Hoekstra, A.Y., 2011. The Global Dimension of Water Governance: Why the River Basin Approach Is No Longer Sufficient and Why Cooperative Action at Global Level Is Needed. *Water*, 3: 21-46. • Hoekstra, A.Y., 2012. The Hidden Water Resource Use Behind Meat and Dairy. *Animal Frontiers*, 2(2): 3-8. • Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E., and Richter, B.D., 2012. Global Monthly Water Scarcity: Blue Water Footprints versus Blue Water Availability. *PLoS ONE,* 7(2): e32688. • Mekonnen, M.M. and Hoekstra, A.Y., 2011. National Water Footprint Accounts: The Green, Blue and Grey Water Footprint of Production and Consumption. Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands.
Activity	Overall Time: 15 hours This unit is broken up into the following 3 sub-units. Each is designed to take a minimum of 1 class period, where a class is assumed to last 1 hour. **Unit 1.1 - Are We Sliding into a Water Crisis?** Linked to Learning Outcomes Are we in the midst of a water crisis? Is the global situation improving or deteriorating? What are the big issues? This unit delves into these matters and provides the primary justification for having a module devoted to water sustainability. The readings of this unit have a global perspective. As such, they impress upon the students how dire the situation already is in many regions of the world and how the problems are not limited to remote areas. They also highlight how water + sustainability is a highly politicized subject, providing a natural segue to the next sub-unit on sustainability. Participation on the

students' part should enhance their critical and holistic thinking, numeracy, and communication and collaboration skills.

Activity 1.1a - Homework: Reading Assignment and Online Discussion on the Water Crisis
Assign homework in preparation for the class period of Unit 1.1b. Students will read 3 short readings, watch a short video, and participate in an online discussion of the readings. The readings and discussion challenge students to assess whether or not our global water situation constitutes a "crisis." Suggested readings and discussion prompts are found in the following guidance document, as are the broader learning goals. Instructors are encouraged to award a small amount of points to students for satisfactory participation in the discussion. If instructors do not have access to online teaching platforms like Blackboard or Canvas, they could try out free online chat services like Google Hangouts.

- Instructor Guidance for Activity 1.1a: Reading and Online Discussion (Microsoft Word (.docx))

Activity 1.1b - Group Work: Analyze/Display Water-related Statistics (in class)
The downloadable Word documents below provide context, guidance, and handouts for the Activity 1.1b – Group Work: Analyze/Display Water-related Statistics. The purpose is to get students to work with and discuss water related statistics, causing them to sink in to a greater degree than simply skimming over them in a reading. The activity is also designed to enhance the critical thinking, numeracy, and communication skills of the students. As they review the statistics in small groups, they are asked to do the following:

- Identify a common theme for your water statistics.
- Decide which statistics you think are most important to share with the rest of the class.
- Collaborate in making a poster that illustrates the story or stories you wish to tell with these statistics.
- Make graphical representations of the quantitative data. Provide each graph or figure with a title and a caption. Cite the source of the information.

Each group gets a handout featuring a set of statistics centered around a different theme. By graphically illustrating some of their statistics and sharing them with each other, the entire class will learn more about our global and national level water issues. This activity sets up a discussion about the state of water resources around the world and impacts of water problems on people and ecosystems.
For classes with more than 30 students, you can have two Group 1s, two Group 2s, two Group 3s, etc., so the group sizes do not get too large. For classes with 7-12 students, you can have them work in pairs. If you have <7 students, they will each get their own water statistics handout to digest and illustrate.

- Instructor Guidance for Activity 1.1b: Group Work on Water Statistics (Microsoft Word (.docx))
- Student Handout for Activity 1.1b: Group Work on Water Statistics (Microsoft Word (.docx))

OPTIONAL Activity 1.1c - Interactive Lecture: Overview of the Water Crisis
If desired and there is sufficient time, you can also bounce through the following slide presentation to provide a framework for thinking about water problems and an overview of the geographic variability in water scarcity.

- Slides for 'Are We Sliding into a Water Crisis?' (PowerPoint)

Unit 1.2 - What is Sustainability in the Context of Water? Linked to Learning Outcome

If our working presumption is that we want to foster a future with more sustainable water resource management, then we need to get some clarity on what is meant by sustainable, sustainability, and sustainable development. This sub-unit provides an introduction to the concepts of sustainability and relates them to water resource management.

Activity 1.2a - Reading Assignment and Online Discussion of Readings
In preparation for the class period of Unit 1.2, students are assigned 3 readings and asked to participate in an online discussion of the readings. The readings and discussion introduce students to the concept of sustainability, its ethical underpinnings, and how it can relate to water resource problems and management. Suggested readings and discussion prompts are found in the following guidance document, as are the broader learning goals. Instructors are encouraged to award a small amount of points to

students for satisfactory participation in the discussion. If instructors do not have access to online teaching platforms like Blackboard or Canvas, they could try out free online chat services like Google Hangouts.

- Instructor Guidance for Activity 1.2a: Reading and Online Discussion (Microsoft Word (.docx))

Activity 1.2b - Group Work: Evaluate Definitions of Sustainability and Sustainable Development (in class)

How sustainability is regarded–as a process, an ideal state, or simply nonsense–is dependent on one's culture, ideology, and education. As a consequence of this and the relative youth of the sustainability movement, there is no universally accepted definition of sustainability. Accordingly, students should approach the concept and the writing around it critically. They should not simply accept as gospel their first readings about it or let their initial notions of it fossilize without further investigation. This activity, along with Activities 1.2a and 1.2c, are designed to help foster this deeper exploration into the concepts of sustainability and sustainable development and how proposals meant to foster them serve as ideological flashpoints.

As the activity title suggests, this group work activity has students evaluating various definitions of sustainability and sustainable development. Critical themes of the sustainability and sustainable development concepts are revealed by identifying common (and differing) elements in the various definitions. The first document below provides guidance for the instructor in running Activity 1.2b. The second document below contains the handout to be distributed to each student for this activity.

- Instructor Guidance for Activity 1.2b: Group Work Evaluating Definitions of Sustainability and Sustainable Development (Microsoft Word (.docx))
- Student Handout for Activity 1.2b: Group Work Evaluating Definitions of Sustainability and Sustainable Development (Microsoft Word (.docx))

OPTIONAL Activity 1.2c - Interactive Lecture: Defining Sustainability and Sustainable Development

If you have more time in your class, you can work through as much of the following PowerPoint presentation as you like. It is designed to elaborate on the concepts and controversies embedded in the terms sustainability and sustainable development. It also encourages students to evaluate the Sustainability Criteria for Water in the assigned reading by Peter Gleick et al., 1995 (Ch 3. Water and Sustainability*)*.

The last page in the handout provided with Activity 1.2b above goes with the lecture/slides of Activity 1.2c.

- Presentation Slides for 1.2c - Defining Sustainability and Sustainable Development (PowerPoint (.pptx))

To learn more about sustainability, particularly how cultural theory and political psychology provide insight into the different ideological perspectives that drive conflict over policies and proposals related to sustainability, instructors could access a set of relevant literature in a bibliography included in the References and Resources section below.

Unit 1.3 - Case Studies in Unsustainable Water Use in Agriculture (1 class period) Linked to Learning Outcomes

In this unit, we turn our attention to agriculture and its impacts on water resources.

Activity 1.3a - Homework/Reading Assignment on Case Studies in Unsustainable Water Use in Agriculture

In preparation for the class period of Unit 1.3, each student is assigned 1 of 5 readings and asked to consider multiple thinking prompts. Each reading provides an overview of regionally-specific unsustainable water use primarily associated with agricultural practices. Each reading can be accessed in the References and Resources section at the bottom of this page. As part of the assignment, students are asked to come to class prepared to share how the tales of agricultural water use detailed in their reading do not meet the criteria of water sustainability as outlined by Peter Gleick (1998) in his article from the preceding sub-unit (Water in Crisis: Paths to Sustainability). The first document below provides guidance on the activity for the instructor, along with the context and learning objectives for the

assignment. The second document below serves as a handout to be distributed to students that walks them through the homework/reading assignment.

- Instructor Guidance for 1.3a - Homework and Reading Assignment (Microsoft Word (.docx))
- Student Handout for Activity 1.3a: Homework and Reading Assignment on Case Studies in Water Unsustainability (Microsoft Word (.docx))

Activity 1.3b - Group Analysis of Case Studies in Unsustainable Water Use in Agriculture (60 minutes, in class)
Students participate in a jigsaw activity to discuss the readings (learn more about jigsaws). Students are first divided into groups with students that have had the same reading for the day. Each of these groups are challenged to come to some collective consensus on the water resource problems detailed in their article. They are also prompted to evaluate how the agricultural practices and the associated use of water in their article failed to meet the sustainability criteria outlined by Gleick (1998). Then, the students are shuffled into new groups so that each group has a representative for each of the 5 articles. After each student outlines from their article how water use in agriculture is not sustainable, the groups are challenged to identify the common problems between their articles and then come up with viable solutions for water sustainability in agriculture. The first document below provides guidance for the instructor to run Activity 1.3b, with context, learning objectives and teaching tips for the activity. The second document is the student handout.

- Instructor Guidance for 1.3b - Group Analysis of Case Studies in Water Unsustainability (Microsoft Word (.docx))
- Student Handout for 1.3b - Group Analysis of Case Studies in Water Unsustainability (Microsoft Word (.docx))

This PowerPoint slide presentation can be used to run Activity 1.3b.

- Slides for Activity 1.3b - Case Studies in Water Unsustainability (PowerPoint (.pptx))

Activity 2.1a - Linked to Learning Outcomes

Homework: Reading Assignment and Online Discussion on Virtual Water
This activity is to be completed as homework in advance of the class period. Suggested readings and discussion prompts are found in the following guidance document, as are the specific learning goals. Instructors are encouraged to offer a small amount of points for satisfactory participation in the online discussion.

- Instructor Guidance for Activity 2.1a: Reading Assignment and Online Discussion for Virtual Water (Microsoft Word (.docx))

Activity 2.2b - Group Work: Analysis of Individual Water Footprints and Footprints of Nations (80 minutes stretched over 2 class periods - 20 minutes on day 2 of the unit, 60 minutes on day 3)
This activity will extend over 2 class periods. After the virtual water debate (Activity 2.1c), students will work in small groups to share their individual water footprint results for 20 minutes. During the second class period, students will work in small groups to analyze various water footprint statistics and figures. Students apply this information to discuss water footprint regulation, whether or not there should be a maximum allowable water footprint amount per person or nation. The first document below provides detailed guidance for the instructor on how to run Activity 2.2b, with context and learning goals. The second document is the student worksheet.

- Instructor Guidance for Activity 2.2b: Analysis of Water Footprints (Microsoft Word (.docx))
- Student Handout for Activity 2.2b: Analysis of Water Footprints (Microsoft Word (.docx))

Power Point presentation on Water Footprints for use in class.

- Slides for Activity 2.2b: Water Footprints (PowerPoint)

Activity 4.1c - Linked to Learning Outcome

Analyzing Well Records and Google Earth Satellite Imagery (50 minutes)
In this exercise, students will look at groundwater well level records for six provinces to observe changes in water table levels over time. The exercise is based on Groundwater Watch records and

Google Earth Satellite imagery. The optimal scenario is for students to have printed records of the groundwater records and Google Earth on a web-enabled computer. If computers are not available, the other option is to use the printed imagery. The advantage of using Google Earth is that students can zoom in/out and get a more complete view of each region.
The full exercise uses two wells in each of the six Province. If the instructor is constrained for time or feels that students may be overwhelmed with this much information, there is an option to use one well per state.

If Using Google Earth:

- Students can work independently or in pairs using laptops or desktop computers that have Google Earth installed on them. First, hand out the printed copies of the Unit 4 Student Worksheet (Microsoft Word (.docx) 30kB Jan23 17) to each student. Each student, for pair of students, should have a copy of the well records (PowerPoint (.pptx) 119kB Jan23 17) either printed out or as a file that they can download and view on the computer (students seem to do better with a printed handout).
  - If the instructor is using the shortened version of the exercise, then use the well records with one well per Province (PowerPoint (.pptx)).
- Have students download the .kmz file Groundwater Well Sites (KMZ File) and have them open this in Google Earth.
  - If the instructor is using the shortened version of the exercise, then use the .kmz file with one well per state (KMZ File).
- The students can now follow the directions on the worksheet. The main part of this is recording observations from both the water table vs time plots and the terrain characteristics from the satellite imagery. In particular, students should be looking for evidence of agriculture and irrigation (such as crop circles).

If NOT Using Google Earth:

- Students should work in groups of two to four. Each student should receive a printed copy of the Unit 4 Student Worksheet (Microsoft Word (.docx) 30kB Jan23 17) and each group should have a printout of the well records and terrain images (PowerPoint (.pptx)).
  - If the instructor is using the shortened version of the exercise, then use the well records and maps (PowerPoint (.pptx)) with one well per Province.
- The students can now follow the directions on the worksheet. The main part of this is recording observations from both the water table vs. time plots and the terrain characteristics from the satellite imagery. In particular, students should be looking for evidence of agriculture and irrigation (such as crop circles).

Case Study - Adapting to a changing water level in High Dam Lake

Through field trip to Aswan High Dam, study the Environmental Impacts of the GERD Project on Egypt's Aswan High Dam Lake and Mitigation and Adaptation Options.

Module 3	**Time-load**
Directed Learning Online ❑ Viewing presentations and reading articles as specified in the activities	1.5 hours
Dynamic Interaction online ❑ Discussing or engaging with the e-tutor and/ or peers	1.5 hour
Assessment ❑ Individual and Group Contributions and Discussion Forum	Expected from 20-60 hours for this module, as the student may be directly working on the creation of for assessment.

	[Note: Time allowed for preparing Assessment work can vary from 1-7 hours on average per module]	
	Independent Learning ❑ Private online or offline engagement with readings, peers or experts [Note: Time available to spend on Independent learning can vary from 7-30 hours in final weeks]	At the discretion of the student
	Total Time for Module 3	Approximately 23- 63 hours required for engagement within this module, plus an additional 7-30 hours for independent learning at your own discretion.

SD Pillars	**environment**			**economy**				**social**			**culture**						
21st ESD	Learning to know ✓			Learning to be			Learning to do ✓			Learning to live together ✓			Learning to transform oneself and society ✓		Learning to give and share ✓		
SDGs Sub goals	1	2	3	4	5	6 ✓	7	8	9	10	11	12	13	14 ✓	15	16	17
Vision 2030	This module provides a framework for students to learn about the concepts of wate sustainability, virtual water trade, and water footprints, and consider ways we migh foster more sustainability in water management. This will lead to all human beings ca fulfill their potential in dignity and equality and in a healthy environment.																

ECTS WORK	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**	
LOAD	**8 h**	**3 h**	**3 h**	**15 h**	**15 h**	**-**	**-**	**-**	**44 h**	

Module 4	**Soil Resources for Sustainable Agriculture**
Key Concepts	Soil Characteristics, Land Use Practices, Climate Change, Soil Loss
Overview	Continued agricultural productivity and the ability to feed the earth's growing population hinges on understanding how to manage soil resources. This module addresses this need by providing students the opportunity to examine the differences between intensively managed agricultural landscapes (e.g. grazelands, conventional tillage) and "natural" landscapes (forested or prairie).
Aim	Using learning-centered strategies, students will develop a working knowledge of soil physical properties and geospatial data at both local and global scales. The module culminates with a project centered on making sustainable soil management decisions under global climate change.
Learning Outcomes	At the end of this module students will be able to: - Addresses soil sustainability in the context of land management and climate change. Students are engaged through an **active learning environment** (e.g. physical modeling, think-pair-share, and jigsaw exercises), encouraging critical thinking and reflection. The entire process requires

	that students develop **interdisciplinary thinking skills** to synthesize how soil erosion relates to land management decision-making. - Investigate the basic interactions between **Earth's spheres**, a key component of which is the positive feedback between agricultural practices and the sustainability of soil as a vital resource. They apply **systems thinking** as they consider how predicted changes in climate will impact soil sustainability in their **local** area. - Challenge their conceptual models about soil erosion and sustainability using **real-world geoscientific data,** both data they generate and data gathered from existing databases. In the process, they develop **data collection and analysis skills** and the ability to access existing data using **technology tools**. - Gain an understanding of the **nature and methods of geoscience** through building observational skills, using charts to characterize soil samples, and working with geospatial data to understand how humans alter geologic rates of change. **Geoscientific habits of mind** will grow through working with authentic data and translating scaffolded knowledge into decision-making as students take on the role of agricultural "experts."
Units	Unit 4.1: Impacts of Land Use Unit 4.2: Soil Characteristics and Their Relationship to Land Use Practices Unit 4.3: Predicting the Effects of Climate Change on Soil Loss
Readings	• Wortmann, Charles S., and Paul J., 2009. NebGuide: Management to Minimize and Reduce Soil Compaction, University of Nebraska – Lincoln Extension • Montgomery, D. R.., 2007. Soil erosion and agricultural sustainability: Proceedings of the National Academy of Sciences of the United States of America, v. 104, no. 33, p. 13268-13272. • Wilkinson, B. H., and McElroy, B. J., 2007. The impact of humans on continental erosion and sedimentation: Geological Society of America Bulletin, v. 119, no. 1-2, p. 140-156. • Gorr W.L. and Kurland K. S., 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, Redland, California, ESRI Press. • Allen D. W., 2010. GIS Tutorial 2: Spatial Analysis Workbook, 2nd Edition for ArcGIS 10. Redland, California, ESRI Press.
Activity	Overall Time: 10 hour **Overview**
	Small group work Linked to Learning Outcome *Small group work* The small group work starts by having students practice their powers of observation, followed by the small groups discussing and interpreting their observations. Observation (15 minutes): Divide students into small groups of three or four and either give each group a stack of photos of each type of landscape or project Slides 8 and 9 for a few minutes each, switching back and forth several times during the small group work time. If slides are projected, the instructor may want to make one or two sets of the photographs available for close-up viewing. Provide each group with the student instructions and one response table: • Student Instructions (MS Word version) (Microsoft Word (.docx) 17kB Feb2 15) • Response Table (MS Word version) (Microsoft Word (.docx) 18kB Feb2 15) Remind them to start by simply making observations without making any interpretations of their observations. They should then observe and list the physiographic features of the landscapes they are viewing. Discussion (15 minutes): The students should then begin discussing their observations in small groups as follows: • Groups should compare the physiographic similarities and differences between the two landscape/land use types. Each group should use the questions on the Student Instructions sheet to

help them interpret the effects of agriculture on the landscape and, to a lesser extent, the effects of weather/climate.

- Each group should record all of their observations and all of their responses to the questions on one Response Sheet.
- Students should then organize their thoughts as a group and summarize their conclusions as a short presentation for the classroom discussion that follows.

Classroom discussion

(10 minutes) Bring the groups back together and encourage students to use the remaining time to describe their observations and interpretations of how the obvious physiographic impacts of agricultural land use compare to natural land. Follow with a classroom discussion of the impacts of different types of agriculture. Project Slides 8 and 9 during the discussion so that the class can view the photographs as they are being discussed. The Talking Points provided for this exercise includes important discussions about soil erosion, sustainable agriculture, and systems thinking, including exploring the potential impacts of climate change on agriculture.

Talking points for classroom discussion (MS Word version) (Microsoft Word (.docx) 19kB Oct15 14)

- The classroom discussion should begin with the instructor checking that the students understand some of the potentially unfamiliar terms described in Section 1 of the Talking Points for Classroom Discussion (which are also shown on Slide 10). Ask students to identify images that they believe best feature soil erosion, runoff/infiltration, organic matter, anthropogenic effects, and ecosystems. Use the definitions provided in Section 1 of the Talking Points for Classroom Discussion.
- Next, ask students to use their observations to reflect aloud on why it is important to care about soil erosion. Use Section 2 of the Talking Points to support their reflections.
- Lastly (Section 3 of the Talking Points), ask them to use the photos to infer examples of what they think are either sustainable or unsustainable agricultural practices. Also, ask if they are able to infer the influence of weather or climatic effects on the agricultural landscapes.
- Wrap up by asking them to discuss, as a group, what they think humans will do if our agricultural practices disrupt our food supply.

Wrap-up homework (very short)

Provide the following homework sheet or, if class time allows, complete this activity at the end of the classroom discussion. The purpose of this part of the exercise is to have to students look at the big picture to take what they learned and consider the various connections as Earth's spheres are all interrelated. The activity is provided as Slides 15 through 17 in the Landscapes PowerPoint™ for use in the classroom.

- Unit 1 Wrap-Up Homework (MS Word version) (Microsoft Word (.docx) 1.9MB Jul20 15)
- ▶ Answer Key to Unit 1 Wrap-Up Homework -- private instructor-only file

Photographs, separated by land use

- Agricultural Landscape Photos (Acrobat (PDF) 493kB Aug11 13)
- Non-Agricultural Landscape Photos (Acrobat (PDF) 697kB Aug26 13)

Student instructions and response table—instructions and leading questions for small groups to use in making observations of the photographs

Pre-work (before class)

Each student will complete a reading, then answer questions provided on the Pre-work for Unit 5 student page. Students will investigate one of four different factors that influence erosion rates. They will bring their responses to the discussion questions and use this information in an in-class activity.

The instructor will need to assign students to one of the four factors in roughly equal numbers.

The four assigned topics are:

1. Rainfall and runoff erosivity (R factor)
2. Soil properties (K factor)
3. Landscape characteristics (LS factor)
4. Agricultural practices (C and P factors)

Note: These factors are based on the Revised Universal Soil Loss Equation (RUSLE) defined by Renard et al. (1991), where:
Estimated average soil loss (tons/acre/year) = R*K*LS*C*P

- R = rainfall-runoff erosivity factor
- K = soil erodibility factor
- LS = length slope factor
- C = cover-management factor
- P = support practice factor

Guided lecture and activities (50 minutes)

The in-class portion of this unit is a guided lecture that intersperses active learning activities throughout. The instructor can use the provided presentation (PowerPoint (.pptx) 3.4MB Jul30 14) to guide the class period. Instructions are provided in the Notes section of the Powerpoint slides and an outline of the guided lecture is included below.
A lecture notes outline (MS Word (Microsoft Word (.docx) 3.1MB Sep18 14) or pdf (Acrobat (PDF) 911kB Sep21 14)) is provided as a handout that instructors can distribute to students if desired.

- Slide 1: Overview and learning objectives
  - Display as students enter the classroom
- Slides 2-3: RUSLE homework follow-up small group activity (15 minutes)
  - Students will divide into groups with classmates who had the same factor. The size of the groups is up to the instructor; four or five students is recommended. Students will compare answers from their homework and work together to address any questions that arise. Once students have discussed their answers and reached consensus, one group for each factor will present information about their factor to the class and list any remaining unanswered questions. If there were multiple groups for each factor, each group for a given factor should get a chance to add comments and questions. If desired, the instructor can record key ideas on the board as the groups present to provide a visual reminder students can refer to throughout the class period. Once all of the factors have been discussed, the instructor will summarize the key information for each one and address any outstanding questions before moving on.
- Slides 4-6: Using the RUSLE (5 minutes)
  - In this set of slides, students will consider how the factors work together to produce a rate of soil loss. Two short thought problems are provided that can be used for quick think-pair-share discussions.
- Slide 7: Human activity vs. natural processes activity (10 minutes)
  - This activity gets students moving around the room and allows them to consider whether factors are influenced by human or natural processes, or both. The activity is structured like the classic "getting to know you" game in which participants are asked to make a choice and move to a designated space indicating their choice. In this case, you should designate one space for human activity and another for natural processes. Opposite sides of the classroom work well. If it is difficult to move around your classroom, you could also use clickers, index cards, or a show of hands.
  - How it works:
    - Tell students that when each component is revealed, they must decide if they think it is influenced more by human activity or by natural processes, then move to the designated space.
    - Advance the slide to reveal the component and corresponding photo, remind students what it means, and tell them to move to the designated space.
    - Once everyone has made their choice, have students explain to a neighbor their reasoning for choosing that side. Then ask for a few volunteers from each side to share with the whole class.
    - Clear up any confusion or ideas that need to be addressed before moving on to the next component. Note: Many components are influenced by both so there is no single correct answer. Students should be encouraged to consider multiple processes that can impact the same thing.

- Expected answers:
  - Support practices (human)
  - Soil porosity (both: texture, organic matter, and biological activity are examples of natural processes; tillage and driving machinery are examples of human activities; these are introduced in the Unit 2 homework)
  - Slope steepness (mostly natural, except in areas where terracing is a common practice)
  - Surface roughness (both: Tillage can increase surface roughness up to a point when clods are broken up too much; rainfall causes depressions to fill with sediment and decrease surface roughness over time)
  - Rainfall intensity (natural)
- Wrap-up:
  - Use rainfall intensity as a transition to the next section on impacts of climate changes by asking students what controls rainfall (climate). End with the idea that climate change influences natural processes such as rainfall and heightens the need for human action. The video in the next slide discusses this idea in the context of agriculture.

- Slide 8: Climate change and agriculture video: "Science for a Hungry World" from NASA (5 minutes)
  - The video addresses the effects of increasing atmospheric CO_2 on plant growth, discusses decreasing crop yields with increasing temperatures from a global perspective, and ends with a bit about how NASA satellite data in gathering this type of data. Before starting the video, the instructor should ask the class to predict how global climate change might impact agriculture.
- Slide 9: Local impacts of climate change
  - It is important to help Students Bridge global (as presented in the video) and local impacts of climate change. Use the map of modeled changes in precipitation for North America to have students determine one predicted impact in their local region.
- Slides 10-12: Introduction to systems diagrams
  - This series of slides links the idea of changing precipitation patterns back to soil sustainability. The RUSLE allows us to calculate changes in erosion, but a systems diagram (presented in Slide 12) allows for a more nuanced investigation of the mediating processes that link precipitation and erosion.
- Slides 13-22: Interpreting systems diagrams
  - This series of slides walks students through each component of the systems diagram and explains how to interpret the relationships indicated by the various symbols. The headings are written so that students can review them on their own if needed.
- Slides 23-25: Example
  - These slides give students a chance to practice using the systems diagram by considering data from a particular region (in Nebraska) and how the same climate change effects (decrease in precipitation) can have different effects on erosion when you consider the needs of the plants themselves.
- Slide 26: Wrap-up
  - In the corn/wheat example, students see that a change in the system can impact individual crops in different ways. What is planted and the management practices employed are ultimately human decisions that have a big impact on the agro-ecosystem. This slide of the U.S.-Mexico border is provided as an example of how economics and politics also affect the agricultural system. You can use this to guide a closing discussion about the idea that sustainable solutions to mitigating the impacts of climate change must address environmental, social, and economic factors.

Case Study – Prepare Land Use, Land Cover and DEM Map using ArcMap

Prepare digital data set of land use/land cover, soil and digital elevation model (DEM) using RS and GIS techniques.

Follow-up homework Linked to Learning Outcome

In the homework, students will synthesize what they have learned in this unit and practice using systems language to describe relationships in the system under investigation.

Module 4	**Time-load**
Directed Learning Online ❑ Viewing presentations and reading articles as specified in the activities	2.5 hours
Dynamic Interaction online ❑ Discussing or engaging with the e-tutor and/ or peers	1.5 hour
Assessment ❑ Individual and Group Contributions and Discussion Forum [Note: Time allowed for preparing Assessment work can vary from 1-7 hours on average per module]	Expected from 15-25 hours for this module, as the student may be directly working on the creation of for assessment.
Independent Learning ❑ Private online or offline engagement with readings, peers or experts [Note: Time available to spend on Independent learning can vary from 7-30 hours in final weeks]	At the discretion of the student
Total Time for Module 4	Approximately 19- 29 hours required for engagement within this module, plus an additional 7-30 hours for independent learning at your own discretion.

SD Pillars	**environment**			**economy**			**social**			**culture**					
21st ESD	Learning to know ✓			Learning to be ✓		Learning to do ✓	Learning to live together ✓			Learning to transform oneself and society ✓		Learning to giv and share ✓			
SDGs Sub goals	1	2 ✓	3	4	5	6	7	8	9 ✓	10	11	12	13	14	15 ✓	16	17
Vision 2030	The module culminates with a project centered on making sustainable soil managemen decisions under global climate change. This will lead to a spirit of strengthened globa harmony, focused in particular on the needs of the poorest and most vulnerable and witl all stakeholders and all people.																

ECTS WORK	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
LOAD	**9 h**	**3 h**	**3 h**	**1 h**	**10 h**	**5 h**	**14 h**	**-**	**45 h**

Module 5 Overview of the Wicked Problem of Food Security

Key Concepts	Food security, Food (in)security, Global food system, ArcGIS Online, Earth system, Systems thinking
Overview	The 1996 World Food Summit declared food security to be "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life." Over the next several decades, food security will continue to be one of the most pressing issues facing our planet. In this three-week module, we take an GIS and RS approach to understanding and addressing world food insecurity issues, and explore how social, economic, and political factors impact decision making and can improve or compromise the biogeochemical interactions provided by the Earth system as they pertain to food production. Students will explore the very factors that cause food insecurity (including climate, socio-economic, and physical) through readings, lecture, case studies, and geospatial analysis using ArcGIS Online. The module will culminate with a summative assignment where students will design a community-based action plan utilizing a variety of data sources addressing food insecurity in a location of their choosing. This module begins by contextualizing food security as an example of a wicked problem. Wicked problems are problems that are unsolvable in the traditional sense, and have complex multiscalar causal factors that contribute to the creation of new issues as old ones are addressed. Both global food security and climate change are examples of wicked problems. This module presents systems thinking as a way to identify complex problems and explore solutions. Using a flipped classroom model, students complete a self-study tutorial that presents system concepts in the context of Earth system science. The slide stack includes two guided activities related to the carbon cycle and soils. A short reading, "Why Systems Thinking?" and a video clip is included in the tutorial. Authentic assessment of the homework activity is an Earth system diagram connected to one of the issues of global food security from Unit 1 that they will bring to class.
Aim	Students will be able to use systems thinking to evaluate and assess food insecurity in a location by analyzing authentic geospatial and socioeconomic data; be able to identify components, processes, and fluxes of Earth system science and apply these concepts in a location and assess the role the Earth system plays in the food system and contributes to food insecurity; and be able to propose plans to promote food security in a locality that include an understanding of the present day food vulnerability, the interaction of human and natural systems, and impacts of climate change.
Learning Outcomes	After completing this unit, students will be able to: 1. Define food security. 2. List the major causes of food (in)security. 3. Describe and illustrate the components of the global food system. 4. Be able to create a simple map using ArcGIS Online. 5. Describe the major components of the Earth system. 6. Apply systems thinking to wicked problems like global food security. 7. Create a diagram that identifies connections between the Earth system and the global food system.
Units	• Unit 5.1: Introduction to Global Food Security. • Unit 5.2: Systems Thinking and the Wicked Problem of Global Food Security. • Unit 5.3: Climate Change and Food Security
Readings	Hanning, I., O'Bryan, B., Crandall, C.A., and Ricke, S. C., 2012. Food Safety and Food Security. Nature Education Knowledge 3(10):9. McDonald, B.L., 2010. *Food Security*. Malden, Ma: Polity. Paci-Green, R. and Berardi, G., 2015. Do global food systems have an Achilles heel? The potential for regional food systems to support resilience in regional disasters. *Journal of Environmental Studies and Sciences* 5: 685-698. Pinstrup-Andersen, P. and Watson, D.D., 2011. *Food Policy for Developing Countries: The Role of Government in Global, National, and Local Food Systems*. Ithaca: Cornell University Press. Sage, C., 2012. *Environment and Food*. London: Routledge.

	Berhe, A. A., Arnold, C., Stacy, E., Lever, R., McCorkle, E. & Araya, S. N., 2014. Soil erosion controls on biogeochemical cycling of carbon and nitrogen. Nature Education Knowledge 5(8):2. Brodt, S., Six, J., Feenstra, G., Ingels, C. & Campbell, D., 2011. Sustainable Agriculture. Nature Education Knowledge 3(10):1. Connolly, A., and Phillips-Connolly, K., 2012. Can agribusiness feed 3 billion new people...and save the planet? A glimpse into the future. International Food and Agribusiness Management Review, 15 (Special Issue B):139-152. Dentoni, D., Hospes, O., and Ross, R., 2012. Managing Wicked Problems in Agribusiness: The Role of Multi-Stakeholder Engagements in Value Creation. Special Issue, International Food and Agribusiness Management Review, 15(B): 1-165. This resource provides numerous papers addressing different aspects of food production and food security. http://www.wageningenportals.nl/sites/default/files/resource/ifama_managing_wicked_problems_in_agribusiness.pdf#page=7 'whole issue' McLusky, S. and Sessa, R., 2015. *Making It Count: Increasing the Impact of Climate Change and Food Security Programmes.* FAO.
Activity	Overall Time: 9 hour **Overview** 1.1 - Pre-class Activity Linked to Learning Outcome 1. Instructors should give the students the following prompt **BEFORE** they read the PDF. Students should type/write out their responses and bring to class for discussion. When you hear the words food security, what images, places, characteristics come to mind? Spend a few minutes writing your impressions (a couple sentences). You could also search for images that illustrate your thoughts. Paste those images into your word document. Students should submit their responses to the course management system. (Estimated time to complete: 5 minutes) 2. Assign the following activity Student Handout on Food Security (Microsoft Word (.docx)) as a pre-class homework/reading assignment. (Student Handout will include information defining and explaining the key concepts of this unit i.e. food security, malnutrition, and global food network.) Students will then take a Food Security Quiz (Microsoft Word (.docx)) over the material either before class (using an online learning platform) or at the start of class. (Estimated time to complete: 15 minutes) 3. Students should complete the 4x5 Activity to Orient to AGO (Microsoft Word (.docx)), four activities that take five minutes each, to familiarize students with ArcGIS Online (AGO) (Estimated time to complete: 30 minutes) 1.2 - In-Class Activity: Mapping the Global Food System Linked to Learning Outcome Students will create a map tracing the commodity of chocolate through the global food system considering the multiple factors involved. • Student activity handout: The Global Food System: Chocolate (Microsoft Word (.docx)) (Estimated time to complete: 60 minutes) 1.3 - Post-Class Activity Linked to Learning Outcome Students who do not finish their maps should complete them outside of class. Teaching Notes and Tips • Sample assignment guide for module (Microsoft Word (.docx)) should be given to students before the start of the food security module. • Instructor version of pre-class quiz on food security: Quiz Instructor Version With Answers (Microsoft Word (.docx))

- Prior to starting the Food Security module, students might want to read Bryan L. McDonald. (2010). *Food Security*. Malden, Ma: Polity or *The State of World Food Insecurity 2015* FAO. This will provide a more detailed understanding of the social, economic, and environmental factors impacting food security.
- Students should submit their responses to Activity 1.1 to the course management system.
- Instructor may want to devote a few minutes of class to describing the geographic grid (information on latitude and longitude) prior to starting the ArcGIS Online activity.

Assessment

Learning goals are listed with their associated summative and/or formative assessment. A Universal Rubric for Assignments Units 1-5 (Excel (.xlsx)) is available.

Learning Goal 1: Define food security

Learning Goals 1-3: Students will reinforce their understanding of the assigned PDF reading by taking a quiz before class: Professors can utilize the multiple choice quiz by uploading it to their online learning platform or give the students the quiz at the start of class.

Learning Goal 2: List five contributing factors to food (in)security

Learning Goals 1-3: Students will reinforce their understanding of the assigned PDF reading by taking a quiz before class: Professors can utilize the multiple choice quiz by uploading it to their online learning platform or give the students the quiz at the start of class.

Learning Goal 3: Define and describe components of the global food system

Students will create a map describing the global food system through the case study of chocolate.

Learning Goal 4: Create a simple map using ArcGIS Online

Students will create a map describing the global food system through the case study of chocolate.

2.1 Pre-class Activity: Homework to be completed in preparation for this unit Linked to Learning Outcome

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For a flipped classroom format, assign students the reading assignment and the slide stack before class. The reading describes global food security as a "wicked problem," which has complex attributes and are notoriously difficult or impossible to solve. It explains to the student why they will be learning about systems thinking, and how this tool will help them to navigate the complexity of the global food security problem. These skills will be applied when they assess and identify parts of the problem that they may want to address when they conduct a case study analysis of an aspect of food security pertinent to their assigned region.

Reading: *The Wicked Problem of Global Food Security* (Microsoft Word (.docx)).

(Estimated time to complete: 15 minutes).

Review: Unit 2 Pre-Class Homework Tutorial (PowerPoint (.pptx)). Students can use the homework organizer supplied here to take notes and complete their homework assignment: Unit 2 Homework Organizer (Microsoft Word (.docx)).

(Estimated time to complete: 45 minutes)

2.2 Introductory Class Discussion Linked to Learning Outcome

Self-evaluation: As part of the homework tutorial, students are instructed to bring to class the system diagram they created that identifies parts of the Earth system and how they are connected to any one of the socioeconomic, geopolitical, and cultural factors that result in food insecurity. The provided rubric that shows expectations for the diagram can be projected as students enter the classroom so they can check their work and make changes as needed. Alternatively, the diagrams can be collected as homework. (Estimated time to complete: 5 minutes)

Discussion: A short slide stack to initiate classroom discussion is provided that reviews Earth system concepts covered in pre-class assignment. Unit 2 Discussion Slides (PowerPoint (.pptx)). What were impressions of students? What were some of the big takeaways? Was anyone overwhelmed when they took a closer look at the scope of the problem of food security? Review the idea of "wicked problems" as discussed in the homework and stress that food security is characterized by complexity and can only be approached through the use of a systems perspective. Review the parts of a system. Students were introduced to systems thinking in the homework tutorial, using the Earth system as an example. They also read a short piece by a computer scientist why he thinks Earth systems are a good way to learn about systems thinking. Draw a simple Earth system diagram on the board, and ask a few students to volunteer how they connected a part of the global food system to the Earth system diagram in their homework. When satisfied that the students have a working knowledge of these concepts, break the students into groups of 3-5. (Estimated time to complete: 15 minutes).

2.3 Activity: Creating a Systems Diagram of the Global Food System Linked to Learning Outcome

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Group work. Provide each group with a piece of poster paper and marker. Their goal is to identify the parts of the food system as it was presented last class. In the Earth system, there are 4 components identified (hydrosphere, atmosphere, lithosphere, biosphere). What are the components they want to use to organize their diagram? (It might be economic, social, political; or food safety, transportation, storage, or production, for instance). How will they integrate parts of the Earth system? Stress that complex wicked problems will benefit from exploring several different approaches to organizing information, so there is no right or wrong answer, but together the class will identify appropriate approaches for issues they plan on examining.
(Estimated time to complete: 20 minutes)

Gallery walk. With chart paper diagrams posted on the wall or on tables, invite the class to do a gallery walk and see the variety of ways that different teams conceptualized the global food system. After the gallery walk, the teams are welcome to make additions or changes on their own diagram. Groups are asked to evaluate their diagram, using the systems diagram rubric.
(Estimated time to complete: 15 minutes)

Self evaluation. Students are provided with an example of a generalized food system diagram, and are asked to identify the components, using system science vocabulary.
(Estimated time to complete: 20 minutes)

Written exit assignment. Ask each student to submit a short paragraph or diagram describing any one aspect of the global food system that interests them, and how it is linked to other parts of the global food system, including both the human and Earth system aspects. Have them use labels to identify at least one cycle or feedback, flux of matter or energy, as they link the components they have selected. Ask them to speculate on 1) what kind of data they would need to learn more about this part of the food system, and 2) what kinds of changes in human behavior, in what sectors of society, would be required to increase global food security.
(Estimated time to complete: 10 minutes)

Assessment
In this class students are building conceptual skills that build toward the completion of an authentic assessment in Unit 6.
The self evaluation at the beginning of classes will assist students in determining whether they can:

- Identify the parts of a system: flux, reservoirs, residence time, cycles, and feedbacks
- Describe the major components of the Earth system

Creation of the group global food system diagram serves as a formative assessment of the following learning goals:

- Be able to articulate how systems thinking is critical to understanding wicked problems like global food security

- Apply systems concepts in creating a diagram that identifies one or more links between the Earth system and the global food system for future analysis.

The short paragraph submission at the end of the class will enable the instructor to evaluate whether individual students are able to generalize from their guided understanding of the Earth system to creating system diagrams in another context.

To facilitate self-evaluation or assessment by the instructor, a product rubric is provided that includes guidance for creating diagrams and written work. This rubric can be distributed to students at the beginning of the module so that expectations are explicit for graded work. Universal Rubric for Assignments Units 1-5 (Excel (.xlsx)).

Module 5	**Time-load**
Directed Learning Online ❑ Viewing presentations and reading articles as specified in the activities	2 hours
Dynamic Interaction online ❑ Discussing or engaging with the e-tutor and/ or peers	1 hour
Assessment ❑ Individual and Group Contributions and Discussion Forum [Note: Time allowed for preparing Assessment work can vary from 1-7 hours on average per module]	Expected from 17-20 hours for this module, as the student may be directly working on the creation of for assessment.
Independent Learning ❑ Private online or offline engagement with readings, peers or experts [Note: Time available to spend on Independent learning can vary from 7-30 hours in final weeks]	At the discretion of the student
Total Time for Module 5	Approximately 20- 23 hours required for engagement within this module, plus an additional 7-30 hours for independent learning at your own discretion.

SD Pillars	**environment**		**economy**			**social**			**culture**								
21st ESD	Learning to know ✓		Learning to be ✓			Learning to do ✓			Learning to live together ✓			Learning to transform oneself and society ✓			Learning to give and share ✓		
SDGs Sub goals	1 ✓	2 ✓	3	4	5	6	7	8	9 ✓	10	11	12	13	14	15	16	17
Vision 2030	Using systems thinking, students will be able to assess the role the Earth system plays in the food system and contributes to food insecurity; and be able to propose plans to promote food security in a locality that include an understanding of the present day food vulnerability, the interaction of human and natural systems, and impacts of climate change. This will lead to end poverty and hunger, in all their forms and dimensions, and to ensure that all human beings can fulfill their potential in dignity and equality and in a healthy environment.																
ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**								
	9 h	**3 h**	**3 h**	**-**	**9 h**	**15 h**	**15 h**	**3 h**	**57 h**								

SDGs		**CLIMATE CHANGE**	**SUSTAINABLE AGRICULTURE**	**FOOD SECURITY**	**COURSE MODULE**
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	Students work with Gallery walk: "Impact of climate change on agricultural production • There are several activities that may be used in implementing the climate change adaptation to achieve food security and promote sustainable agriculture, examples activity: Each student is given a handout with all of the climate change adaptation examples.	Students work with Case Study: "Application of sustainable agriculture practices to enhance adaptation to climate variables. In this activity, students consider how several communities are adapting to climate change-related problems including drought's impacts on agriculture, loss of assets due to climate-related hazards, freshwater availability, and extreme heat waves. They will read brief case studies about agro-forestry, insurance strategies	* Students work individually and use internet searching engine and prepare a presentations/seminar on: "Food security of local and regional agro- ecosystems in the context of socio-economic trends" "Food security dimensions in an interdisciplinary fashion". **working in groups: Investigate social and technological progress occurs in food security.	Module 2

	4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Students work individually and describe climate change and its impact on the human-built systems such as coastal communities. Next, have students watch Rising Sea Levels video. This engaging video highlights the effects of climate change on coastal communities. As students watch the video, have them record what they "observed" and "wondered" in the first column of Table 1: The Issue (OWL chart). Then, discuss their responses with the class.	Case Studies in Unsustainable Water Use in Agriculture. Each groups are challenged to come to some collective consensus on the water resource problems. They are also prompted to evaluate how the agricultural practices and the associated use of water failed to meet the sustainability criteria. "Application of sustainable agriculture practices to enhance food security problem.	* Students work individually and use internet searching engine and prepare a presentations/seminar on: "Utilize geoscientific thinking techniques in solving a food security problem through a systems approach". "Food security dimensions in an interdisciplinary fashion". working in groups	Module 1
	15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss	How Full is Full activity. This activity can be conducted as a whole-group activity. Give all students soil samples that will be used to simulate an agricultural soil under global climate change to enhance adaptation to climate variables. Collecting and preparing soil for the activity from, a local soil sample.	Students work on **Soil property identification** in-class activity consists of an opening "think/pair/share" activity, followed by a hands-on soil porosity and permeability activity, making sustainable management to restore the terrestrial ecosystems, combat desertification, and reverse land degradation. The activity wrapped up by a class discussion and a homework assignment.	* Students work individually and use internet searching engine and prepare a presentations/seminar on: Agricultural productivity and the ability to feed the growing population. **working in groups: Understanding how to manage soil resources in the context of food security.	Module 4

SUMMRY OF ECTS WORKLOAD

Learning Components	No	Time Factor	Workload	Course Modules					Workload
				1	2	3	4	5	
Lecture (face- to-face)	10	4	40	6	8	8	9	9	40
Online	5	3	15	3	3	3	3	3	15
Lab Work	5	3	15	2	4	3	3	3	15
Reading	80	0.5	40	11	13	15	1	-	40
Course activities	6	13	78	20	24	15	10	9	78
Project Work	1	20	20	-	-	-	5	15	20

Prepare exam	1	29	29	-	-	-	14	15	29
Writing the exam	1	3	3	-	-	-	-	3	3
Total			240	42	52	44	45	57	240

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CCSAFS COURSE SYLLABUS Course Syllabus

Course Number: CSAF802

Sustainable Management of Soil and Water (8 ECTS)

University of Suez Canal, Faculty of Agriculture, Department of Soil and Water,

1st Semester, 2018 -2019

Instructor Information

Instructor: Dr. Samy Abd El-Malik Mohamed Abd El-Azeem

Office Location: Soil and Water Department

Telephone: +201146559578

Office Hours: Sunday- Wednesday: 10.00 AM - 3.00PM

E-mail: sazeem18@gmail.com, samy_abdelmalik@agr.suez.edu.eg

Website:

Course Identification

Course Number:

Course Name: Sustainable Management of Soil and Water

Course Location: University Campus

Class Times: Friday: 10.00 AM - 14.30 PM

Prerequisites: None

Faculty Web Page: http://scuegypt.edu.eg

Course Description/Overview

Soil and water are key resources for agriculture that determine levels of food production and thus food security on a local, national and global scale. In general, effective management of soil and water is

essential for society, but critical for agriculture. Management of water is also of key importance as water is likely to become an increasingly limited resource in a world subject to climatic and environmental change.

Sustainable management of agricultural soils and water is fundamental to global food security, especially in the face of climate change and increasingly erratic weather. Using innovative technologies, we develop sustainable soil and water management practices that contribute to increasing global agricultural production and food security while conserving natural resources. This course seeks to evaluate the sustainability of existing and proposed systems for managing soil and water in the agricultural environment. Evaluation of farming systems (organic, integrated, conventional), proposed protection strategies and risk posed by climate change. The course is divided into six sections. The first section addresses the terms used in water management for sustainable agriculture and water sustainability issues. The second section discusses the centrality of water, its global dimensions, and the impacts of climate change on water resources. The third section focuses on the integrated water resource management and water rights and pricing. The fourth section concentrates on management of Soil Fertility. In this section, we focused on the impacts of climate change on soil gas emission and carbon sequestration in the soil. The fifth section shows the management of soil erosion (water and wind erosion). Finally, the sixth section discusses the management of soil threats such as soil pollution, salinization and sodicity and loss of soil biodiversity.

Course Learning Objectives

This course aims to develop knowledge and skills relating to the sustainable management of soil and water resources. The objectives of this course are: a) to provide students with a fundamental understanding of key hydrological processes in the context of the present status of agronomic productivity and the availability of the water resources: b) to gain and understanding the relationship between climate change and global water cycle and by association the natural and human systems: c) to understand present-day challenges to the governance and management of water resources: d) to evaluate the soil fertility, which nutrients are needed for the growth of plants, and brief the processes that cause a loss of soil fertility and the effects of that: e) to present best management practices for managing erosion on agricultural soils for preventing and resolving wind or water erosion: f) and finally investigate the management of salt and sodic problems and soil pollution as well as investigate the technolgies for resolution loss of soil biodiversity.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Examine and critically appraise the application of the fundamentals of pedology and hydrology in sustainable resource management.
2. Evaluate the sustainability of systems for managing the soil resource.
3. Evaluate water resource use within the environment.
4. Manage and measure salinity and sodicity in irrigated agricultural systems.
5. Manage and remediate polluted soil.
6. Investigate the primary causes of a wide range of soil degradation problems, including soil acidity and alkalinity, erosion, salinity and sodicity, and nutrient loss.
7. Evaluate the impact of soil management on soil organic matter, soil structural stability, water quality and other important soil properties.

8. Learn how to work effectively in small groups in the lab and in the field.
9. Define biodiversity and describe problems associated with biodiversity loss, as well as progress in protecting biodiversity.

Course Resources

Course Website(s)

Required Course Texts and Materials

Hands-out prepared by the instructor for the class

Students should be familiar with the content of at least one of the following:

- Lal, Rattan, & Stewart, Bobby Alton. (2013). *Principles of sustainable soil management in agroecosystems*: CRC Press.
- Cook, Hadrian F, & Lee, Howard C. (1995). *Soil management in sustainable agriculture. Proceedings Third International Conference on Sustainable Agriculture, Wye College, University of London, 31 August to 4 September 1993*: Wye College Press.
- Baritz, Rainer, Wiese, Liesl, Verbeke, Isabelle, & Vargas, Ronald. (2018). Voluntary guidelines for sustainable soil management: global action for healthy soils *International Yearbook of Soil Law and Policy 2017* (pp. 17-36): Springer.
- Magdoff, Fred, & Weil, Ray R. (2004). *Soil organic matter in sustainable agriculture*: CRC press.
- Tejada-Guibert, JA, Setegn, SG, Stoa, RB (2015). Sustainable Development and Integrated Water Resources Management. In: Setegn, Shimelis Gebriye, & Donoso, Maria Concepcion. (2015). Sustainability of Integrated Water Resources Management: Springer.
- Edwin, Golda A, & Poyyamoli, G. (2012). Climate change and sustainable management of water resources Climate Change and the Sustainable Use of Water Resources (pp. 431-447): Springer.
- Mirsal, Ibrahim A. (2008). *Soil pollution*: *origin, monitoring and remediation*. Springer.
- Mace, JE, & Amrhein, C. (2001). Leaching and reclamation of a soil irrigated with moderate SAR waters. *Soil Science Society of America Journal, 65*(1), 199-204.
- Paul, EA, Kravchenko, A, Grandy, A, & Morris, S. (2015). Soil organic matter dynamics: Controls and management for sustainable ecosystem functioning. *The Ecology of Agricultural Landscapes: Long-Term Research on the Path to Sustainability*, 104-134.
- Krishna, Kowligi R. (2016). *Precision farming: soil fertility and productivity aspects*: Apple Academic Press.
- Gupta, Sushil Kumar. (2011). *Modern Hydrology and Sustainable Water Development*: John Wiley & Sons.

Recommended Journals

- Journal of Sustainable Agriculture
- Soil Use and Management
- Agriculture, Ecosystems and Environment
- Soil and Tillage Research

- Land Degradation and Development
- Journal of Environmental Management
- Agronomy Journal

Optional Course Texts and Materials

Assignments and Grading Scheme

Grading System

Grading Policy

Grades will be based on the following: (For example)

Oral Examination	10%
Course assignments	10%
Practical Examination	20%
Final Exams	60%
Total Points	100

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come to ALL classes.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by case basis.

Important Dates to Remember

Course Schedule

Week	Date	**Topics, Reading, Assignments and Deadlines** (Details on assignments and more bibliography are available in the course modules)
1		**Course Overview**

		Discussion of syllabus and assignments, course requirements. The Science of Sustainable Water Management Overview of water sustainability approaches and it is challenges
2		Basics of the hydrologic cycle
3		Climate change concepts and it is impacts on water resources
4		Water Governance, Integrated water resource management, water rights and pricing
5		Water, food, and the global trade of virtual water
6		Management of Soil Fertility, Production and decomposition of organic matter
7		Organic matter and management of soil fertility
8		Managing Soil Erosion Processes of soil erosion and how to manage
9		Tillage management and factors affecting soil erosion
10		Management of Soil Threats, Soil pollution and remediation
11		Soil salinization and sodicity
12		Loss of soil biodiversity and how to manage
13		Soil biodiversity and ecosystem services
14		Soil-Water management relationships
15		Final exam

APENDIX II: The CCSAFS Course Modules

Course	Sustainable Management of Soil and Water
Module 1	**The Science of Sustainable Water Management**
Key Concepts	Overview of water sustainability issues & Water resources management
Overview	Water is life. Growing pressure on water resources - from population and economic growth, climate change, pollution, and other challenges - has major impacts on our social, economic, and environmental well-being. The management and sustainability of water resources is a critical issue facing society over the coming decades. Water resources are affected by changes of climate change, human populations, economic growth, technological change, and other socioeconomic factors. Additionally, they serve a dual purpose; Water resources are critical to both human society and natural ecosystems. Severe weather events ravage some parts of the world with floods, while devastating others with droughts. Water resources are finite, unequally distributed among diverse regions, fragile and prone to loss by soil misuse and soil mismanagement, and vulnerable to extreme events related to the abrupt climate change. The implementation of integrated water resources management at all levels has now been accepted.

Aim	The objective of this module is to provide students with a fundamental understanding of key hydrological processes in the context of the present status of agronomic productivity and the availability of the water resources. Students will then use this understanding to explore various sustainable strategies for integrated water resources management. Students are expected to understand the key components of the water cycle and their relevance for water resource sustainability, including precipitation, evapotranspiration, groundwater, and surface water. Students are also expected to become familiar with the fundamental principle of water conservation, as it is a basic concept needed to manage water resources sustainably. Finally, the students will understand the importance of managing water as natural resources.
Learning Outcomes	At the end of this module students will be able to: • Explain the basic concepts of sustainable management of water • Identify the connections between environmental inputs (i.e. natural resources) and outputs (i.e. energy), and their effects on the natural environment. • Comprehend the fundamental principle of water conservation, as it is a basic concept needed to manage water resources sustainably. • Address the concerns of food security as a result of a steadily increasing global population • Outline technological options for water sustainability
Units	Unit 1.1. Overview of water sustainability issues Unit 1.2. Definition of sustainable water management. Unit 1.3. Challenges for achieving sustainable water management. Unit 1.4. Overview of different water management and Sustainability approaches. Unit 1.5. Basics of the hydrologic cycle
Readings	• Russo, Tess, Alfredo, Katherine, & Fisher, Joshua. (2014). Sustainable water management in urban, agricultural, and natural systems. *Water, 6*(12), 3934-3956. • Water resources management, from Wikipedia https://en.wikipedia.org/wiki/Water_resource_management • Brauman, Kate A, Daily, Gretchen C, Duarte, T Ka'eo, & Mooney, Harold A. (2007). The nature and value of ecosystem services: an overview highlighting hydrologic services. *Annu. Rev. Environ. Resour., 32*, 67-98. • Edalat, Farideh Delavari, & Abdi, M Reza. (2017). *Adaptive Water Management: Concepts, Principles and Applications for Sustainable Development* (Vol. 258): Springer.
Activity	**An overview (1 hour)** Ask the students to describe the responsibilities of a store manager. Ask them what would happen if the manger did not do these tasks. Most likely the business would fail. The same is true with our environmental resources such as water. We are the water managers and we have certain responsibilities that we must do. **Assignment 1.1** **Pre-work homework activity (4 hours)** • Prior to the classroom portion of the module, students should read all of "Management of water resources" including the three subsections " Definition of sustainable water management, and "Overview of water sustainability issues?" This should take approximately 1 hour. To increase comprehension and help them relate the reading to this module, have students answer the questions. You can write your own description or use the following,

Sustainability of water here can be defined as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This means sustainable water are not fixed to any one system, but essentially considers all available systems.

URL: https://en.wikipedia.org/wiki/Water_resource_management

Water **2014**, *6*, 3934-3956; doi:10.3390/w6123934

Assignment 1.2

Post-Activity Homework (4 hours)

The students should have spent time in this module learning about basic of hydrology and the hydrologic cycle. Now it is time to use what you have learned to educate others. To provide her with useful advice, please follow these steps:

1. Read the topic in titled "hydrology basics and the hydrologic cycle" and read the "glossary" in this file. The file contains 9 pages (3 pages/hour), so the reading this article equal 3 hours, the file is available in URL:

   https://ext.vt.edu/content/dam/ext_vt_edu/topics/agriculture/water/documents/Hydrology-Basics-and-the-Hydrologic-Cycle.pdf

2. Briefly summarize the component of hydrological cycle using your own words so that the students will understand your summaries, and be sure to define any technical terms used. Your summary limit from 3 to 5 sentences.
3. Provide a closing paragraph informing the reader how component of hydrological cycle such as runoff or evapotranspiration affect soil fertility and plant growth and its potential impacts on agriculture.
4. All technical terms should be defined correctly and should be conveyed in such a manner that a lay-person could understand them (since they are your audience).
5. Make sure that your document is well organized, easy to read, and free of grammar and Spelling errors.

Assignment 1.3

Tutorial session activity (2 hours)

In this module, we also using tutorial session activity in which quizzes will be held, each followed by 1-hour tutorial session for feedback on quiz. Lectures include the opportunity for open discussion, questions and problem solving activities with support materials provided online. The students should access link https://pmm.nasa.gov/education/videos/tour-water-cycle A tour of the water cycle. All students should be write a paragraph from this video, but this paragraph must show the importance of heat on water cycle. The students should be shared the report about this video by emails.

Assignment 1.4 (5 hours)

The student should be reading the book chapter in title "Adaptive Water Quantity Management: Designing for Sustainability and Resiliency in Water Scarce Regions.

	https://link.springer.com/content/pdf/10.1007%2F978-0-387-84891-4_12.pdf

SD Pillars	**Environment**	√	**Economy**	√	**Social**	√	**Culture**	√

21st ESD	Learning to know √	Learning to be √	Learning to do √	Learning to live together √	Learning to transform oneself and society √	Learning to give and share √

SDGs **Sub goals**	1	2 √	3	4	5	6 √	7	8	9	10	11	12 √	13	14	15	16	17

Egypt Vision 2030	This module will lead to ensure and evident that the strategy vision for the environment until 2030 aims at identifying the mechanisms for encouraging investment in natural resources such as water and ecological systems to support the economy and provide new job opportunities (Ninth Pillar: Environment).

ECTS Work Load	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6 h			10					**16**

Module 2	**Climate Change and Water Resources**
Key Concepts	Climate change concepts and impacts on water resources
Overview	Many challenges, including climate change, face the Nation's water managers. The Intergovernmental Panel on Climate Change (IPCC) has provided estimates of how climate may change, but more understanding of the processes driving the changes, the sequences of the changes, and the manifestation of these global changes at different scales could be beneficial. Since the changes will likely affect fundamental drivers of the hydrological cycle, climate change may have a large impact on water resources and water resources managers. The weakness of water resources under a changing climate has received increasing awareness amongst policy makers, planning and environmental agencies, stakeholders and beyond; driven by exciting developments in climate science and bolstered by a surge in media coverage. An important driver of water resource availability is the interaction between the hydrologic cycle and the climate system. Assessing the effects of climate change on water use efficiency is critical for policymaking and adaptation. The impacts of climate change on the water cycle are of key relevance to the sustainable management of water resources. The interaction between water and climate plays an integral role on the coupling between natural, economic and human systems.
Aim	This module will cover the information to understand the main features of the global water/hydrologic cycle, the link between science of water and climate. This module will also cover the effect of climate change on water cycle and by association the natural and human systems.
Learning Outcomes	At the end of this module students will be able to: • Understand the water/hydrological cycle and its connection to climate. • Understand how variability and changes in climate affect/will affect water supply/availability on land. • Understand how water impacts ecosystems. • Learn how to critically evaluate a scientific article and write a review. • Diagnose the cause of a climate-related water problem and develop solutions to address it.
Units	Unit 2.1. Water resources and climate: an overview

	Unit 2.2. Connections between climate and water Unit 2.3. The impact of climate change on the water cycle Unit 2.4. The coupling of hydroclimate variability with human systems
Readings	• Bates, Bryson, Kundzewicz, Zbigniew, & Wu, Shaohong. (2008). *Climate change and water*: Intergovernmental Panel on Climate Change Secretariat. • Gleick, Peter H. (2000). *Water--the potential consequences of climate variability and change for the water resources of the United States*: Pacific Institute for Studies in Development, Environment, and Security. • De Loe, Rob C, & Kreutzwiser, Reid D. (2000). Climate variability, climate change and water resource management in the Great Lakes. *Climatic Change*, *45*(1), 163-179. • Brekke, Levi D. (2009). *Climate change and water resources management: A federal perspective*: DIANE Publishing.
Activity	**Assignment 2.1 (3 hours)** The student should watch the web video related the topic "How climate change impact water resources"? *that available in the following link:* http://blogs.ei.columbia.edu/2017/06/06/how-will-climate-change-impact-water-resources/ The instructor will ask all students to brief this video and write one page. This activity will increase the knowledge of students to understand the effect of climate change on water resources **Assignment 2.2** **Written evaluation activity (13 hours)** Read and written assignments will be requested for 2 book chapters (38 pages) discussed in class. The chapters 3 and 4 in Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., (2008). Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva. For all students, these written critiques are due *via* Coursework/Canvas at noon of the day of class. Each critique must include: • A short essay giving an overview of the reading (not less than 200 and no more than 300 words) • Two strengths and two weaknesses of the investigation/reading • Two critical questions that can be used as a part of the class discussion The critique should discuss the readings in terms of the topics covered, the strengths and weaknesses of the articles, and critical aspects of the research presented. We have included the following list to act as a guideline for preparing your critique. Not all points need to be included in every critique. • Provide a general overview • Explain the main ideas • Explain important numbers/facts • Incorporate original thought • Tie the paper into the overarching theme of the module The Submission of written critiques are due before **NOON on the day of class**. Please let us know of any extenuating circumstances that may prevent you from meeting this deadline as soon as possible. Critiques received after noon will be subject to deductions. Later than day after class maximum grade possible will be decreased and feedback from the instructor will not be guaranteed.

	Assignment 2.3 (6 hours) Students will use case studies and review scientific literature to critically evaluate real-world water security issues and develop sustainable solutions to address them. **Example: Case study on Nile delta region, Egypt** Briefly, Low-lying land in the Nile delta region is especially at risk from the effects of any sea level rise resulting from global warming. In particular, the cities of Alexandria, Rosetta and Port Said, which are major industrial and economic centers, are expected to experience serious environmental impacts, if no action is taken. Students should read the covered topic that available in link below and summarized it, and discussed with instructor and other students in class. http://www.ess.co.at/GAIA/CASES/EGY/impact.html **Assignment 2.4 (5 hours)** **Using GIS for predict the effect of climate change on water resources activity** In this activity, the students will use ArcGIS to analyze the new lakes that have formed in the Toshka Depression, Egypt as a result of overflow from Lake Nasser and use their analyses to evaluate the wisdom of the plan to bypass the Toshka Lakes in developing the New Valley Project for irrigation in the Western Desert of Egypt. In this exercise, students download and prepare their own SRTM DEMs (Shuttle Radar Topography Mission and degree digital elevation model) and learn how to determine areas and volumes using ArcGIS. They can then ask questions and use ArcGIS to determine the answers. How much water is in the Toshka Lakes? What happens if Lake Nasser rises and more water flows down the canal? Will more lakes form, or will the lakes that are there just get bigger? How much water might be evaporating from the lake surfaces? How much water must flow down the canal to keep the lakes at a particular level? What might happen as the annual Nile flood fluctuates from year to year?

SD Pillars	**Environment** √					**Economy** √			**Social** √					**Culture** √			
21st ESD	Learning to know √			Learning to be √		Learning to do √			Learning to live together √			Learning to transform oneself and society √			Learning to give and share √		
SDGs **Sub goals**	1	2 √	3	4	5	6 √	7	8	9	10	11	12 √	13	14	15	16	17
Egypt Vision 2030	**Based on third Pillar: Knowledge, Innovation and Scientific Research**, this module will lead to gain innovative science, technology, and knowledge for impact of climate change on water resources, and using their innovation sciences to face challenges and meet national objectives.																

ECTS Work Load	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	3 h		2	10	12				27

Module 3	Water Governance
Key Concepts	Integrated water resource management, water rights and pricing
Overview	Water is widely recognized as the most essential natural resource for Earth's ecosystems and human society. Yet the relationship between water and society is complex. Water is a multifaceted resource that is important to all economic sectors and across a range of spatial scales from local to global. Water is also frequently a hazard; flooding, droughts, and contaminated water are formidable threats to human well-being. To deal with this seemingly dual nature of water, people have long modified the water cycle through engineering schemes like dams, reservoirs, irrigation systems, and interbasin transfer systems as well as through land use and land-cover change. To even the casual observer, a clear and robust plan is needed to manage and govern water given the multitude of ongoing human activities impacting the water cycle. This module will provide an overview of the political, social, economic, and administrative systems that affect the use, development, and management of water resources and scarcity. Students will be introduced to current themes that influence water governance including sustainable development, integrated water resource management, water rights and pricing, corruption, and equity for marginal groups. These themes will be explored at the local, national, and international levels to provide students with a holistic understanding of water governance issues.
Aim	The objective of this module is for you to understand present-day challenges to the governance and management of water resources. You will be able to demonstrate a working knowledge of the processes through which sustainability and water governance rules and regulations are created by governments and implemented by organizations. You will also gain experience in crafting solutions to these challenges, integrating the needs of multiple stakeholders, and analyzing water resources from a multi-sectoral perspective.
Learning Outcomes	When student complete this module, you will have gained experience in: • Interdisciplinary research related to water, linking together information from various disciples and sources • Clear and succinct communication of ideas and findings • Debating water-governance issues at the local, national, and international levels.
Units	3.1. Module Overview and Expectations 3.2. The Centrality of Water and its Global Dimensions 3.3. Water, Food, and the Global Trade of Virtual Water 3.4. Integrated Water Resources Management: Past, Present, and Future 3.5. Water Governance in Practice
Readings	• Read the definition of water governance at: http://www.watergovernance.org/whatiswatergovernance • Conca, Ken. (2006). *Governing water contentious transnational politics and global institution building*. MIT Press • Lall, Upmanu, Heikkila, Tanya, Brown, Casey, & Siegfried, Tobias (2008). Water in the 21st century: Defining the elements of global crises and potential solutions. *Journal of International Affairs*, 1-17. • Vörösmarty, Charles J, McIntyre, Peter B, Gessner, Mark O, Dudgeon, David, Prusevich, Alexander, Green, Pamela, Liermann, C Reidy (2010). Global threats to human water security and river biodiversity. *Nature, 467*(7315), 555.

	• Visit the website http://www.waterfootprint.org and explore their efforts to understand the links between water use and food production.
Activity	**Overview** **Assignment 3.1 (5 hours)** **Just in Time Teaching (JiTT) Warm Up activity** What is water governance? What are the four dimensions of water governance? What are the opportunities and challenge? Article that students may be assigned to read for this set of questions include (but are not limited to): • Water governance literature assessment by Charles Batchelor. Report contributing to the scoping exercise managed by IIED • Visit web site http://watergovernance.org/governance/what-is-water-governance/ **Evaluation student responses:** There are several choices to make in assigning credit for the students responses to JiTT questions based on the number of students in the classroom. Therefore, the instructor supposed different ways to evaluate the students as follows: • How much will JiTT responses "count" toward course grades? • Will you grade all of the JiTT exercises, or a random selection? • How will you assign points? Will you grade for correctness or for effort? **Assignment 3.2** ***Effective discussion activity (10 hours)*** Discussion is an excellent way to engage students in thinking and analyzing or in defending one side of an issue, rather than listening to lecture. Students must also respond to one another, rather than interacting intellectually only with the instructor. To do this the students should follow the next step: **Part I: preparation before class** **Before class on Tuesday, read the following:** Water for food: The global virtual water trade network. *Water Resources Research, vol. 47, W05520, 2011*: *in this paper* you show the applied novel conceptual and methodological framework to the study of global virtual water trade. The paper is *available in*: http://onlinelibrary.wiley.com/doi/10.1029/2010WR010307/epdf or https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2010WR010307 [illegible] the following: 1. [illegible] the global virtual water trade network 2. [illegible] [illegible] of the conceptual and methodological framework

Bring two copies of your written answers to class. I will collect one copy at the beginning of class.

Part II: discussion during class

In class:

1. Consider the following statements:
   - Quantifying the global structure is important for the understanding and management of any system, which here is the linked water and food trade.
   - Highlighted how individual nations fit into the global structure, which enables national policy makers to determine the relationship of their country to the international community.
   - Applying the analytical tools of complex network theory to virtual water trade provides important insights into its global architecture.
2. In student's small group, discuss the implications of these statements for exploitation of water for food. Make a list of groups most important points to prepare for class discussion.

Part III: written work after class

Follow-up writing assignment:

The students must pull together everything that have learned about water for food.

Assignment 3.3

Discussion Lead and Summary activity (5 hours)

Topic for discussion is covered some units in this module such as "The Centrality of Water Regime Formation for Water Security in West Africa: An Analysis of the Volta Basin"

URL: https://link.springer.com/chapter/10.1007/978-3-540-68488-6_52

The students will divide into small group (2-3) and their students will be responsible for leading the group discussion during this module. The goal is to facilitate the flow of comments among the students. Each group should prepare a 1-page (maximum) summary of the class discussions and submit it by the following session (i.e. one week later). This summary will be graded based on its clarity in summarizes the discussions and will count for half of your 'Discussion lead and summary' grade. The other half of this grade will be based on how well you facilitate the discussions. **The students should be shared the information about this activity by email.**

Assignment 3.4 (6 hours)

The student should be reading the article "virtual water in food production and global trade review of methodological issues and preliminary results" and each group (1-2 students) prepare the ppt presentation and discussed with other students and instructor.

SD Pillars	**Environment**	√	**Economy**	√	**Social**	√	**Culture**	√									
21st ESD	Learning to know √	Learning to be √	Learning to do √	Learning to live together √	Learning to transform oneself and society √	Learning to give and share √											
SDGs Sub goals	1	2 √	3	4	5	6 √	7	8	9	10	11	12 √	13	14	15	16	17

Egypt Vision 2030	Based on fifth Pillar: Social Justice "By 2030, Egypt is a fair interdependent society characterized by equal economic, social, and political rights and opportunities, realizing social inclusion. A society that supports citizens' rights to participate based on efficiency and according to law, encouraging social mobility based on skills. A society that provides protection, and support to marginalized and vulnerable groups and protects the neediest". This module will lead to understand the political water rights, integrated water resource management, water rights and pricing.								
ECTS Work Load	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6 h		**2**	**9**	**9**				**26**
Module 4	**Management of Soil Fertility**								
Key Concepts	Dynamics of organic matter and soil quality								
Overview	Soil organic matter is the fundamental source of fertility in organic systems. It is important for producers to understand the basics of organic matter cycling in the soil. Soil organic matter is that portion of the soil that consists of biological residues from plants, animals, and microorganisms. Soils with high organic matter content contain a greater abundance of water-stable aggregates and have a greater exchange capacity for nutrients. Soils with good tilth have better structure, water-holding and nutrient absorption capacities. Larger aggregates also slow organic matter degradation; producing a slowly mineralizing pool of nutrients. A good management of soil fertility is a key to creating healthy soils for growing healthy crops and environmental safety. This module will teach students what determines soil fertility that nutrients are needed for the growth of plants and summarize the processes that cause a loss of soil fertility and the effects of that. You will learn about the role of soil organic matter in nutrient dynamics, soil water holding capacity and climate change mitigation, as well as the threats to soil organic matter. Organic wastes can be effectively and safely recycled to compost during composting process to meet the nutritional requirement of crops. These findings will reduce the application rates of chemical fertilizers and pesticides, subsequently reduce environmental pollution and reduce import cost of fertilizers.								
Aim	This module will teach you what determines soil fertility, which nutrients are needed for the growth of plants, and brief the processes that cause a loss of soil fertility and the effects of that.								
Learning Outcomes	At the end of this module, the students will be able to: • To identify basic soil fertility processes • Describe the natural factors influencing soil organic matter decomposition and accumulation rate. • Explain the relationship between climate change and carbon sequestration. • identify the different processes leading to the stabilization of soil organic matter. • Understand SOM decomposition. • Explain why soil organic matter is important for plant nutrition.								
Units	Unit 4.1. What is soil organic matter? Unit 4.2. Production and decomposition of organic matter. Unit 4.3. Role of soil organic matter on nutrients dynamics. Unit 4.4. Effect of soil management on soil organic matter. Unit 4.5. Climate change and carbon sequestration.								
Readings	• Coleman, David C, & Oades, J Malcolm. (1989). Dynamics of soil organic matter in tropical ecosystems. Univ of Hawaii Publisher • Paul, EA, Kravchenko, A, Grandy, A, & Morris, S. (2015). Soil organic matter dynamics: Controls and management for sustainable ecosystem functioning. *The Ecology of Agricultural Landscapes: Long-Term Research on the Path to Sustainability*, 104-134.								

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- Krishna, Kowligi R. (2016). *Precision farming: soil fertility and productivity aspects*: Apple Academic Press.

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<tr><td>Activity</td><td>

Assignment 4.1 (3 hours)

Training of students on how to determine soil organic matter (OM) in the lab. In this section, the students will divide into groups (2-3 students) to determine soil OM using Walkley and Black method.

Assignment 4.2 (3 hours)

Training the students on how to calculate soil organic carbon content and conversion organic carbon to organic matter in soil.

Note, you can find this method and the calculations in chapter 34 "Total carbon, organic carbon, and organic matter". In Sparks, D.L. et al., (Eds) (1996) *Methods of soil analysis*. Madison, Wisconsin: ASA and SSSA.

Assignment 4.3 (12 hours)

During this module each students group (5-6 students) will start the pot experiment for 4-5 weeks and observe the effect of soil nutrients on plant growth.

Assignment 4.4. (19 hours)

Reading and Guided discussion (possible topics):

- Soil fertility and plant nutrition. In: Neal Van Alfen, editor-in-chief. Encyclopedia of Agriculture and Food Systems, Vol. 5, San Diego: Elsevier; 2014. pp. 166-184. **(6 hours)**
- Root morphology and nutrient uptake kinetic by Australian Ceder clones. Rev. Caatinga, Mossoró, 29(1): 153-162, 2016. **(4 hours)**
- Farmer decisions about adopting environmentally beneficial practices. in S. K. Hamilton, J. E. Doll, and G. P. Robertson, editors. The Ecology of Agricultural Landscapes: Long-Term Research on the Path to Sustainability. Oxford University Press, New York, New York, USA, pages 340-359. **(5 hours)**
- Carbon sequestration in agricultural lands of the United States doi:10.2489/jswc.65.1.6A **(4 hours)**

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<tr><td>SD Pillars</td><td>

Environment	√	**Economy**	√	**Social**	√	**Culture**	√

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<tr><td>21st ESD</td><td>

Learning to know √	Learning to be √	Learning to do √	Learning to live together √	Learning to transform oneself and 3society √	Learning to give and share √

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<tr><td>SDGs
Sub goals</td><td>

1	2 √	3	4	5	6	7	8	9	10	11	12 √	13	14	15 √	16	17

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<tr><td>Egypt Vision 2030</td><td>This module is focused on Tenth Pillar: Urban Development that explain the balance spatial development management of land and resources to accommodate population and improve the quality of their lives.</td></tr>
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Lecture	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**

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ECTS Work Load	**6 h**		**10**	**9**	**12**				**37**
Module 5	**Managing Soil Erosion**								
Key Concepts	Wind and water erosion								
Overview	Erosion is a natural process that has sculpted landscapes for millions of years. However, climate change, human alterations of land use and cover have caused erosion rates to increase for many areas of the world, resulting in considerable land and environmental degradation. Soil erosion over decades can have detrimental effects on productivity and soil quality because most of soil nutrients and soil organic matter are stored in the topsoil, the soil layer most affected by erosion. Soil erosion is a widespread problem in agriculture in the developing countries. The problem has far-reaching economic, political, social and environmental implications due to both on-site and off-site damages. Runoff can carry fine sediments, nutrients and other pollutants to water sources, possibly degrading water quality. Soil erosion is the physical movement of soil particles from one location to another, primarily due to forces of water or wind. The three main phases of soil erosion are detachment, transport and deposition. Additionally, soil tillage often leads to an improvement in soil structure because of reduced mechanical disturbance and an increase in soil organic matter content and aggregation. During this module, the students will investigate the types and causes of wind and water erosion and learn how to prevent or manage of erosion.								
Aim	The aim of this module is to present best management practices for managing erosion on agricultural soils for preventing and resolving wind or water erosion. For achieving this aim, we will explain the processes involved in wind and water erosion, the causes of wind and water erosion and its effects on soil functions.								
Learning Outcomes	After reading this module, the students should be able to: • Differentiate among the different types of wind and water erosion • List physical factors which affect the rate of erosion • Recognize how conservation practices impact water erosion and environmental quality • Describe how residue management practices and cropping systems affect soil productivity • Know how to estimate percent residue								
Units	Unit 5.1. Processes of soil erosion Unit 5.2. Factors affecting wind and water erosion Unit 5.3. Estimating and measuring soil erosion Unit 5.4. Sustainable management for erosion control (Tillage and vegetation) Unit 5.5. Modeling water and wind erosion								
Readings	• Blanco, Humberto, & Lal, Rattan. (2008). *Principles of soil conservation and management* (Vol. 167169): Springer New York. • Soil Science Society of America. (2001). *Glossary of soil science terms*. https://www.soils.org/publications/soils-glossary/								
Activity	**Overview** **Activity 5.1. Reading and group discussion (8 hours)** The instructor should spend time at the end discussing with the whole class their answers to question (Do you think the compacted soil is more vulnerable or less vulnerable to soil erosion by runoff?). Start by asking them their answers and encourage them to debate until they agree on the correct answers. Some students may believe that compacted soil is less vulnerable to erosion by								

runoff; however, the opposite is true. If rainfall cannot infiltrate (percolate down into) the soil, there will be more water flowing on the surface wearing away the soil. After students have shared their answers and this discussion has occurred. Ask the students to look carefully and interpret what they see. Then point out how the compacted field equipment track (traffic lane) is wetter than the adjoining planted areas. The planted areas themselves are likely more compacted due to tillage than are soils from natural areas surrounding this field. A brief discussion of soil compaction should follow. Ask the students to summarize what they have learned about soil compaction in the context of this lesson (compacted soil has lower porosity and is more erosive than uncompacted soil). Next, if possible, show students at least the first few minutes of this YouTube video that demonstrates the benefits to soil of one of the sustainable soil management practices your students will be addressing in their post-activity homework. Link videos show the differences in tilled and no till soils related to soil erosion. **The students should be shared the information about this activity by email.**

https://www.youtube.com/watch?v=q1aR5OLgcc0&feature=player_embedded#at=274

https://youtu.be/-Pa8iJskSZg

https://www.youtube.com/watch?v=-Pa8iJskSZg&feature=youtu.be

Activity 5.2.

Warm-up: 'brain dump' activity (2 hours)

In this warm-up exercise, students will recall information they have learned in Units 1-5 in order to prepare them for the summative assessment. Instructors will give the students time to write down everything they can remember about the topic of soil erosion without using their notes. Students will then compare lists with a partner and add any missed items to their own list. If conflicts arise, students should also note these. They will then compare their new list with a second partner and again add any missed items to their own list and attempt to resolve any conflicts. Finally, the instructor should ask for items from the whole class, one student at a time, and record them on the board. (Online)

Activity 5.3. (12 hours)

Investigating the rainfall erosivity (GIS mapping and analysis) (27 pages)

An exercise to use a simple image analysis program of Egyptian territory (e.g. Eastern desert) and use soil erosion models (e.g. the revised universal soil loss equation, RUSLE) to use arithmetical expressions to explore relationships among various processes occurring in the terrain. In this activity the students will use an approach to integrate RUSLE model and geographic information system (GIS) to detect erosion vulnerability and determine the soil erosion risk in the study area. The study area is situated in the eastern desert, Egypt. Ground truth data were examined to represent two regions: Luxor-Suhag and Suhag- ElMinya. More details about this activity the students should be reading the article in titled, *Estimating the rainfall erosivity for management planning in the Eastern Desert, Egypt*. This article in available in following website:

https://www.researchgate.net/profile/Reinhard_Zoelitz/publication/284195550_Estimating_the_Rainfall_Erosivity_for_Management_Planning_in_the_Eastern_Desert_Egypt/links/57f3f

	54708ae8da3ce537d09/Estimating-the-Rainfall-Erosivity-for-Management-Planning-in-the-Eastern-Desert-Egypt.pdf **Activity 5.4. (8 hours)** **Preliminary activity for service learning:** The student should read the book chapter related to next activity to give more details and information about how to control erosion using plant. The students will read the chapter in title " Soil-Erosion and Runoff Prevention by Plant Covers: A Review" in E. Lichtfouse et al. (eds.), Sustainable Agriculture, DOI 10.1007/978-90-481-2666-8_48. **Activity 5.5. Community/Service learning activity (6 hours)** **Activity: Erosion Control by vegetation** The goals of erosion control are to reduce erosion of disturbed areas, meet or exceed stormwater quality requirements and minimize life cycle costs by creating long-term soil health, establishing the most appropriate vegetation and achieving permanent soil stabilization. The sustainability triangle, soil, water and vegetation, must be considered to achieve successful, self-sufficient erosion control at a project site. With helping the course instructor, the students will select two small area in eroded site, one is cultivated with vegetation and the other not cultivated. This activity will be helping the community to increase our environmental awareness for sustainable erosion control. In this activity the students will work based on the community needs and they work cooperatively with the community to ensure effectively manage of soil and water resources. Additionally, this collaboration led to an engages community members and ensures the result responds to actual community needs. This activity is linked with the module 5 (managing for soil erosion) and the unit 5.4. that in titled Sustainable management for erosion control (Tillage and vegetation). The theoretical approach of sustainable erosion control in this unit and the whole course will provide the students with an opportunity to apply their knowledge and skills in their actual life. The students will work cooperatively with the community to help community to find the suitable solution for erosion control. The student will be shared in this activity to give their reflection and capabilities necessary for future work and learning in this activity. The student will apply their academic and vocational skills and knowledge to address real life/work situation and led to an improve this activity. It involves students applying knowledge and skills to make a difference in their communities. This developing students' ability to give and take effective feedback. The students will share their experience with others. The students not only learned how to share their knowledge but also communicate it in different ways based on their audience. The student will compare between the pre- and pot-application of sustainable erosion control on the community served. These findings will answer the question; Can service-learning change the community behaviours for sustainable erosion control?								
SD Pillars	**Environment**	√	**Economy**	√	**Social**	√	**Culture**	√

21st ESD	Learning to know √	Learning to be √	Learning to do √	Learning to live together √	Learning to transform oneself and society √	Learning to give and share √

SDGs / **Sub goals**	1	2 √	3	4	5	6	7	8	9	10	11	12 √	13	14	15 √	16	17

Egypt Vision 2030	This will lead to encourage investment in natural resources and hazard ecological systems to support the economy, sustainable agriculture and provide new job opportunities (Ninth Pillar: Environment).

ECTS Work Load	**Lecture**	**Online**	**Lab**	**Community learning activity**	**Prepare Course activity**	**Project work**	**Reading**	**Prepare exam**	**Writing exam**	**Total**
	6 h	**2**		**6**	**10**	**5**	**12**	**8**		**49**

Module 6	**Management of Soil Threats**
Key Concepts	Soil pollution, salinization and biodiversity
Overview	Soil threats, soil pollution, desertification, salinization and sodicity and loss of soil biodiversity, have increasingly been recognised as serious problems. Soil pollution is the occurrence of contaminants in soil above a certain level causing deterioration or loss of one or more soil functions. This module will explain the main sources of soil pollution and how different pollutants behave in the soil and why it is important to know about the natural background levels of heavy metals in soils. How soil properties affect pollutants? and also will explain the concept and importance of bioavailability of heavy metals in soil. We also provide an overview of some soil remediation techniques and explain the concept of phytoremediation. Additionally, saline and sodic (alkali) soils can significantly reduce the value and productivity of affected soil. Soil salinity and related problems generally occur in arid or semiarid climates where rainfall is insufficient to leach soluble salts from the soil or where surface or internal soil drainage is restricted. This module includes on the process of salinization, the causes of salinization and the effects on soil functions. How to calculate some parameters such as Leaching and Gypsum Requirement for managing soil salinization. Measures and strategies to prevent and resolve salinization will be considered in this module. Finally, this module will explain the relation between soil biodiversity and soil functions and summarize the processes that cause a loss of soil biodiversity and their effects. We will also explain the measures and strategies to prevent and resolve the loss of soil biodiversity.
Aim	This module will examine current interdisciplinary topics on soil contamination and remediation as well as soil salinization, sodicity and loss of biodiversity. Topics include environmental contaminants and their sources in the environment, pathways to contaminate soils, impacts on the environment, fates in soils, and remediation. We also investigate the management of salt and sodic problems because it is important for many agricultural producers, consultants and soil managers. This module will investigate the technolgies for resolution loss of biodiversity.
Learning Outcomes	In this module, the students will learn: • Learn the various sources of heavy metals causing soil pollution. • Identify the prevention and control measures of metal contaminated soil • Understand how salt-affected soils develop • Recognize properties of saline, sodic and saline-sodic soils • Determine the relative difference of plant tolerances to salts • Describe suitable management plans to prevent and reclaim salt-affected soils • Define biodiversity and describe how protect soil biodiversity
Units	Unit 6.1. Soil Pollution

	6.1.1. Major Types of Soil Pollutants 6.1.2. Sources of Soil Pollution 6.1.3. Soil Remediation Unit 6.2. Saline, sodic and saline-sodic soils (Development of Salt-Affected Soils) Unit 6.3. Soil reclamation Unit 6.4. loss of soil biodiversity
Readings	• Mirsal, Ibrahim A. (2008). *Soil pollution*: *origin, monitoring and remediation:* Springer. • Mace, JE, & Amrhein, C. (2001). Leaching and reclamation of a soil irrigated with moderate SAR waters. *Soil Science Society of America Journal*, *65*(1), 199-204. • Richards, LA (1954). Diagnosis and Improvement of. *Saline and Alkali Soils. Handbook, 60. Available in website:* https://www.ars.usda.gov/ARSUserFiles/20360500/hb60_pdf/hb60complete.pdf • Wagg, Cameron, Bender, S Franz, Widmer, Franco, & van der Heijden, Marcel GA. (2014). Soil biodiversity and soil community composition determine ecosystem multifunctionality. *Proceedings of the National Academy of Sciences*, *111*(14), 5266-5270. • Lamond, RE & Whitney, DA (1992). *Management of saline and sodic soils*. MF-1022. Cooperative Extension Service, Kansas State University. Manhattan, Kansas. 4 p. • El Mujtar, V., Muñoz, N., Prack Mc Cormick, B., Pulleman, M., & Tittonell, P. (2019). Role and management of soil biodiversity for food security and nutrition; where do we stand? *Global Food Security*, *20*, 132-144. doi: https://doi.org/10.1016/j.gfs.2019.01.007
Activity	**Activity 6.1 (20 hours)** **Pre-work homework activity** The students should be using internet and read the topics: • Management of soil threats that including the three subsections "Sources of soil pollution and it is nature," "Soil salinity and sodicity," and "Loss of soil biodiversity?" • The students should evaluate the effects of climate change in terms of agricultural productivity, land suitability, and contamination risks. • The discussion should be done between instructor and students and the feedback of students can be sharing by email. Online **Activity 6.2** **"think/pair/share" activity (4 hours)** • Start with a pre-activity "think/pair/share" exercise to make the students think about what they know about soil treats (learn more about think-pair-share). Instruct students to think about what they learned about management of soil threats under climate change scenarios in the pre-activity homework, then ask them to divide into pairs, and have each pair write a description of soil threats in fewer than 35 words. Have your own description ready that includes reference to soil pollution, salinity and sodicity, and loss of soil biodiversity. **online** **Activity 6.3**

Practical Work: (6 hours)

- Training the students to conduct a pot experiment to discover the influence of Specific ions and levels of concentration of salt on soils and plants.
- Measuring of soil microbial activity and Enzyme activities.

Activity 6.4

Group discussion (3 hour)

The students should read the article about theoretical gypsum requirement (TGR) Models, available in http://www.caslab.com/News/theoretical-gypsum-requirement-tgr-models.html

Activity 6.5 (10 hours)

Just-in-Time Teaching (JiTT) Warm Up Activity
Warm Up Questions:

1. What degree of change in the direct and/or the indirect effects of climate change on microbe-microbe or plant-microbial interactions are relevant for ecosystem functioning?
2. Are the indirect effects of climate change on communities as important as the direct effects for ecosystem process rates and carbon feedbacks?

References and Notes:

Articles that students may be assigned to read for this set of questions include (but are not limited to):

Direct and indirect effects of climate change on soil microbial and soil microbial-plant interactions: What lies ahead? Available in website:

http://onlinelibrary.wiley.com/doi/10.1890/ES15-00217.1/full

The instructor should create an incentive for students to answer the Just-in-Time Teaching warm-up questions. The students are encouraged to do the readings and think about the questions before responding.

Evaluation

Marrs et al. (2003) reports a JiTT scoring rubric adapted from de Caprariis et al., 2001:
1. Student says he / she does not know how to answer the WarmUp question.

2. Student tries to answer the WarmUp question but does not show evidence of any previous knowledge to assist in answering. Student may reveal misconceptions about concepts. Student does not use any information from the text or lecture notes to answer the question. (Incorrect answer)

3. Student shows some prior knowledge and may use terminology to answer the WarmUp question. Student does not use appropriate information from the text or lecture notes to answer the question. (May be partially correct but still incomplete).

4. Student answers the WarmUp question correctly and completely. Student incorporates information from the text or class notes into the answer. Student may look for answer outside the class (web, etc).

Reference

- de Caprariis, Pascal, Barman, Charles, & Magee, Paula. (2001). Monitoring the benefits of active learning exercises in introductory survey courses in science: An attempt to improve the

	education of prospective public-school teachers. *Journal of the Scholarship of Teaching and Learning*, 1 (1). 13-23. • Marrs, Kathleen A, Blake, Robert E, & Gavrin, Andrew D. (2003). Use of warm up exercises in just-in-time teaching to determine students prior knowledge and misconceptions in biology, chemistry, and physics. *J Coll Sci Teach, 33*, 42-47.																
SD Pillars	**Environment**	√	**Economy**	√	**Social**	√	**Culture**	√									
21st ESD	Learning to know √	Learning to be √	Learning to do √	Learning to live together √	Learning to transform oneself and society √	Learning to give and share √											
SDGs Sub goals	1	2 √	3 √	4	5	6	7	8	9	10	11	12 √	13	14	15 √	16	17
Egypt Vision 2030	This module will lead to create a system of positive cultural values respecting diversity and differences for soil threats (Eighth Pillar: Culture). Based on the remediation project and reduced soil pollution, Egyptians should enjoy a healthy, safe, and secure life (Sixth Pillar: Health).																
ECTS Work Load	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**								
	9 h	**4**	**4**	**11**	**13**	**15**	**15**	**3**	**74**								

Summary of ECTS Course workload (8 ECTS)

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**						**Workload**
				1	**2**	**3**	**4**	**5**	**6**	
Lectures (face-to-face)	14	3	42	6	6	6	6	6	12	42
Online	2	3	6	-	-	-	-	2	4	6
Lab work	9	2	18	-	2	2	10	-	4	18
Reading articles (3 pages per hour)	120	0.3	36	6	6	5	6	6	7	36
Reading book chapters (5 per/h)	110	0.2	22	4	4	3	3	4	4	22
Preparing course activities	5		57	-	12	10	12	10	13	57
Project work	1	20	20	-	-	-	-	5	15	20
Community/Service learning activity	1	6	6	-	-	-	-	6	-	6
Preparation for exam	1	25	25					10	15	25

Writing the exam	1	3	3						3	3
Total			**235**	16	30	26	37	49	77	**235**

Connection of course activities and 17 SDGs with the 3 key domains of the CCSAFS MSc.

SDGs		CLIMATE CHANGE	SUSTAINABLE AGRICULTURE	FOOD SECURITY	COURSE MODULE
1	End poverty in all its forms everywhere				
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	√	√	√	Module 4
3	Ensure healthy lives and promote well-being for all at all ages				
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				
5	Achieve gender equality and empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all	√	√	√	Module 2 Module 3
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns				
13	Take urgent action to combat climate change and its impacts				
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				

15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss	√	√	√	Module 4 Module 5 Module 6
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS

Course Syllabus

Course Number: CSAF880

Course Title:

Statistics, and Design and Analysis of Biological Experiments

Semester: II

Instructor Information

Instructor: **Prof. Dr. Abdelrehim A. Ali**
Internal Reviewer: Prof. Manal M. Hefny (SCU)
External Reviewer: Prof. Nancy Kanbar
Office Location: Agronomy Department
Telephone: 02 064- 3201793- Ext. 1872
Office Hours: Sunday-Wednesday: 9.00 AM - 3.00 PM
E-mail: drrahem@gmail.com
Website:

Course Identification

Course Number: CSAF880

Course Name: Statistics and Design and Analysis of Biological Experiments

Course Location: Laboratory 2, MSc Program in CCSAFS - Agronomy Building-University New Campus

Class Times: Monday: 10.00 am-1.00 pm

Prerequisites: None

Faculty Web Page: http://scuegypt.edu.eg

Course Description/Overview

Statistics is a discipline which is concerned with the collection and analysis of data based on a probabilistic approach. Generally one can say that statistics is the methodology for collecting, analyzing, interpreting and drawing conclusions from information. Putting it in other words, statistics is the methodology which scientists and mathematicians have developed for interpreting and drawing conclusions from collected data. Everything that deals even remotely with the collection, processing, interpretation and presentation of data belongs to the domain of statistics, and so does the detailed planning of that precedes all these activities.

Agriculture belongs to the research fields in which experiments play an outstanding role. A great number of new ideas are based upon results of field and laboratory experiments. Statistics is one of the principal tools, not only when it comes to the analysis of experiments, but already in the planning phase. In this sense statistics means not only management and analysis of numbers, but it defines largely the principles of the scientific method. In this course we try to summarize some aspects deemed important for a good understanding of scientific experimentation, based on the experience of advising students from different fields.

The main purpose of this course is to introduce students to quantitative and qualitative methods for conducting meaningful analysis and research. The course will provide an overview of the important concepts of research design, data collection, statistical and interpretative analysis, and final report presentation. Students will be exposed to the broad range of designs used in communication research from laboratory and field experiments, surveys, focus groups and in-depth interviewing. The course is structured in a logical order of seven modules. It is expected that the statistical knowledge will achieved by the end of this course provide a solid foundation for master degree studies in Biometrics. It is necessary to emphasize the important role of statistics for improving students' general knowledge and for better use of statistical methods in research work.

Statistical methods can be used to find answers to the questions like:

• What kind and how much data need to be collected?

• How should we organize and summarize the data?

• How can we analyze the data and draw conclusions from it?

• How can we assess the strength of the conclusions and evaluate their uncertainty?

So, statistics provides methods for

1. Design: Planning and carrying out research studies.

2. Description: Summarizing and exploring data.

3. Inference: Making predictions and generalizing about phenomena represented.

The course will be delivered through a combination of face-to-face lectures, computer lab practice, individual assignments and seminars. Lectures will explain theories underlying techniques, with real applications of the program disciplines. The course material is designed to offer students a balance between theory and applied examples. In addition the lab practices will provide students opportunities to perform and apply proper statistical analyses for different modules using SPSS package

Course Learning Objectives

The major objective of statistics is to make inferences about population from an analysis of information contained in sample data. This includes assessments of the extent of uncertainty involved in these inferences.
More specifically, we will discuss the process of identifying research questions and selecting appropriate methodologies, understanding the difference between quantitative and qualitative data, and associated benefits and limitations. We will give an overview of common methods, knowledge and skills in statistical techniques using statistical program such as SPSS and finally discuss the interpretation of findings using multiple data sources.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Develop research questions and link them to study designs relevant with CCSAFS

2. Understand differences between quantitative and qualitative research and their applications in the CCSAFS fields.

3. Organize and summarize the data.

4. Be familiar with different methods for collecting and analyzing qualitative data

5. Understand simple descriptive analyses for quantitative data

6. Interpret multiple sources of data and develop evidence-based conclusions and recommendations

These learning outcomes will equip students to better understand the data collection methods and tools that are used within the overall CCSAFS research.

Course Resources

The course resources including books, journal and some links as listed below. Other important sources are listed in the course modules.

- https://www.westga.edu/academics/research/vrc/assets/docs/spss_basics.pdf
- https://www.snapsurveys.com/blog/qualitative-vs-quantitative-research/
- https://imotions.com/blog/design-a-questionnaire/
- https://students.shu.ac.uk/lits/it/documents/pdf/questionnaire_analysis_using_spss.pdf
- https://www.statisticshowto.datasciencecentral.com/experimental-design/
- https://teaching.shu.ac.uk/hwb/ag/resources/resourceindex.html
- https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression
- http://dspace.tiss.edu/jspui/bitstream/1/7047/1/Research-MethodologyMethods-and-Techniques-by-CR-Kothari.pdf
- https://www2.ib.unicamp.br/profs/fsantos/apostilas/Quinn%20&%20Keough.pdf
- ftp://public.dhe.ibm.com/software/analytics/spss/documentation/statistics/25.0/en/client/Manuals/IBM_SPSS_Statistics_Core_System_User_Guide.pdf.

Course Website(s)

Required Course Texts and Materials

- Rao Sabir Sattar, et. al. (2017). Qualitative and quantitative approaches to study adoption of sustainable agricultural practices: A research-note on mixed method approach. International Journal of Agricultural Extension and Rural Development ISSN 3254-5428 Vol. 5 (2), pp. 539-544.

- Kothari, C.R. (2004). Research methodology, methods and techniques. NEW AGE International (P) Limited, Publishers, Ansari Road, Daryaganj, New Delhi, India. Available at: http://dspace.tiss.edu/jspui/bitstream/1/7047/1/Research-MethodologyMethods-and-Techniques-by-CR-Kothari.pdf.

- Montgomery, D. C. (2012). Design and Analysis of Experiments, 8th Edition, John Wiley & Sons.

Optional Course Texts and Materials

- Hands-out is prepared by the course instructor and distributed to the students. Selected presentations prepared by the students could be used as course materials.

-http://onlinestatbook.com/Online_Statistics_Education.pdf

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Assignments and Grading Scheme

Grading Policy

Assignments	10%
Final Exam	60%
Practical Exam	20%
Oral Exam	10%
Total Points	**100**

Grading System

The performance of students will be assessed/evaluated on several measures:

Final written exam (60% total) will cover all of the course contents (readings, outside readings, and discussions), the final exam will be cumulative. The date of this exam depends on the schedules decided by the university council, however, mostly will be during May. Course assignments (10%), the goal of each assignment is to help students develop critical thinking skills and improve their abilities to write clearly and concisely, compare popular opinions to scientific evidence. Assignments will be posted online through LMS, presented and discussed during the class time, printed as hard copies. Participation actively in class discussion is part of assignments. Each assignment should be delivered on specific time, evaluated by the instructor and discussed with the students. Practical Exam (20%), will be passed during the fifth week of the semester, software should be applied to solve statistical

problems relate with CCSAFS. Oral Exam (10%) is scheduled directly after the final exam, where each student is given 2-3 questions.

Late Assignments

Course assignments will be given to the students at or during the class. Each assignment has specified date to be delivered to the course instructor either printed/ or online. Students who are late in assignments provision 3 days after the specified date will lose 3 marks from the total course assignments grades. After the due date passed without notice and justification, the submission is not accepted and the students lose the full mark of the specific assignment.

Classroom Protocol

To be eligible for attending the final course exam, student must attend 75% of the total course lectures. If students absent more than 75%, he/she must provide reasonable justification for absence to the program's coordinator who has the authority to accept or reject it. The coordinator will discuss with the faculty dean if it is allowed for that students to enter the exam. The students must respect the time of the lecture (starting and ending). Students are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assigned material before you come to class. The course instructor expects active class participation.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by case basis.

Important Dates to Remember

Course Schedule

Week	Module	Contents
1	**Module 1**	**Course Overview** Discussion of syllabus and assignments, course requirements and prerequisites; assessment criteria and due dates _____ **An Introduction to Statistics (2 weeks)** **Unit 1.1: The CCSAFS Research Context: Trends, Needs & Priorities** **Unit 1.2: Collection, Organizing and Producing Data** 1.2.1. Uses of Statistics

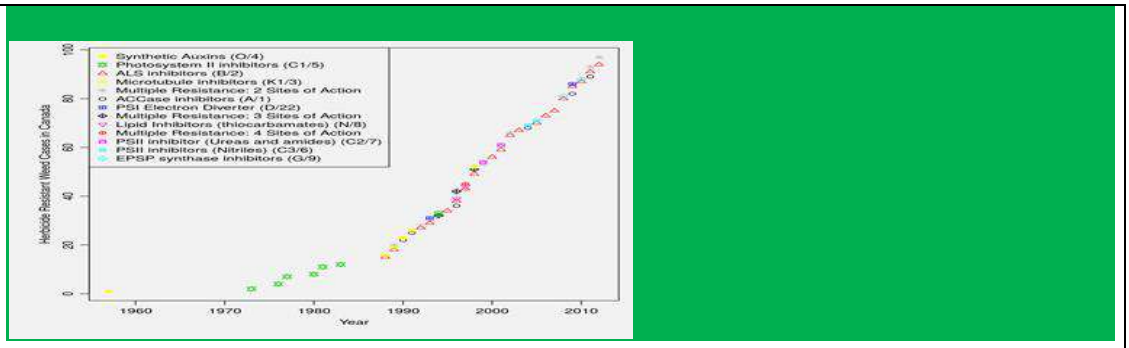
		1.2.2. Research problem, definition and identification 1.2.3. Types of Variables. 1.2.4. population and sample 1.2.5. Sampling Technique **Unit 1.3: Displaying Data (Describing data by tables and graphs)** 1.1. Categorical Data (Pie Chart - Bar Charts - Two-way Tables) 1.2. Histograms and the Empirical Cumulative Distribu Function 1.3. Scatterplots
2		**Unit 1.4: Measures of center and variation** 2.1. Measuring Center (Measures of location) 2.2. Measuring Spread (Measures of spread) 2.3. Confidence interval
3	**Module 2**	**Introduction to SPSS (2 weeks)** **Unit 2.1. Creating and preparation Data in SPSS** 2.1.1: SPSS interface: data view and variable view 2.1.2: Data type, measurement level, and variable list icons 2.1.3: Data entry (create, edit, and format a data file) 2.1.4: Coding data 2.1.5: Data Transformations
4		**Unit 2.2. Manipulating and Data analysis in SPSS** 2.2.1: Generating Graphical Statistics in SPSS 2.2.2: Statistical Models, Data processing and analysis using SPSS Package
5	**Module 3**	**The Quantitative vs the Qualitative Research Debate (1 week)** 3.1. Variables (Type - Scales of measurement). 3.2. Parametric and non-parametric tests. 3.3. Normal distribution curve.

		3.4. Normality test 3.5. Applications of SPSS
6	**Module 4**	**Planning Experiments and Developing the Research Design (2 weeks)** **4.1. Basic Principles and Techniques of Experimental Design** 4.1.1. The Art of Experimentation 4.1.2. Replication 4.1.3. Blocking 4.1.4. Randomization **4.2. Conducting research design and Significance test** 4.2.1. Recognition and statement of the problem 4.2.2. Define the objectives of the experiment. 4.2.3. Choice of factors, levels, and ranges 4.2.4. Selection of the response variable(s) 4.2.5. Identify all sources of variation. 4.2.6. Specify the Test, measurements to be made, the experimental procedure, and the anticipated difficulties 4.2.7. Choosing and justifying a research design.. a rule by which to assign the experimental units to the treatments. 4.2.8. Run a pilot experiment. 4.2.9. Conducting the experiment.
7		**4.3. An overview of research designs** 4.3.1. Simple experiments 4.3.2. Factorial experiments 4.3.3. Multivariate
8	**Module 5**	**Qualitative research methods (2 weeks)** **5.1.** Introduction to qualitative research **5.2.** Methods of data collection (Observation –Interview – Questionnaires). **5.3.** (Questionnaire design) Handling open-ended answers to semi-structured questionnaires. **5.4.** Extracting themes, patterns, etc. from qualitative data.
9		**5.5.** Some important non - parametric tests are used extensively. (Binomial Distributions - Poisson Distributions - Q2).

10	**Module 6**	**Moving from the Quantitative and Qualitative Research Design to the Data Analysis (3 weeks).** **6.1. Statistical analysis and drawing conclusions.** **6.2. Comparison between two groups (parametric and non-parametric).** 6.2.1. One sample T test – Binomial. using SPSS 6.2.2. Paired Samples T Test - Two Related Samples Test (Wilcoxon Signed Ranks Test)…. using SPSS. 6.2.3. Independent Samples Test - Mann Whitney…. Using SPSS. **6.3. Analysis of variance (Comparison between more than two groups)** 6.3.1. **Hypothesis testing and Test of significance.** 6.3.2. **F teat – Kuruckal Wallace…. using SPSS.**
11		**6.4. Types of experiments** 6.4.1. Simple experiments CRD – RCBD – LS… using SPSS. 6.4.2 Factorial experiments CRD – RCBD – LS… using SPSS. 6.4.3. Split plot experiments using SPSS
12		. **6.5. Multivariate using SPSS.**
13	**Module 7**	**Variables trend and associations (2 weeks)** **7.1. Correlation Estimates** **Measuring Strength of Association with Correlation using SPSS.**
14		**7.2. Regression analysis** 7.2.1. Linear Regression using SPSS. 7.2.2. Coefficient of determination using SPSS. 7.2.3. Multiple Linear Regression using SPSS.
15		General discussions and preparing for the exams

The CCSAFS Course Modules

Course	Biostatistics and Design and Analysis of Biological Experiments
Module 1	**An Introduction to Statistics (2 weeks)**
Key Concepts	Sample and sampling – Variable – Parameter – Statistic - Probability distribution - Discrete and Continuous probability distributions – Symmetrical and skewed probability distributions
Overview	The first module addresses fundamentals and concepts of statistics as a very broad subject, with applications in a program subjects; climate change,sustainable agriculture and food security. When describing quantitative data, we are talking about the distribution of data. The distribution of quantitative data is described by: Shape, Center, Spread, and Outliers. There are two main branches of statistics: descriptive and inferential: Descriptive statistics is used to say something about a set of information that has been collected, describing the main features of a collection of data. For example changes in temperature levels and rainfall variability depend on the operation of climate for the world as a whole. Use descriptive statistics in this context descripe the impacts regionally and their differences internationally. One of the most basic exploratory tasks with any data set involves computing the mean, variance, and other descriptive statistics. This module will demonstrate how to obtain many of these statistics from a data set, using the summary, mean and sd functions. These functions will be used in the context of an entire data set or column from a data set; in most cases it will be more informative to calculate these statistics for groups of data, such as experimental treatments. Inferential statistics is used to make predictions or comparisons about a larger group (a population) using information gathered about a small part of that population. Descriptive statistics are distinguished from inferential statistics (or inductive statistics), in that descriptive statistics aim to summarize a sample, rather than use the data to learn about the population that the sample of data is thought to represent. As indicated in the following figure data represented to show Cumulative number of herbicide resistant weed cases in Canada over time.

	
Aim	The main objective of this module is studying and learning different ways to collect, describe and display data. Understanding the essentials of calculating common descriptive statistics for measuring centre, variability, and skewness in data. Also, learning to calculate and interpret these measurements and graphs
Learning Outcomes	At the end of this module students will be able to: 1. Describe the different methods and data collection process. 2. Identify, collect and communicate appropriate quantitative and qualitative data to solve real problems relevant to CCSAFS themes 3. Organize and summarize the data. 4. Know the difference between categorical & quantitative variables 5. Understand simple descriptive analyses for quantitative data 6. Interpret multiple sources of data and develop evidence-based conclusions and recommendations
Units	Unit 1.1: The CCSAFS Research Context: Trends, Needs & Priorities Unit 1.2: Collection, Organizing and Producing Data Unit 1.3: Displaying Data (Describing data by tables and graphs) Unit 1.4: Measures of center and variation
Readings	***Introductory textbooks*** https://www.google.com/search?q=Springer+Texts+in+Statistics&se_es_tkn=kydnrolv Descriptive and Inferential Statistics Descriptive and Inferential Statistics
Activity	**Overview**

Assignment 1.1

In Context of study Crop Productivity and Sustainable Agro-ecosystems, write a paragraph explaining how you would take a random sample of wheat plants growing in Ismailia Governorate.

Keep in mind; you need to devise a method that will not be biased in any way.

Assignment 1.2

(Individuals and variables). We consider two populations - the first is the nations of the world and the second is the people who live in those countries. Below is a collection of variables that might be used to study these populations.

nations	**people**
population size	age
average rainfall	gender
mean income	annual income
literacy rate	literacy
capital city	mother's maiden name
largest river	marital status

Classify the variables as quantitative or categorical in the example above.

Assignment 1.3

There are many different greenhouse gases, carbon dioxide, or CO2, is the one that has been on the rise during the last century. The concentration of CO2 in the atmosphere has increased by 39 percent. The average Earth surface temperature has gone up by about 1.4 degrees Fahrenheit (0.8 degrees Celsius) relative to the mid-20th-century baseline (measured between 1951 and 1980)..

In this activity, students will use global temperature data to create models and compare short-term trends to long-term trends. They will then determine whether global temperature is rising based on the data

- CLIMATE CHANGE EARTH GLOBAL WARMING CLIMATE TEMPERATURE MODELS MODELING TEACHABLE MOMENTS.

1. Explain to students that they will be analyzing average temperatures measured on Earth for the past 136 years, but each group will only be looking at a portion of that data.
2. Distribute the global temperature data, either as a whole set or pre-divided for individuals or groups.

3. Call out each of the date ranges to verify that each one is assigned to a group of students.
4. Tell students that because their graphs will be combined with the graphs from the rest of the class, everyone must use the same horizontal and vertical scale.
5. Ask students to examine the data and determine which value, year or annual mean temperature, should go on the vertical axis. *Although it can be done either way, annual mean temperature should go on the vertical axis for ease of viewing.*
6. When individual graphs are complete, have students determine if they see an increase or decrease in mean global temperature for their group's time frame. Discuss the risk of making climate assumptions and projections when looking at a small data set.

Assignment 1.4

Individually, students will read the data in the following links related with the climate change in Egypt then,.

- Each student presents short report about statistics of different items included in these files.
- General discuss in the class about these subjects indicating the role of descriptive statistics generally and in a specific in the program subjects.

https://www.unisdr.org/partners/countries/egy

Egyptian national action program to combat desertification

Egypt: National strategy for adaptation to climate change and disaster risk reduction

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√											√				

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6h			**7h**	**9h**				**22**

Module 2	**Introduction to SPSS (2 weeks)**
Key Concepts	Educational SPSS software, inferential statistics, introductory statistics, sampling distribution.
Overview	SPSS is a Windows based program that can be used to perform data entry and analysis and to create tables and graphs. SPSS is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more. SPSS is commonly used in the Social Sciences and in the business world, so familiarity with this program should serve you well in the future. SPSS is updated often. This document was written around an earlier version, but the differences should not cause any problems. Why Computer Applications?

	Statistical methods are mostly difficult and complicated (ANOVA, regression etc); so, advances in computer technology and statistical software development make the application of statistical method much easier today than before. such analytical software necessary for the Decision support system which serve the management, operations and planning levels of an organization and help people make decisions about problems that may be rapidly changing and not easily specified in advance. To combine the use of models or analytic techniques with traditional data access and retrieval functions.
Aim	Get knowledge and skills to use statistical packages accurately to perform analysis for data and experiments relevant with CCSAFS issues and draw conclusions.
Learning Outcomes	At the end of this module students will be able to: 1. Learn about SPSS and be familiar and aware with Menus and Icons of the program 2. Be familiar with quantitative and qualitative data entry on the SPSS program 3. Use statistical packages accurately to perform analyses for data and experiments relevant with CCSAFS issues. 4. Interpret results and develop evidence-based conclusions and recommendations These learning outcomes will equip students to better understand the data collection methods, data description, analysis and tools to deal with real problems of the overall CCSAFS research (food security, climate change and sustainable agriculture).
Units	**Unit 2.1. Creating and preparation Data in SPSS** **Unit 2.2. Manipulating and Data analysis in SPSS**
Readings	SPSS Instruction Manual [PDF] Online introductions and manuals. • http://www.ats.ucla.edu/stat/spss/sk/default.htm • Indiana University- Getting Started (useful instructions with screenshots) • http://www.psych.utoronto.ca/courses/c1/spss/page1.htm • Central Michigan- Tutorials and Clips (movies, screenshots, instructions- slow loading but good) • http://calcnet.mth.cmich.edu/org/spss/toc.htm • SPSS Statistics Coach and Tutorial (under Help) as well as the ZU library • Online Statistics Textbook • http://www.statsoft.com/textbook/stathome.html • Analysing data using SPSS http://spss.allenandunwin.com.s3-website-ap-southeast-2.amazonaws.com/data-files.html#.XL5gjDAzbIU
Activity	**Overview**
	Assignment 2.1: Working in individual:

	Run SPSS, log in and click **Start - Programs - IBM SPSS Statistics - IBM SPSS Statistics…** Learn about SPSS Statistics three main windows. Follow the instructions of the SPSS guidelines.. Type data into a computer, and organize and format the data so both SPSS and you can identify easily. Tell SPSS what type of analysis you wish to conduct. (data entry, variables characterization, coding of data then descriptive data analysis**).** **Assignment:2.2:** Students work individually to differentiate, identify and enter the collected data through SPSS program [(traits) either quantitative or qualitative] of different varieties under local and regional agro- ecosystems. **Assignment 2.3:** Working in groups: apply the presented example data in the SPSS Present your work in 20 min. Be able to interpret what the SPSS output means and discuss the results with your colleagues. **Assignment:2.4**: Read instructions in the following paper then design questionnaire to study real problem or phenomenon in one axis of the overall CCSAFS researches (food security, climate change and sustainable agriculture). Questionnaire design and analyzing the data using SPSS

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√			√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
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ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6h		**2h**	**9**	**14**				**31**

Module 3	The Quantitative *vs* the Qualitative Research Debate (1 week)
Key Concepts	Quantitative/qualitative research, Scales of measurement, Test of normality, Parametric and non-parametric tests
Overview	There is a long history of discourse of quantitative versus qualitative research traditions. This controversy has created a lot of discussions raising the argument of a mixed methodological approach that combines the strengths and minimizing the weaknesses of quantitative (positivist) and qualitative (interpretive/constructivist) paradigms.

	Although the differences between qualitative and quantitative research as distinct and opposite, in practice they are often combined or draw on elements from each other. Research is a systematic investigation that aims to generate knowledge about a particular phenomenon. However, the nature of this knowledge varies and reflects study objectives. Some seek to make standardised and systematic comparisons, others seek to study a phenomenon or situation in detail. These different intentions require different approaches and methods, which are typically categorised as either quantitative or qualitative. The integration of quantitative and qualitative research can give us a broader understanding of our research subject. Quantitative research can describe the magnitude and the distribution of change, for instance, Whereas qualitative research gives an in-depth understanding of the social, political and cultural context. Mixed methods research allows us to triangulate findings, which can strengthen validity and increase the utility of our work. In statistics, **normality tests** are used to determine if a data set is well-modelled by a normal distribution and to compute how likely it is for a random variable underlying the data set to be normally distributed. Testing for normality procedure in SPSS Statistics for the specific statistical test are using to analyze the data, we provide comprehensive guides in our enhanced content. For each statistical test where students need to test for normality, its indicated, step-by-step, the procedure in SPSS Statistics, as well as how to deal with situations where data fails the assumption of normality (e.g., where you can try to "transform" your data to make it "normal"; something we also show you how to do using SPSS Statistics). You can learn about our enhanced content in general here or how we help with assumptions here. However, in this "quick start" guide, we take you through the basics of testing for normality in SPSS Statistics.
Aim	The main aim of this module is to present and discuss the quantitative vs qualitative research arguments and controversies in light of mixed methods designs. Also, the aim of this module is to overview checking for normality in statistical analysis using SPSS to differentiate between the given data (parametric or nonparametric).
Learning Outcomes	At the end of this module students will be able to: • Understand differences between quantitative and qualitative research and their application. • Apply the normality test to differentiate between the given data (parametric or nonparametric). • Discuss the epistemological underpinnings and controversies of the quantitative/qualitative research. • Demonstrate knowledge of various research methods conducive to quantitative and qualitative research.
Units	Unit 3.1:Variables (Type - Scales of measurement) Unit 3.2: Parametric and non-parametric tests Unit 3.3: Normal distribution curve. Unit 3.4:Test of normality Unit 3.5: Application of SPSS
Readings	https://www.snapsurveys.com/blog/qualitative-vs-quantitative-research/

	https://www.simplypsychology.org/qualitative-quantitative.html - Rao Sabir Sattar, et. al. (2017). Qualitative and quantitative approaches to study adoption of sustainable agricultural practices: A research-note on mixed method approach. International Journal of Agricultural Extension and Rural Development ISSN 3254-5428 Vol. 5 (2), pp. 539-544. - Hand, Ashley M. (2014). A mixed-methods approach to understanding farmer and rancher interest in supplying woody biomass in the U.S. Northern Great Plains. *Graduate Theses and Dissertations*. 14145. https://lib.dr.iastate.edu/etd/14145 - Oltmans, Shelley Jayne (2013). A case study on the food retail environment of Accra, Ghana. *Graduate Theses and Dissertations*. 13634.https://lib.dr.iastate.edu/etd/13634 - Barrett, Stephen R. (2013). Investigating The Local Food System: A Mixed Methods Study Of Sustainability in Southwest Atlanta." Thesis, Georgia State University, http://scholarworks.gsu.edu/geosciences_theses/65.
Activity	**Overview**
	Assignment 3.1: How would: 1) quantitative; 2) qualitative; and 3) mixed-methods advocates respond to the ontological, epistemological, methodological and axiological questions in connection to the three research paradigms? **Assignment 3.2:** What are the advantages and disadvantages of qualitatizing quantitative data or quantifying qualitative data? Discuss using examples from the field of CCSAFS research. **Assignment 3.3:** Students work individually and in groups to differentiate and identify the collected data [(traits) either quantitative or qualitative] of different varieties under local and regional agro-ecosystems. **Assignment 3.4:** Students work individually and in groups to discuss and criticize the following papers related to application of qualitative and quantitative approaches in fields sustainable agricultural and food security :- https://www.snapsurveys.com/blog/qualitative-vs-quantitative-research/ https://www.simplypsychology.org/qualitative-quantitative.html Rao Sabir Sattar, et. al. (2017). Qualitative and quantitative approaches to study adoption of sustainable agricultural practices: A research-note on mixed method approach. International Journal of Agricultural Extension and Rural Development ISSN 3254-5428 Vol. 5 (2), pp. 539-544. https://lib.dr.iastate.edu/etd/14145 https://lib.dr.iastate.edu/etd/13634 http://scholarworks.gsu.edu/geosciences_theses/65

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
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SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√		√									√				

ECTS WORK	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
LOAD	3h		3h	9h	12h				27

Module 4	**Planning Experiments and Developing the Research Design** (2 weeks)
Key Concepts	Hypothesis testing, Research design, problem statement, variable, value, subject/case, descriptive statistics, t-tests, ANOVA, multiple regression analysis, philosophical assumptions.
Overview	An experimental design is a rule that determines the assignment of the experimental units to the treatments. Although experiments differ from each other greatly in most respects, there are some standard designs that are used frequently. These are described briefly in this section. Students must know the Scientific Method. They should be able to decide what phenomenon they wish to investigate. Also, they must learn to specify how to manipulate the factor and hold all other conditions fixed, to insure that these extraneous conditions aren't influencing the response they plan to measure. How many factors are involved when he does an experiment? A research design or methodology refers to the overall strategy that student choose to address the research problem and constitutes the blueprint for the collection, measurement, and analysis of data. Since the research problem determines the type of chosen design before creates a research design, There are different types of research designs depending on the research methodology adopted. Thus, in developing the research design, it is crucial that students examine their philosophical assumptions and those underpinning the research problem and questions, before answering where, when, who and what. Philosophical assumptions relate to ontology, or the nature of reality, the epistemology, the nature of knowledge and axiology, the values guiding to research decisions. The practical steps needed for planning and conducting an experiment include: 1. Recognition and statement of the problem 2. recognizing the goal of the experiment 3. Choice of factors, levels, and ranges 4. Selection of the response variable(s) 5. Choice of design 6. Conducting the experiment 7. Statistical analysis 8. Drawing conclusions, and making recommendations Checklist form must be followed to conduct the research design as steps indicated in:- https://link.springer.com/book/10.1007/b97673 **Planning Experiments | SpringerLink - link.springer.com** There are different types of experimental designs depending on the research methodology adopted. Some of them can be: 1) quantitative research design (cause and effect, empirical-analytic, experimental); 2) qualitative research design (action research, case study) and 3) mixed-method research design (combining quantitative and qualitative methodologies). For

	each of them, despite some similarities, there are also differences as you can see in the examples of the dissertations listed in the readings. What this course will deal with primarily is the choice of the design. This focus includes all the related issues about how we handle these factors in conducting experiments. Students must be able to understand a problem so that they can apply statistical procedures appropriately and draw suitable conclusions. Knowing when apply particular statistical procedures, such as hypothesis testing, is a difficult skill for students to acquire. They must know the critical features that underlie statistical methods, recognize problems, and apply them appropriately, towards being responsible citizens able to solve community problems.
Aim	The overriding aim of this module is to enhance student's ability to use knowledge, facts, and data to effectively solve problems and to be familiar with the Checklist for Planning Experiments and guide them step by step to the experimental planning process.
Learning Outcomes	At the end of this module students will be able to: • Define research problem and objectives • Explain and identify basic research design concepts • Acquire the necessary skills to identify solutions to problems • Specify clearly and explicitly hypothesis [i.e., research questions] central to the problem • Classify and evaluate the strengths and weaknesses of the different experimental designs of CCSAFS research • explain and identify basic research design concepts • Define factors affecting the selection of a research problem. • Distinguish among research designs. • Choose appropriately, and describe in details, a research design for a specific CCSAFS research project • Explain the roles of inference and chance in explaining experimental results.
Units	Unit 4.1: Basic Principles and Techniques of Experimental Design Unit 4.2 Conducting research design and Significance test Unit 4.3: An overview of research designs
Readings	http://tll.mit.edu/help/develop-research-design A First Course in Design and Analysis of Experiments - ... [PDF**]** **http://tll.mit.edu/help/develop-research-design** https://www.journals.elsevier.com/global-food-security - Kothari, C.R. (2004). Research methodology, Methods and Techniques. NEW AGE International (P) Limited, Publishers, Ansari Road, Daryaganj, New Delhi, India. Available at: http://dspace.tiss.edu/jspui/bitstream/1/7047/1/Research-MethodologyMethods-and-Techniques-by-CR-Kothari.pdf

	- Sustainable Agriculture Theses IOWA STATE UNIVERSITY DIGITAL REPOSITORY https://lib.dr.iastate.edu/gpsa_etd/index.2.html More information about research design see http://tll.mit.edu/help/develop-research-design.
Activity	**Overview**
	Assignment 4.1. Define your research design through reflecting on: What? So what? Now what? Think about your own field of study and write down several of the factors that are pertinent in your own research area? Discuss the operationalization of the statistical models used and the sources of data for the study. Organise a group discussion using the Blended Learning Environment to exchange your reflections on these issues. **Assignment 4.2** The purpose of this assignment is to explore quantitative, qualitative and mixed-methods research designs. Visit https://lib.dr.iastate.edu/gpsa_etd/index.2.html and choose from the Sustainable Agriculture Theses one example from each of the three research approaches. Read the sections referring to the research methodology. Having these as examples, as continue from the problem statement you formulated in the previous assignment and complete the following: • Background of the research problem • Aims and objectives • Research design be used, and how it was connected to the research subject/discipline • Description of the intervention intended to achieve the objectives • What means will be used to collect the data and what methods will be used to analyse them Upload the assignment and arrange peer-review with another student of your own choice using the Blended Learning Environment. **Assignment 4.3**: **SDGs**… End hunger, achieve food security and improved nutrition, and promote sustainable agriculture (CLIMATE CHANGE): Students work in groups to conduct research design based on problem dealing with Impact of climate change on crop production.

	Students working individually /in groups depending on the number. Students are asked to search for published papers exploring the links between climate change and conflicts with most related disciplines (agriculture, livestock, social, economic, culture) and discuss the following points in a written report: -Identify the research problem. -Describe and explain the research design used -Show the interdisciplinary nature of the study - Select the research designs used, and how they are connected to the research subject/discipline. - Define the studied variables - Explain the sampling procedures and size. **Assignment 4.4:** More Real Experiments in Planning Experiments – Springer..**[PDF].** **Planning Experiments | SpringerLink - link.springer.com**

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√			√	√		√	√	√

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
	√	√	√										√	√	√		

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6h	**3h**		**12h**	**10h**				**31**

Module 5	**Qualitative research methods (2 week)**
Key Concepts	Qualitative data, open-ended questions, text analysis, Grounded theory
Overview	The goal of the service learning activity is to "Implement qualitative assessment methods in agro diversity monitoring". The proposed service-learning activity provides students a vehicle for integrating experiential learning into the course, select and apply suitable qualitative data collection methods and analysis to assess the crop diversity patterns and its relation with food security. This type of learning will: improve students' ability to apply appropriate data collection methods and analysis that they have learned to assess for example, crop diversity patterns and relate it to improve community livelihoods, greater interpersonal development, particularly the ability to work well with civil society, interview skills, and build leadership and communication skills, improve social responsibility and citizenship skills, connections with professionals and community members for strengthening learning and career opportunities, excellent opportunity for student's involvement in community service.

	Research following a qualitative approach is exploratory and seeks to explain 'how' and 'why' a particular phenomenon, or program, operates as it does in a particular context. As such, qualitative research often investigates i) local knowledge and understanding of a given issue or program; ii) people's experiences, meanings and relationships and iii) social processes and contextual factors (e.g., social norms and cultural practices) that marginalize a group of people or impact a program. Qualitative data is non-numerical, covering images, videos, text and people's written or spoken words. Qualitative data is often gathered through individual interviews and focus group discussions using semi structured or unstructured topic guides. Qualitative type of research relies on close observation, direct or indirect, in-depth interviews, and extensive description of natural settings rather than the quantitative manipulation of variables to verify or reject theoretical constructs (hypotheses), using a deductive approach. Usually, open-ended questions are included in quantitative research instruments. In such cases, the information derived from such qualitative data serves to illuminate the analysis and interpretation of the quantitative results. Sometimes, qualitative data can be used to construct more robust quantitative research designs and vice versa. Summing up, qualitative data analysis has the following characteristics: • Often based on grounded theory practices • Answers the 'why?' questions • Looks further than numerical evidence • Does not concern about generalizability • Pays greater attention to personal cases.
Aim	The main target of this module is: • Understand when/how to use questionnaires in interaction design • Develop surveys - – Satisfaction questionnaires (post use) Learn how to prepare surveys • Different types of scales - – Questions wording Learn about the most common types of questionnaire used in user research • Usability - User research Help students become familiar with the characteristics, language and logic of qualitative research methods. • Understand the importance of integrating qualitative data into quantitative studies • Get knowledge on the processes and practices of qualitative data analysis and theory generation using Grounded Theory.
Learning Outcomes	At the end of this module students will: 1. Be familiar with different methods for collecting and analysing qualitative data 2. Understand the tenets of qualitative research 3. Discuss the ways qualitative data can be integrated into quantitative studies 4. Recognise the processes for extracting meaning from qualitative data. 5. …….. you need to add a verb here ! Chunking data into large conceptual categories (composite variables)

Units	Unit 5.1: Introduction to qualitative research Unit 5.2: Methods of data collection (Observation –Interview – Questionnaires). Unit 5.3: (Questionnaire design) Handling open-ended answers to semi-structured questionnaires. Unit 5.4. Extracting themes, patterns, etc. from qualitative data Unit 5.5. Some important non - parametric tests are used extensively. (Binomial Distributions - Poisson Distributions - Q2).
Readings	Grading Rubric for Research Proposal Assignment available at Using Rubrics to Grade, Assess, and Improve Student .. https://dese.mo.gov/sites/default/files/ela-6-my_portfolio_anecdotal-summative_assessment_2-oral_reading_fluency_rubric.pdf Harvard Business Review- Strategies for Effective Interviews accessible at https://hbr.org/1964/01/strategies-of-effective-interviewing See also https://sites.ewu.edu/hr/files/2017/06/Interviewing-Techniques.pdf More information about research design see http://tll.mit.edu/help/develop-research-design https://www.ship.edu/globalassets/student-research/scoring-rubric-1.pdf Questionnaire design and analysing the data using SPSS
Activity	**Overview**
	Assignment: 5.1: **Activity: community service learning** This assignment is to get student to practice qualitative data analysis and theory generation using Grounded Theory. You will complete this assignment in three parts. In the first part, student will carry out 2-3 interviews with key experts in the CCSAFS research topic you have chosen, following-up the instructions provided in the Toolkit Part 1, listed in the readings. Then, you are going to use inductive coding to analyze the collected data from the interviews and develop a narrative that answers your research question, following-up the instructions provided in the Toolkit Part 2. More specifically, using the inductive analysis method to code and analyze your data: A) Read through the entire transcript of the data set derived from your interviews a few times. B) Carry out your initial coding, generating 20-30 categories. C) Go through your codes and data again, reducing overlap and redundancy,

	combining related codes, etc. until you have generated 10-15 codes. D) Continue the iterating process on the data until you have roughly 5-8 high-level and meaningful "themes". In the second part, organize an online discussion to examine the differences and work together to reach a consensus between the two sets of codes/themes. Discuss which are the most meaningful to keep and which can be dropped, changed, or consolidated. You may need to rework your codes/themes based on each other's findings. Finally, develop a narrative that explains your data The tasks will be distributed on the team members, since each will has specific role: completing questionnaires, conducting interviews, gathering data and information, statistical analyses. Preparing and presenting a report will be performed by the group in front of the class. Then other students will discuss and critique on it. Data on: gender, literacy (read & write), access to agricultural information, land use, types of crops (vegetables, fruits, crops, medicinal plants) and productivity, etc. Before starting the activity, students must prepare necessary documents and needed materials. Questionnaires and interviews templates must be prepared with the help of course instructor. Data on: gender, literacy (read & write), access to agricultural information, land use, types of crops (vegetables, fruits, crops, medicinal plants) and productivity, intercropping systems, access to land, water availability and resources, etc. it is very important that students acquire the skills to carry out interviews and communications with variety of patterns within a community. **Assignment 5.2:** **SDGs** End hunger, achieve food security and improved nutrition, and promote sustainable agriculture (**SUSTAINABLE AGRICULTURE**): Students work individually and in groups to prepare questioner to study some qualitative traits in some crops related to adaptability of these crops to climate change (stress conditions). - Students are requested to collect data on: raising temperature, CO2 levels, precipitation levels, crops productivity, cultivated area, livestock production, fish production, quality of irrigation water, land desertification, fertilizers consumption and women enrol in agricultural activities from published reports. Apply mathematical and illustrative methods to describe these data, and provide general overview on the obtained results. This assignment will be presented and discussed with the course instructor through LMS. - Students are asked to explain the following illustration and discuss how communities perceived different contributing factors to climate change? Students can use data from the following sources #https://data.oecd.org/agriculture.htm #Statistical yearbook 2017, Central Agency for Public mobilization and Statistics. http://spss.allenandunwin.com.s3-website-ap-southeast-2.amazonaws.com/data-files.html#.XL5gjDAzbIU

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**

10Cs/6 LEARNING GOALS	√	√	√	√	√	√	√	√	√			√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√	√										√				

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6h	**3h**	**5h**	**10h**	**10h**				**34**

Module 6	**Moving from the Quantitative and Qualitative Research Design to the Data Analysis (3 weeks)**
Key Concepts	Quantitative and qualitative data, Hypothesis testing, Research design, problem statement, variable, value, subject/case, descriptive statistics, t-tests, ANOVA, multiple regression analysis, philosophical assumptions, data analysis, software (SPSS or PSPP), Cronbach reliability.
Overview	**Data Validity:** needs to be confirmed prior to any statistical analysis, but it usually begin after a univariate descriptive analysis. Extremes or outliers for a variable could be due to a data entry error, to an incorrect or inappropriate specification of a missing code, to sampling from a population other than the intended one, or due to a natural abnormality that exists in this variable from time to time. The first two cases of invalid data are easily corrected. The latter two require information about the distribution form and necessitate the use of regression or multivariate methods to re-estimate the values. Many research methods derive from the empirical-analytic research paradigm, which seeks to discover facts and causes through the statistical testing of hypotheses. Contrary to that, as you have seen in Module 2, the qualitative or interpretive research paradigm seeks to discover how people see and experience their world, and how they apply meaning to it. Quantitative data is useful when you want to answer what-type questions, while qualitative data is about why people behave the way they do. Unlike quantitative data, qualitative research questions are open than closed generating mostly unstructured information, often in the form of text or narratives. In quantitative data analysis, students are expected to operationalize the conceptual level (e.g. theory-hypothesis formulation) and apply appropriated of the data analysis methods that support data. Quantitative data analysis may include the calculation of frequencies of variables and differences between variables. A quantitative approach is usually associated with finding evidence to either support or reject hypotheses formulated at the earlier stages of the research process (research design). For the analysis of quantitative data, a variety of statistical tests are available, ranging from descriptive statistics (e.g. frequencies, cross-tabs) to correlations, t-tests, comparing means and to the more complex such as the use of ANOVA, regression and factor analysis to develop scales. When analyzing data, always start from review of the research goals. In general, the qualitative type of research relies on close observation, direct or indirect, in-depth interviews, and extensive description of natural settings rather than the quantitative manipulation of variables to verify or reject theoretical constructs (hypotheses), using a deductive approach. Usually, open-ended questions are included in quantitative research

	instruments. In such cases, the information derived from such qualitative data serves to illuminate the analysis and interpretation of the quantitative results. Sometimes, qualitative data can be used to construct more robust quantitative research designs and vice versa. Summing up, qualitative data analysis has the following characteristics: • Often based on grounded theory practices • Answers the 'why?' questions • Looks further than numerical evidence • Does not concern about generalizability • Pays greater attention to personal cases When analyzing data (whether from questionnaires, interviews, focus groups, or whatever), always start from review of your research goals, i.e., the reason you undertook the research in the first place. This will help you organize your data and focus your analysis. Research methods necessitate in depth knowledge of those statistics needed to answer the research questions posed. ***NCSS, SPSS*** and others programs provide numerous tests to formally test for normality. If a variable fails a normality test, it is critical to look at the box plot and the normal probability plot to see if an outlier or a small subset of outliers has caused the non-normality. A pragmatic approach is to omit the outliers and rerun the tests to see if the variable now passes the normality tests. The most common statistical package are SPSS, but PSPP programs for statistical analysis that resembles much SPSS can do many of the statistics SPSS does.
Aim	The main goals of this module are: 1) to get knowledge and skills in statistical techniques and a statistical program such as SPSS and (2) To apply knowledge and skills relating to statistics to solve problems.
Learning Outcomes	At the end of this module learners will be able to: 1. Code and prepare a quantitative data set 2. Describe the data needed for testing hypotheses. 3. Perform a hypothesis test using the different statistics (T and F tests). 4. Understand the basic purpose for analysis of variance and the general logic that underlies this statistical procedure. 5. Perform an analysis of variance to evaluate the data from a single-factor, independent-measures research study. 6. Describe the steps that are taken in conducting a test of statistical significance 7. Describe and justify the methods of analysis to be applied to the data in determining whether or not the hypotheses are true or false. 8. Acquire the skills of statistical analysis using SPSS program. 9. Describe how to interpret data and analyze results.
Units	Unit 6.1: Statistical analysis and Drawing conclusions. Unit 6.2. Comparison between two groups (parametric and non-parametric) One sample T test – Binomial using SPSS Paired Samples T Test - Two Related Samples Test (Wilcoxon Signed Ranks Test)…. using SPSS Independent Samples Test - Mann Whitney…. using SPSS. Unit 6.3: Analysis of variance (Comparison between more than two groups)

	F teat – Kuruckal Wallace…. using SPSS. Unit 6.4: Types of experiments. Simple experiments … CRD – RCBD – LS… using SPSS. Factorial experiments … CRD – RCBD – LS… using SPSS. Split plot experiments using SPSS. Unit 6.5: Multivariate using SPSS.
Readings	https://www.coursera.org/browse/data-science/data-analysis https://www.predictiveanalyticstoday.com/data-analysis/ https://ori.hhs.gov/education/products/n_illinois_u/datamanagement/datopic.html http://www.businessdictionary.com/definition/data-analysis.html SPSS Instruction Manual [PDF] Online introductions and manuals. • http://www.ats.ucla.edu/stat/spss/sk/default.htm • Indiana University- Getting Started (useful instructions with screenshots)
Activity	**Overview**
	Assignment 6.1 Look into the methodology sections of the dissertations listed in the link. https://lib.dr.iastate.edu/gpsa_etd/index.2.html and choose from the Sustainable Agriculture Theses one example from each of the three research approaches. Read the sections referring to the research methodology. Discuss the methodology used for these studies. Explain whether you think that the methodology used is an appropriate one. Identify possible problems with the methods used. Discuss the operationalization of the statistical models used and the sources of data for the study. Organize a group discussion using the Blended Learning Environment to exchange your reflections on these issues. **Assignment 6.2:** Students are working in groups/individual. This assignment must be implemented as real-world problem. Students are requested to: - specify data collection method suitable to obtain qualitative information on relevant issues with climate change adaptation (cropping systems, tolerant crops, water use practices, livestock management). - state the existence problem/research problem - choose the data collection method - check the suitability of the used method for the study purposed/problem encountered - examine the Economic and social characteristics of the respondents - apply the methods (population studies, number of participants) - process data analysis and report writing. **Assignment 6.3**

	Start applying an example of research data provided by your instructor using SPSS package, Students work individually and in groups to analyse data using appropriate test (parametric or nonparametric) based on normality test data. Drawing data graphically and in tables. Present final conclusion of results to solve intended problem in community.

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√			√	√		√	√	

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√	√	√									√				

ECTS WORK	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
LOAD	**7h**	**3h**	**6h**	**11**	**9h**				**36**

Module 7	**Variables trend and associations (2 weeks)**
Key Concepts	Association – Correlation – Regression - Measuring Strength of Association - Modelling Linear Trends
Overview	When we look at scatterplot, we should be able to describe the association we see between the variables. A quick description of the association in a scatterplot should always include a description of the form, direction, and strength of the association, along with the presence of any outliers. Form: Is the association linear or nonlinear? Direction: Is the association positive or negative? Strength: Does the association appear to be strong, moderately strong, or weak? Outliers: Do there appear to be any data points that are unusually far away from the general pattern? It's also important to include the context of the two variables in the description of these features.
Aim	The overriding aim of the module is make explicit and understandable the meaning and function for correlation and regression, when and how to apply them as statistical methods to deal with the formulation of mathematical model depicting relationship amongst variables which can be used for the purpose of prediction of the values of dependent variable, given the values of the independent variable (regression) or the strength and direction the relationship between the studied variables (correlation).
Learning Outcomes	At the end of this module students will be able to: • Classify the trend as being increasing, decreasing, or non-existent; • Understand the Pearson correlation as a descriptive statistic that measures and describes the relationship between two variables. • Compute the Pearson correlation using either the definitional or the computational formula for SP (the sum of products of deviations). • Recognize the Spearman correlation and how it differs from the Pearson correlation in terms of data that it uses and the type of relationship that it measures. • Understand the concept of a linear equation including the slope and Y-intercept.

	• Understand the concept of a least-squared-error solution. • Compute the linear regression equation for predicting Y values from the X values in a set of correlation data. • Determine if the association is strong or weak, and indicate its shape; • Interpret a scatterplot in context, interpreting trend, strength of association, and shape. • Recognize a linear trend from a scatterplot. • Know what each variable represents in a regression equation. • Use a given linear regression equation to predict a value of the output if given the input. • Interpret the slope of a regression line.
Units	Unit 7.1: Measuring Strength of Association with Correlation using SPSS Unit 7.2: Linear Regression using SPSS Unit 7.3: Coefficient of determination using SPSS. Unit 7.4: Multiple Linear Regression using SPSS.
Readings	Sustainable Agriculture Theses. IOWA STATE UNIVERSITY DIGITAL REPOSITORY https://lib.dr.iastate.edu/gpsa_etd/index.2.html https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression http://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_multivariable/bs704_multivariable5.html https://www.graphpad.com/support/faq/what-is-the-difference-between-correlation-and-linear-regression/
Activity	**Overview**

Assignment 7.1:

Does the value of the correlation coefficient always show that the relationship is linear? Explain why.

(The main idea in this exercise is to emphasize that *r* only after we have confirmed from the scatterplot that the relationship is linear, we are allowed to use the value of *r* strength and direction. In other words, *r* serves as a measure of direction and strength of a LINEAR relationship).

Assignment 7.2:

Global warming refers to the upward temperature trend across the entire Earth since the early 20th century – and most notably since the late 1970s – due to the increase in fossil-fuel emissions since the beginning of the Industrial Revolution. Though there are many different greenhouse gases, carbon dioxide, or CO2, is the one that has been on the rise during the last century. Since the beginning of the Industrial Revolution, the concentration of CO2 in the atmosphere has increased by 39 percent. Increasing the concentration of greenhouse gases causes the Earth greenhouse to overheat. Worldwide since 1880, the average Earth surface temperature has gone up by about 1.4 degrees Fahrenheit (0.8 degrees Celsius) relative to the mid-20th-century baseline (measured between 1951 and 1980)..

Use the regression equation to predict the BMI of the heaviest man in the data set. Then find the residual for this man. Based on this, conclude if the prediction is an overestimate or an underestimate.

Have students predict global temperature means for the subsequent year. Research this data on the Internet to compare.

Assignment 7.3.: Using Global Climate Change data to recognize correlation between C02 increases and global temperature increase as well as natural fluctuates in annual temperature.

What do you understand and interpret for this relation between C02 increases and global temperature increase?

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√			√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√	√										√	√			

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	5h		**4h**	**6h**	**8h**		**3h**	**3h**	**29**

SUMMRY OF ECTS WORKLOAD

Learning Components	No	Time	Workl oad	Course Modules							
				1	2	3	4	5	6	7	Sum
Lectures (face-to-face)	13	3	39	6	6	3	6	6	7	5	39
Online	3	3	9				3	3	3		9
Lab work	5	4	20		2	3		5	6	4	20
Reading articles (3 pages per hour)	100	0.30	30	3	4	5	5	5	5	3	30
Reading book chapters (5 per/h)	20	1.7	34	4	5	4	7	5	6	3	34
Course activities	24	3	72	9	14	12	10	10	9	8	72
Project work											
Preparation for exam	1	3	3							3	3
Writing the exam	1	3	3							3	3
Total				22	31	27	31	34	36	29	210

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CCSAFS COURSE SYLLABUS

Course Code: ***CSAF803***

Economics of Climate Change

Heliopolis University for Sustainable Development, Faculty of Business and Economics,

2018/2019

Instructor Information

Instructor: Assoc. Prof. Karim Badr El-Din

Office Location: Heliopolis University for Sustainable Development

Telephone:

Office Hours:

E-mail: karim.badr@hu.edu.eg

Website:

Course Identification

Course Number:

Course Name:

Course Location:

Class Times:

Prerequisites:

Faculty Web Page: http://www.hu.edu.eg

Course Description/Overview

With global concerns about climate change, countries plan for food security as part of their national security. This course aims to focus on the countries' decision-making processes and the internal and external influences on the food security in the context of sustainable

development. Considering that solving environmental problems will require behavioral changes, it is important that economic planners as well as business entities fully understand agrifood economic requirements and ways to influence it within the concept of sustainable agriculture in its relation with climate change challenges. As such, this course intends to develop in students an in-depth understanding of climate change economics, and discuss behavioral, economic, and sociological aspects of food security, sustainability, and social responsibility that affects the overall economic decision making processes. Understanding how governments and business entities behave is an integral part of correctly identifying their real needs. In this course, students will learn how the government and the business sector can link up effectively, and they will investigate concerns about food security and its impacts that drive governments' to adopt sustainable economic plans that address food security challenges. More emphasis will be demonstrated in the course module as crosscutting related to the ethical issues which is considered as a main part of the economics of climate in general.

Course Learning Objectives

The overarching goals of this course are:

1) To use essential tools of environmental economics, including the assessment of trade-offs, benefits, costs, cost-effectiveness, feasibility analysis.
2) To provide a critical approach to climate change economics;
3) To assess climate change economics in the context of sustainability;

Accordingly, on successful completion of this course, you will be able to:

a) Describe the relevance of food security to the entire economic process, the nature and stages of the economic decision making and the factors influencing governments' choices as related to food security and sustainable agriculture; b) Explain and analyze the major stages which governments and businesses usually go through when making an economic decision related to food security and sustainable agriculture ; c) Understand the social and environmental responsibility and ethical issues associated with the behavior of economic planning process in light of the transformation economic research as related to food security and sustainable agriculture; d) Apply the concepts and theories covered in the course to devise effective solutions in enhancing government and business performance in the context of sustainable food security within the context of the challenges related to climate change.

Course Content Learning Outcomes

1. Analyze climate change economic issues at the microeconomic level

2. Apply the economic concepts learned to the analysis of food security, sustainable agriculture and climate change.

3. Identify both the governments', and business sector behavior as related to the food security in the context of sustainability and the challenges related to climate changes.

4. Evaluate information related to climate change economics knowledge using critical thinking and problem solving skills.

5. Work in team to prepare a project related food and climate change economics.

6. Demonstrate awareness and ability to discourse on ethical issues.

7. Analyze the competitive advantages and risks associated with green economics.

Course Resources

Course Website(s)

- **http://www.economicsplace.com**
- https://www.elgaronline.com/view/9780857937551.xml

Required Course Texts and Materials

PowerPoint presentations prepared by the instructor for the participants.

Optional Course Texts and Materials

- Hackett, S. C. (2006) Environmental and Natural Resource Economics: Theory, Policy, and the Sustainable Society. M.E. Sharpe, Armonk, NY (3rd ed.)
- Halvorsen, R. & D. F. Layton (2105). *Handbook on the Economics of Natural Resources*. Edward Elgar Publishing Limited. Library of Congress control Number: 2014952135.
- North, D. (2017) *Institutions, Institutional Change and Economic Performance,* New York: Cambridge University Press. ISBN: 0521397340
- Parkin, M. (2015), "*Economics*", 11th ed., Addison-Wesley, USA.
- Pindyck, R. S. & Rubinfeld, D. L. (2015). *Microeconomics*, 7th Edition, Prentice Hall
- Prasad, M. (2012), *The Land of Too Much: American Abundance and the Paradox of Poverty*, Cambridge MA: Harvard University Press. ISBN-9780674066526
- Tietenberg, T. & Lewis, L. (2016). *Environmental & Natural Resources Economics: 9th Edition*. Pearson. ISBN-13: 978-0-13-139257-1 (alk. paper) ISBN-10: 0-13-139257-3 (alk. paper).
- Varian, H.R. (2014) *Microeconomic Analysis*, 3rd edition, Norton.

Assignments and Grading Scheme

Grading System

0 to 100 (where 60 is the least pass mark)

Grading Policy

Grades are based on the following:

Assignments	**10%**
Class attendance/participation	**10%**
Group Project	**40%**
Midterm Exam	**20%**
Final Exam	**20%**
Total Points	**100**

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come to ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat

faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assigned material before you come to class. I expect active class participation, which counts for 20% of the grade.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by- case basis.

Important Dates to Remember

Course Schedule

Week	Topics to be covered
1	Course Overview: Discussion of syllabus and assignments, course requirements and prerequisites; Criteria for student selection
2	Microeconomics
3	Human transformation of the Earth: drivers of change: *Demographic drivers (population size, age and gender structure, and spatial distribution) *Economic drivers (national and per capita income, macroeconomic policies, international trade)
4	Economics and Sustainability
5	The Economics of Sustainable Development
6	Midterm Exam
7	The Economics of Food Security
8	The Economics of Climate change
9	The Economics of Sustainable Agriculture
10	Agrifood Economics and Policy- UNIPAD
11	Climate change and policies
12	Projects Presentations
13	Revision

Course	***Economics of Climate Change, Sustainable Agriculture and Food Security (Agrifood Economics and Policy- UNIPAD***
Module 1	**Introduction to Economics**
Key Concepts	Demand, Supply, Aggregate Demand, Aggregate Supply, Production, Economic Sectors, GDP, Trade
Overview	Students who will join this program are mostly not coming from economics background; therefore they will be introduced to microeconomic theory in this module. They will learn how this applies to markets' participants and their behavior in different ways. Moreover, they will get exposed to the nature of perception and how marketers use their knowledge of perception to enhance strategies. This will include applications on climate changes, food security, and sustainable agriculture. Questions to be addressed in this module include the following: who are the consumer? What is meant by the term demand? What is supply? Determinates of supply and demand? What is the production possibility frontier? How to arrive at aggregate demand and aggregate supply? What is GDP? What are the international trade impacts on the economic sectors?
Aim	The overriding aim of this module is to introduce students to the basics of economics. This will include applications on climate change, food security, and sustainable agriculture.
Learning Outcomes	At the end of this module learners will be able to: • Identify and explain factors which influence demand, supply and the national economy. In a team, work effectively to prepare a professional, logical and coherent report on economic issues within a specific context. This will include applications on climate changes, food security, and sustainable agriculture.
Units	1. Demand and supply 2. Production 3. The national economy
Readings	1. Pindyck, Robert S. &Rubinfeld, Daniel L. (2015) *Microeconomics*, 7th Edition, Prentice Hall 2. Varian, H.R.(2014) *Microeconomic Analysis*, 3rd edition, Norton.

Activity	1. Class Activity 1: 2. The development in the supply and demand forces in the labor market case study. 3. Assignment 2: Select a market that is controlled versus a free market. Justify your selection. Describe the advantages and the disadvantages of each market. **4. Project Phase 1: Project Focus** This project is to apply the economic concepts and principles to the development of a real-world economy that matches with economic planning. Students should integrate all the concepts discussed in the course. This phase will require a. Selecting a country b. Macroeconomic indicators c. Stage of development This will include applications on climate changes, food security, and sustainable agriculture.

SD Pillars	**environment**		**economy**			**social**			**culture**								
21st ESD	Learning to know ✓		Learning to be ✓		Learning to do ✓	Learning to live together ✓			Learning to transform oneself and society ✓			Learning to give and share ✓					
SDGs Sub goals	1	2	3 ✓	4 ✓	5	6	7	8	9	10	11	12	13	14	15	16	17
ECTs Workload	**Lecture**		**Online**		**Lab**		**Reading**		**Course activity**		**Project**		**Prepare exam**		**Writing exam**		**Total**
	9		6				5		5		5		10				40

Vision 2030	This will lead to ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social and technological progress occurs in harmony with nature. It is obvious here that the ethical consideration has to be emphasized in this module in accordance with Egypt vision for 2030

Module 2	**Human transformation of the Earth: drivers of change**
Key Concepts	Drivers of change: Demographic, economic, sociopolitical, scientific and technological, cultural and religious. Benefits and Costs of Climate Change Mitigation, Threats caused by climate change, Policy Initiatives.
Overview	In this module, we discuss- in a holistic view-the different drivers of change for the transformation of the earth (including climate change) * Demographic drivers (population size, age and gender structure, and spatial distribution) * Economic drivers (national and per capita income, macroeconomic policies, international trade) * Sociopolitical (democratization, roles of women and local communities, role of private sector) * Scientific and technological (research and development, adoption of new technologies) *Cultural and religious (choices individuals make about what and how to consume and what they value).
Aim	The aims are: 1) to discuss the drivers of climate change; 2) to understand the threats caused by climate change on humans and other living things through impacts on ecosystems, agriculture and food security; 3) to analyze economically estimates of mitigation benefits and costs in the case of various market distortions; 4) to discuss making policy choices under uncertainty in climate change models
Learning Outcomes	At the end of this module, learners will be able to: 1. Identify drivers of change; 2. Understand the threats caused by global climate change through impacts on agriculture and food security; 3. Analyze economically estimates of mitigation benefits, improved understanding of costs in the presence of various market distortions, 4. Design tools for making policy choices under uncertainty
Units	Unit 1: Drivers of change Unit 2: Assessing the Benefits and Costs of Climate Change Mitigation Unit 3: Dealing with Uncertainty of climate policy Unit 4: International Policy Coordination
Readings	• Millennium Ecosystem Assessment Reports http://maweb.org • Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity (www.eia.doe.gov/oiaf/kyoto/kyotorpt.html): Comprehensive economic analysis of the costs of complying with the Kyoto Protocol, sponsored by the U.S. Energy Information Administration

Activity	Write a five-page essay in which you summarize what is known about global climate change. Discuss how the complexity, the long-term nature of the problem, the uncertainty regarding climate change effects, and the challenging policy problems related to sustainable agriculture and food security. The essay to be uploaded on Moodle and each student write 5 questions that the answers are embedded into his essay. These questions to be answered by one of his colleagues (each one select one essay to answer its questions). All answers to be shared in the forum discussion.

SD Pillars	**environment**	**economy**	**social**	**culture**
21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals				✓							✓		✓				

ECTs Workload	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6	9		15	10				40

Vision 2030	The main factor in Egypt vision that address sustainable consumption and production is obviously embedded in this course

Module 3	**The Economics of Sustainable Development**
Key Concepts	Development, Sustainable Development, Renewable Resources, and Nonrenewable Resources, Green Economics, climate change, mitigation, adaptation
Overview	Developing more environmentally sustainable consumption and production systems depends upon consumers' willingness to engage in greener economic activities. Green economics is a form of economic activities that cope with the modern actions to protect the environment and the depletion of natural resources. The change in economic activities toward green economics is a long process that depends on several variables such as, planning, awareness, and motivations. Consumers' and producers' motivations are energizing forces that activate behavior and provide purpose and direction to that behavior. There are economic models. The Hotelling rule and the Hartwick rule. The Hotelling rule deals with the risk of efficient resource utilisation. Hartwick rule deals with the investment of the proceeds from resource extraction. Questions to be addressed in this module include the following: What is green economics? How can planning, awareness, and motivations direct the economy toward green products? What are the required economic plans? What is the relationship between depletion and sustainability? How to deal with nonrenewable resources? How to deal with renewable resources? This will include applications on climate changes, food security, and sustainable agriculture. Climate change mitigation and adaptation ant its relation to macroeconomics policies embedded in Egypt vision 2030?
Aim	1) The aim of this module is to emphasize the concept of consumption and production and to link consumer motivation, personality, and emotions toward buying green products. This will include applications on climate changes, food security, producing green products, and sustainable agriculture. 2) Explore decision-making options that can harmonize the use of ecosystem goods and service with human needs (such a food provision and other ecosystem services)
Learning Outcomes	• Demonstrate how knowledge of green economics that can be applied to the economic development process and planning. • Demonstrate awareness and ability to discourse on ethical issues in using economic planning. • Analyze the competitive advantages and risks associated with green economics.
Units	1. Green economics 2. Sustainable economic development 3. Examine decision-making to mitigate and adapt to climate change 4. The Millennium Ecosystem Assessment

Readings	1. Douglass, N. (2017) *Institutions, Institutional Change and Economic Performance*, New York: Cambridge University Press. ISBN: 0521397340 2. Halvorsen, R. & Layton D. F. (2105). *Handbook on the Economics of Natural Resources*. Edward Elgar Publishing Limited. Library of Congress control Number: 2014952135. 3. Millennium Ecosystem Assessment for the Arab region http://gis.cedare.int/arabma/docs/MA_final%20full%20Report_Low.pdf http://sdsegypt2030.com/?lang=en
Activity	**Activity 1.** In the forum discussion students Discussion related to the application of economic principles to environmental issues, such as climate change and sustainable agriculture **Project Phase 1:** Develop a sustainable economic approach as related to: • Nonrenewable resources • Renewable resources **Project Phase 2:** Sustainable Economic Analysis a. Government role b. Business role c. Green economics d. Economic planning, awareness, and motivations

SD Pillars	**environment**		**economy**			**social**		**culture**	
21st ESD	Learning to know ✓		Learning to be ✓		Learning to do ✓	Learning to live together ✓		Learning to transform oneself and society ✓	Learning to give and share ✓
SDGs **Sub goals**	1	2	3	4	5	6	7 ✓	8 ✓	9	10	11 ✓	12	13	14	15	16	17

ECTs workload	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**

	6	2		10	10	7	5		40
Vision 2030	This will lead to protect the planet from degradation, including through sustainableconsumption and production, sustainably managing its natural resources								

Module 4	**The Economics of Food Security**
Key Concepts	Food production, food consumption, food processing, agroindustry.
Overview	The challenges facing food security are mainly attributed to many problems, namely: desertification, urbanization, and the increase in population. The increase in population at a rate higher than the rate of increase in food supplies cause shortages in food supply. This is a case of shortage in supply causing excess demand. This is a case of a vertical perfectly elastic aggregate supply curve. This is reflected in constant aggregate supply with increasing demand. This will lead to a rightward shift in the aggregate demand curve leading to inflation or even to hyperinflation. When all the resources are tied up the only possible way is the advancement in agricultural technology to reach abundance food production that will pull inflation downward. This requires economic planning that focuses on comparative advantage and incentives. Questions to be addressed in this module include the following: What is food security? What are the socioeconomic aspects of food security? What is meant by the term 'vertical perfectly elastic aggregate supply curve'? Why is it important for governments to understand situational influences on production and consumption behavior? What are the policies tools that the government has to emphasize on in order to ensure food sovereignty? Describe a process for developing a situation-based food security economic strategy as related to productivity.
Aim	The aim of this module is to explain the food security issue and the forces that affect food security in any nation. This will include applications on climate changes, food security, and sustainable agriculture.
Learning Outcomes	• Identify and explain factors which influence food security. • Demonstrate how knowledge of economics can be applied to the issue of food security. • Gain, evaluate and synthesize information and existing knowledge from a number of sources and experience. • Demonstrate awareness and ability to discourse on ethical issues.
Units	1. Food security 2. Vertical perfectly elastic aggregate supply curve
Readings	Tietenberg, T. & Lewis L. (2016). *Environmental & Natural Resources Economics: 9th Edition*. Pearson. ISBN-13: 978-0-13-139257-1 (alk. paper) ISBN-10: 0-13-139257-3 (alk. paper).

	Assignment 1: (Group Assignment) Find 2 comparative countries with one story of success in food security versus another country with shortage in food security. Discuss the approach of each in terms of its economic policies and incentives. Also discuss why the country that suffers from the shortage in food supply can overcome its problems as related to the challenges of climate changes. **Activity 2**. Students are going to make glossary related to the food security and food sovereignty A glossary can also be a collaborative activity, where students will add key terms related the 2 concepts to build their knowledge **Project Phase 3: Recommended** Activity **Economic Strategy that fits the following:** a. Food security b. Vertical perfectly elastic aggregate supply curve and productivity

SD Pillars	**environment**		**economy**			**social**			**culture**								
21st ESD	Learning to know ✓		Learning to be ✓		Learning to do ✓	Learning to live together ✓			Learning to transform oneself and society ✓		Learning to give and share ✓						
SDGs **Sub goals**	1 ✓	2 ✓	3	4	5	6	7	8	9	10	11 ✓	12 ✓	13 ✓	14	15	16	17

ECTs Workload	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6	2		10	10		5	3	36

Vision 2030	This will lead to end poverty and hunger, in all their forms and dimensions, and to ensure that all human beings can fulfill their potential in dignity and equality and in a healthy environment.

Module 5	**Climate Change: Science, Policy, and Economics**
Key Concepts	Greenhouse Gas Emissions and Global Climate Change, trends in greenhouse gas emissions, climate change predictions, international action on Climate Change: The Earth Summit , The Kyoto Protocol

Overview	According to the Intergovernmental Panel on Climate Change (IPCC), the present carbon dioxide concentration has not been exceeded during the past 650,000 years, and likely not during the past 20 million years. The current rate of increase is unprecedented during at least the past 20,000 years. Climate models are extremely complex, and so as our understanding of the world's climate improves, so too will our ability to model climate change caused by greenhouse gas emissions.
Aim	The aims of this module are to: 1) understand that deterioration of ecosystems due to climate change could have negative consequences for the world's economy, 2) introduce climate change models and predictions, 3) discuss international action on climate change.
Learning Outcomes	At the end of this module, learners will be able to: • Understand that major alterations to ecosystems due to climate change could possibly have negative consequences for the world's economy • Explore assumptions of climate change scenarios • Discuss the Earth Summit and The Kyoto Protocol that includes three incentive-based economic instruments.
Units	Unit 1: The scientific aspect of climate change Unit 2: Assessing the Benefits and Costs of Climate Change Unit 3: Policy Initiatives
Readings	Hackett, S. C. (2006) Environmental and Natural Resource Economics: Theory, Policy, and the Sustainable Society. M.E. Sharpe, Armonk, NY (3rd ed.) - chapter 11
Activity	An Inconvenient Truth (movie)

SD Pillars	**environment**		**economy**			**social**			**culture**								
21st ESD	Learning to know ✓		Learning to be ✓			Learning to do ✓			Learning to live together ✓			Learning to transform oneself and society ✓			Learning to give and share ✓		
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals													✓		✓		✓

ECTs Workload	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	6	2		5	5	10	2		30
Vision 2030	This will lead to a spirit of strengthened global solidarity, focused in particular on the needs of the poorest and most vulnerable and with the participation of all countries, all stakeholders and all people.								

Module 6	The Economics of Sustainable Agriculture & Climatic Change
Key Concepts	Economics of Sustainable Agriculture , Climatic Changes, International Agreements
Overview	Economic decision making becomes more extensive and complex as development needs increase. It starts from the problem of poverty and the need to develop at the expense of the sustainable development by depleting the nonrenewable recourses to accelerate the current development process. Governments' faces the problem of recognition by the voters by decreasing environmental taxes and encouraging labor intensive projects with environmental adverse impacts to support employment. This led to the desertification with the incredible trend of urbanization and industrialization together with the pollution problems. This also, led to climatic problems such as the greenhouse effects and the problem of ozone depletion. The use of the biological fuels and the cultivation of crops that depletes the fertile soils led to unsustainability of agriculture. This will include applications on climate changes, food security, and sustainable agriculture.
Aim	The aim of this module to understand the different issues related to the economics of sustainable agriculture and climatic changes. This will include applications on climate change, food security, and sustainable agriculture.
Learning Outcomes	- Identify and explain factors which influence sustainable agriculture. -Demonstrate the knowledge of the climatic changes. -Gain, evaluate and synthesize information and existing knowledge from a number of sources and experience. -In a team, work effectively to prepare a professional, logical and coherent report on the economics of sustainable agriculture and climatic changes issues within a specific context. -Deliver an oral presentation in a professional and engaging manner. -Demonstrate awareness and ability to discourse on ethical issues.
Units	The economics of sustainable agriculture and climatic changes
Readings	• Prasad, Monica (2012), *The Land of Too Much: American Abundance and the Paradox of Poverty,* Cambridge MA: Harvard University Press. ISBN-9780674066526 • http://www.ipcc.ch/ • http://climatechange.worldbank.org/ • Adaptation to a changing climate in the Arab countries: a case for adaptation governance and leadership in building climate resilience http://www.preventionweb.net/english/professional/publications/v.php?id=29948

Activity	**Assignment 1:** Interview three students and identify five aspects that affect the sustainability of agriculture. Identify those that related to climatic changes. What reasons could be overcome in both the short run and the long run to enhance the process of sustainable agriculture? **Project Phase 3: Recommended Economic Strategy that fits the following:** a-The economics of sustainable agriculture and climatic changes. b- Final Submission & Presentation.
Community Based Learning Activity	The students will be engaged in a Community Based-Learning Activity represented by a significant sample of the population of the agriculture entrepreneurs who are unaware of the long-term economic benefits of sustainable agricultural methods and who are involved in land reclamation projects in Egypt. The target is to provide them with their real needs of applying sustainable agricultural economic methods. The students will conduct a project in this connection. They will be responsible to collect data about relevant population to choose a significant sample. They will contact the chosen companies to designate the sustainable development methods of agriculture and to ask them to train their families accordingly. They will convince them of this transformation process through elaborating comparative long-turn cost-effective techniques calculated based on real figures. This will serve as a prototype model for Egypt and MENA region. The field work involves the direct interface with the farmers in addition to desk based studies including sampling data and required calculations and computations. The design of the whole process and all work steps are done under the full supervision of the instructors. Finally, the students will present their work in a written report and will present it in class. **Note**: During the first lecture, the students will receive an assignment briefing sheet verifying all requirements, the writing instructions, the deadline of submission by the end of the course, and the exact date of the presentation which will correspond to the date of the last lecture.

SD Pillars	**environment**		**economy**			**social**			**culture**								
21st ESD	Learning to know ✓		Learning to be ✓			Learning to do ✓			Learning to live together ✓			Learning to transform oneself and society ✓			Learning to give and share ✓		
SDGs Sub goals	1	2	3	4	5	6	7	8 ✓	9	10	11	12	13	14	15 ✓	16	17 ✓
ECTs Workload	Lecture		Online		Lab		Reading		Course activity		Project		Prepare exam		Writing exam		Total
	6		2				10		5		5		5		3		36
Vision 2030	This will lead to a spirit of strengthened global solidarity, focused in particular																

SUMMRY OF ECTS WORKLOAD

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**						**Workload**
				1	**2**	**3**	**4**	**5**	**6**	
Lectures (face-to-face)	9	3	30	6	6	3	6	6	6	27
Online	6	2	12	2	2	2	2	2	2	12
Lab work										
Reading articles (3 pages per hour)	120	0.3	40	5	10	10	5	5	10	40
Reading book chapters (5 per/h)	100	0.3	35	5	5	10	5			35
Preparing course activities	2	17	35	5	10			5	5	35
Project work	2	13	26			7		10	5	26
Preparation for exam	4	5	20	10		5	5	2	5	20
Writing the exam	2	3	6				3			6

Total		**219**	40	40	40	36	**30**	**36**	**219**

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SUEZ CANAL UNIVERSITY

Course Syllabus

Course Number: CSAF820

Course Title: Sustainable Livestock Management

Semester (II)

Instructor Information

Course Instructor: Prof. Atef Mohamed Kamel Ahmed

Office Location: Faculty of Veterinary Medicine, Suez Canal University, new campus

Telephone: +20 1004135504

Hours: (Times & Days)

E-mail: atefkamel1955@hotmail.com or atefkamel1955@gmail.com

Website:

Course Identification

Course Number: CSAF820

Course Name: Sustainable Livestock Management

Course Location: Faculty of Agriculture- Suez Canal University -University New Campus

Class Times: Depends on students and instructor available time

Prerequisites: None

Faculty Web Page: http://www.agri.scuegypt.edu.eg

Course Description/Overview

Livestock are central to achieving many of the Sustainable Development Goals (SDGs) and directly relevant to most of them. The growing demand for livestock products in developing countries, driven by population growth, higher incomes and urbanization, represents a huge opportunity for hundreds of millions of poor smallholder livestock

farmers, processors and marketers, to meet that market demand and rise out of poverty. Livestock products (meat, milk, eggs) provide essential nutrients that contribute to food and nutritional security. The course explores the impact of climate change on livestock production system and the effect of infectious disease on sustainable and ethical animal health -based food production. The course discuss the global impacts of climate change on livestock production, the contribution of livestock production to climate change, and specific climate change adaptation and mitigation strategies in the livestock sector. The course aims to help students develop key competencies and knowledge of essential ecological, environmental, social, institutional, and economic dimensions as part of an ethical sustainable farming system and livestock production. Topics includes animal welfare, health monitoring and management and animal use ethics concept, animal welfare inputs, climate change impacts, modern livestock production systems and resources, animal welfare to improve production and impact assessment of livestock production systems using welfare concept. Upon completion, students should demonstrate an understanding of the role of livestock production in a sustainable production system under the umbrella of animal welfare. Field trips are an essential part of this course; students are expected to pay attention to where class meetings will be held based on the syllabus structure.

Course Learning Objectives:

1. Study Livestock production and SDGs
2. Define terminology and concepts related to sustainable livestock practices.
3. Define the concept of welfare and ethical livestock production.
4. Apply best welfare practices in livestock management to maximize livestock productivity.
5. Identify key factors relating to interaction between sustainable livestock production and the Climate change.
6. Improve Livestock health care, disease management and production.
7. Analyze and discuss the importance of livestock production in sustainable production systems.
8. Understand the Environmental Impact Assessment of sustainable and ethical livestock production systems.
9. Strengthen group work, communication, facilitation and reporting skills

Course Content Learning Outcomes:

Global demand for livestock products is increasing due to the enormous increase in global population. Such demand on animal product result in direct or indirect influence towered animal's quality of life and environment. This can either be utilizing production resources or livestock production plan and management. The overall aim with the course is to give the students the necessary basic information about sustainable livestock production and the effect of diseases and good practises of welfare on its productivity. This should be set in overall view so the students are able to critically evaluate the factors which are important for a sustainable growth in the ethical livestock production systems.

Upon completion of this course, students should demonstrate competency in:

- Selecting of appropriate livestock production system to ensure sustainable and ethical production strategy.
- Identifying appropriate livestock production strategies to maintain best animal health, disease control and welfare.
- Identifying the contribution of livestock production to climate change, and specific adaptation and mitigation strategies in the livestock sector
- Monitoring animal health and evaluating animal welfare to maintain ethical livestock use and increase its productivity.
- Identifying key factors relating to interaction between sustainable livestock production and the Climate change

Course Resources:

There is no single text for this course. Readings will come from a variety of articles, books and reports including reports on Climate Change and livestock production. The following articles may be helpful.

1. Animal Rights: Current Debates and New Directions, (2004), edited by Cass R. Sunstein and Martha C. Nussbaum (Oxford University Press.
2. Barnes, A.P., (2013). Heterogeneity in climate change risk perception amongst dairy farmers: a latent class clustering analysis. Appl. Geogr. 41, 105–115.
3. FAO (Food and Agriculture Organization of the United Nations), (1986). Farm structures in tropical climates: Animal environmental requirements. <http:// www.fao.org/docrep/s1250e/s1250e10.htm> (acessed 12.02.13).
4. FAO (Food and Agriculture Organization of the United Nations), 2013. Climate-smart agriculture: Sourcebook. FAO, Rome. <http://www.fao.org/3/a-i3325e.pdf>.
5. Fraser, A.F. & Broom, D.M. Farm Animal Behaviour and Welfare. London, Boiler Tindall 3rd Ed. (1990).

6. IFAD (International Fund for Agricultural Development), (2010). Livestock and climate change.

7. <http://www.ifad.org/lrkm/events/cops/papers/climate.pdf>.Iglesias, A., Avis, K., Benzie, M., Fisher, P., Harley, M., Hodgson, N., Horrocks, L., Moneo, M., Webb, J., 2007. Adaptation to climate change in the agricultural sector. AEA Energy & Environment and Universidad de Politécnica de Madrid.

8. IPCC (Intergovermental Panel on Climate Change), (2007). Climate Change 2007: Synthesis Report. In: Pachauri, R.K., Reisinger, A. (Eds.), Contribution of Working Groups I, II and III to the Fourth assessment report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland, p. 104.

9. Kurukulasuriya, P., Rosenthal, S., (2003). Climate change and agriculture: a review of impacts and adaptations. Climate Change Series Paper No. 91, World Bank, Washington DC.

10. Monteny, G.J., Groenestein, C.M., Hilhorst, M.A., (2001). Interactions and coupling between emissions of methane and nitrous oxide from animal husbandry.Nutr. Cycl. Agroecosyst. 60, 123–132.

11. Nardone, A., (2000). Weather conditions and genetics of breeding systems in the Mediterranean area, in: XXXX International Sysmposium of Societa Italiana per il Progresso della Zootecnia, Ragusa, Italy, pp. 67–92.

12. Olivier, J.G., Janssens-Maenhout, G., (2012). Part III: Greenhouse gas emissions, in: International Energy Agency (IEA), CO2 Emissions from Fuel Combustion, 2012 Ed, Paris, France, pp. III.1–III.51.

13. Sustainable Livestock Management for Poverty Alleviation and Food Security (2012) by Katrien van t'Hooft; Terry S. Wollen; Dilip P. Bhandari .Call Number: SF55.D44H66, Publication Date: 2012

14. The Royal Society, (2001). The role of land carbon sinks in mitigating global climate change. Policy document 10/01. The Royal Society, London.

15. Thornton, P.K., Boone, R.B., Ramirez-Villegas J., (2015). Climate change impacts on livestock. CGIAR Resrach program on Climate Change, Agriculture and Food Security (CCAFS), Working Paper No. 120.

16. Thornton, P.K., Herrero, M., (2010). The Inter-linkages between rapid growth in livestock production, climate change, and the impacts on water resources, land use, and deforestation. World Bank Policy Research Working Paper, WPS 5178. World Bank, Washington, DC.

17. Thornton P.K., Herrero M., Freeman A., Mwai O., Rege E., Jones P., McDermott J., (2008). Vulnerability, climate change and livestock: Research opportunities and challenges for poverty alleviation. International Livestock Research Institute (ILRI), Kenya

Course Website(s)

Required Course Texts and Materials

Optional Course Texts and Materials

1. **Sustainable Livestock Management for Poverty Alleviation and Food Security (2012) by Katrien van t'Hooft; Terry S. Wollen; Dilip P. Bhandari** .Call Number: SF55.D44H66, Publication Date: 2012.

2- M. Melissa Rojas-Downing, A. Pouyan Nejadhashemi, Timothy Harrigan, Sean A. Woznicki. 2017. Climate change and livestock: Impacts, adaptation, and mitigation. Climate Risk Management. 17: 145-163.

https://www.sciencedirect.com/science/article/pii/S221209631730027X

3- J.M. Rust & T. Rust. Climate change and livestock production: A review with emphasis on Africa. South African Journal of Animal Science 2013, 43 (No. 3)

http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0375-15892013000300004

Assignments and Grading Scheme

Grading System

Grading Policy

Component	Grade
Assignments	20%
Exams	60%
Practical exam	20%
Oral Exam	20%
Total Points	100%

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes.

Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and / or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Disability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Important Dates to Remember

Course Syllabus

Week	**SUBJECT**	**Date**
1	General Introduction to the course structure and its modules contents and start with module 1 - Introduction to the course. - Course overview includes 6 modules both (presentation and practical work at College of Veterinary & Agriculture livestock farms). - **Module. 1: Sustainable and ethical livestock production and Animal Welfare** - **Unit 1.1:** The role of livestock in achieving the SDGs. - **Unit 1.2**: The 3 dimensions of livestock and SDGs (people, planet and processes) - Unit 1.3: Animal welfare , the five freedom and ethics the concept (inputs and outputs) - **Unit 1.4:** The importance of animal welfare and Welfare validation how and why? - **Unit 1.5:** Introduction to Environmental Ethics	

	- **Unit 1.6:** Welfare Assessment: (Livestock production systems and problem solving) - **Unit 1.7:** Good Management Practices in Animal Welfare and Ethical farm standards. - **Unit 1.8:** Animal Welfare Impact on Productivity and Economics	
3	Field Visit to livestock production plan	
4	**Module.2: Ethics of Animal Use in Food Production** - **Unit.2.1:** Participatory Approach - **Unit. 2.2:** The New era of Animal Ethics - **Unit. 2.3:** Unit Our duties to Animal - **Unit 2.4:** Community Organization - **Unit.2.5:** Advisory Committees - **Unit 2.6:** Use of Traditional Knowledge - **Unit.2.7:** Case Studies: Examples of Community Small Livestock Holding Management - **Unit.2.8:** Exercise: Develop Plan for Winning Argument for Using Animal in Food Production.	
5	**Module.3: Modern livestock production and food security** - **Unit 3.1:** Whole Farm Planning: with Livestock (Meat & Milk Production) - **Unit 3.2:** Principles of Animal Nutrition (quality and quality of feeds). - **Unit. 3.3:** Livestock plan management - **Unit 3.4:** Principles of Animal Nutrition (quality and quality of feeds). - **Unit. 3.5:** Livestock production and the livestock industry	

	- **Unit 3.6:** Animal production systems and requisites - **Unit 3.7:** Animal production environment and production factors - **Unit 3.8:** Livestock Breeds and Rare Breeds - **Unit 3.9:** Poultry & Ostrich Farms	
6	**Module.4: Livestock health, disease management and production** **Unit 4.1:** Livestock Health, Disease Management and Production **Unit 4.2:** Livestock High Impact diseases. **Unit 4.3:** Primary Animal Health Care ('PAHC') and Good Management Practices **Unit. 4.4:** Risk Assessment for Emergency Animal Diseases **Unit. 4.5:** The Concept of One Health	
7	Minor Exam: Midterm	
8	**Module.5: Sustainable Livestock Production and Climate Change** - **Unit 5.1:** Livestock Productions and Management Systems - **Unit 5.2:** Impacts of Climate Change on Livestock Production - **Unit. 5.3:** The Impact of Livestock on Climate Change - **Unit 5.4:** Adaptation and Mitigation Measures	
9	Communication strategies for working with stakeholders & Farmers	
10	Case study: Visit to Livestock production farm	

11	**Module 6: The Application of Animal Welfare Ethics** Unit.6.1: Ethical Animal Breeding Unit.6.2: Farming and Animal Nutrition Unit.6.3: Animal Housing & Husbandry Unit 6.4: Animal Welfare Impact on Productivity and Economics Unit 6.5: Utilitarianism Unit 6.6: Introduction to Environmental Ethics Unit. 6.7: Sustainability certification of animal products Unit.6.8: Managing small-scale livestock production systems in developing countries	
12	Case study: Visit to Livestock production farm	
13	Student Presentations	
14	Final exam	

Course Name	Sustainable and Livestock Management
Module 1	Sustainable and Ethical Livestock Production and Animal Welfare
Key Concepts	Animal welfare, ethics, livestock Sustainability, Ethical animal farming and five freedom
Overview	- Livestock are central to achieving many of the Sustainable Development Goals (SDGs) and directly relevant to most of them. Topics included are livestock and sustainable development, animal welfare and animal use ethics concept, animal welfare inputs, livestock production systems and resources, animal welfare to improve production and assessment of livestock production systems using welfare concept.
Aim	1. To explain the Sustainable Livestock Production 2. To mention the Role of Livestock in achieving the Sustainable Development Goals (SDGs) 3. To know the Concept of Animal welfare

	4. To define different terminology and concepts related to sustainable farming practices. 5. To know the basic methods to develop basic animal Health care and disease control and control. 6. To describe the ecological, economical, and social implications of agricultural practices. 7. To define the concept of welfare and ethical livestock production. - 8. To know how to apply best welfare practices in livestock management to maximize animal productivity.
Learning Outcomes	At the end of this module learners will be able to: • Know the role of livestock in achieving the SDGs • Define the relation between Livestock and SDGs (people, planet and processes) • Understand the terminology of Animal Ethics and Welfare • Know the concept of Animal welfare and Ethics • The Good Management Practices in Animal Welfare • Understand the role of Ethical farms in prioritizing Animal Welfare
Units	- Unit 1.1: The role of livestock in achieving the SDGs - Unit 1.2: The 3 dimensions of livestock and SDGs (people, planet and processes) - Unit 1.3: Animal welfare , the five freedom and ethics the concept (inputs and outputs) - Unit 1.4: The importance of animal welfare and Welfare validation how and why? - Unit 1.5: Introduction to Environmental Ethics - Unit 1.6: Welfare Assessment: (Livestock production systems and problem solving) - Unit 1.7: Good Management Practices in Animal Welfare and Ethical farm standards. Unit 1.8: Animal Welfare Impact on Productivity and Economics.
Readings	• **Course Notes.** • **Compulsory Reading:** Farm Animal Welfare. http://www.fao.org/ag/againfo/themes/animal-welfare/aw-abthegat/aw-whaistgate/en/. • See http://www.oie.int/animal-welfare/animal-welfare-key-themes/. • OIE (2014). – Introduction to the Recommendations for Animal Welfare. In: Terrestrial Animal Health Code. OIE, Paris, Article 7.1.1. Available at: http:// www.oie.int/fileadmin/Home/eng/Health_standards/tahc/2010/chapitre_aw_introduction.pdf. • 11http://conventions.coe.int/Treaty/en/Treaties/Html/087.htm

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- **Optional readings:** Bawden, R.J. (1991): System thinking and practice in agriculture. J. Dairy Sci., 74, 2362-2373; Fromm, J. 2004: The emergence of complexity. Kassel University Press, Kassel, Germany; Sundrum, A. 2008: System approach in organic livestock production (in preparation)

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<tr><td>Activity</td><td colspan="16">Overview</td></tr>
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Assignment 1a

In light of the global trends, needs and priorities of CCSAFS research that can be identified through the links listed in the readings:

1) develop a catalogue of trends, needs and priorities;

2) assess the extent to which they are related to your country/region;

3) what other research needs and priorities can be considered in your local/national area**;**

4) develop an inventory of CCSAFS research topics on Animal welfare, ethics, livestock Sustainability, Ethical animal farming and five freedom in line with the local/national circumstances.

Assignment 1b:

Use class discussion forum available in the Blended Learning Environment and share your topic list with your instructor and classmates. Select one or two topics from the list that you would like to learn more about and return to your instructor or supervisor to discuss further.

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<tr><td>10Cs/6</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
<tr><td>Learning Goals</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td>√</td><td>√</td><td></td><td>√</td><td>√</td><td></td></tr>
<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
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<tr><td>ECTS WORK</td><td colspan="2">Lecture</td><td colspan="2">Online</td><td colspan="2">Lab</td><td colspan="2">Reading</td><td colspan="2">Course</td><td colspan="2">Project</td><td colspan="2">Prepare exam</td><td colspan="2">Writing</td><td>Total</td></tr>
</table>

LOAD					**activity**			**exam**	
	4h	**2h**	**6h**	**5h**	**3h**	**2h**	**-**	**-**	**22 hours**
Module 2	**Ethics of Animal Use in Food Production**								
Key Concepts	At the end of this module students will be able to: Understand the integrity and ethics of using animals for food production								
Overview	- Consumer awareness and demand is increasing for products from animals that have been treated appropriately and with consideration for their needs. - Animal welfare impacts the growth, reproduction and health care and survival of animals. It also has an impact on the quality of animal products.								
Aim	Based on a scientific and practical up-to-date level, students should learn the followings: 1. The main Goals of Primary Animal Health Care ('PAHC'). 2. How to develop modern and effective livestock hygiene practices , disease isolation , control and eradication, health monitoring programs, 3. The difference between healthy and unhealthy animals , Disease epidemiology, 4. Types of infectious diseases of livestock, Causes of Diseases, transmission and prevention, emerging diseases, vaccination and quarantine measures.								
Learning Outcomes	At the end of this module learners will be able to: 1. Identify the role of disease impacts on livestock health, management and production. 2. Understand the goal of PAHC system. 3. Gain the knowledge, skills and tools needed at the first line of defence against livestock disease and production loss. 4. Ensure livestock handlers undertake a structured observation of their animals on an on-going daily basis. 5. Improve disease recording and reporting systems, so that veterinary services can develop seasonal disease prevention and treatment strategies.								

Units	- Unit.2.1: Participatory Approach - Unit. 2.2: The New era of Animal Ethics - Unit. 2.3: Unit Our duties to Animal - Unit 2.4: Community Organization - Unit.2.5: Advisory Committees - Unit 2.6: Use of Traditional Knowledge - Unit.2.7: Case Studies: Examples of Community Small Livestock Holding Management - Unit.2.8: Exercise: Develop Plan for Winning Argument for Using Animal in Food Production

Readings	**Compulsory Readings:** Rollin, B. (2006). An introduction to veterinary medical ethics: Theory and cases (2nd ed., pp. 1-41). Oxford: Blackwell. Anthony, R. (2003). The ethical implications of the human–animal bond on the farm. Animal Welfare, 12, 505-512. Sandøe, P., & Christiansen, S. B. (2008). Ethics of animal use (pp. 15-31). Chichester, UK: Wiley-Blackwell. **Optional readings:** Cohen, C. (2003). Reply to Tom Regan. In S. Armstrong & R. Botzler (Eds.), The animal ethics reader (pp. 25-29). London: Routledge. Douglas-Hamilton, I., Bhalla, S., Wittemyer, G., & Vollrath, F. (2006). Behavioural reactions of elephants towards a dying and deceased matriarch. Applied Animal Behaviour, 100, 87-102. Heleski, C. R., & Anthony, R. (2012). Science alone is not always enough: The importance of ethical assessment for a more comprehensive view of equine welfare. Journal of Veterinary Behaviour, 7, 169-178. Langford, D., Crager, S., Shehzad, Z., Smith, S., Sotocinal, S., Levenstadt, J., Chanda, M. L., Letivin, D. J., & Mogil, J. S. (2006). Social modulation of pain as evidence for empathy in mice. Science, 312, 1967-1970. Regan, T. (1984). The case for animal rights. London: Routledge. Schneider, B. (2001). A study in animal ethics in New Brunswick. Canadian Veterinary Journal, 42, 540-547. Taylor, A. (1999). Magpies, monkeys and morals. What philosophers say about animal liberation (pp. 25-66). Peterborough, UK: Broadview.
Activity/ Self Study	1. Seminars / presentations; a series of seminars and student presentations. 2- Practical work: Farm visit (Veterinary & Agriculture College Farms) + practical work: Students will submit an individual reflection paper of approximately 1000 words on through LMS: 1. Animal Production Practices 2. Livestock Systems (Dairy & Milk productions)

<table>
<tr><td></td><td colspan="16">3. Produce for Purpose
4. Farm Management
5. Risk analysis for Livestock farms
6. Economic of Livestock Systems
7. Market Supply and Demand
8. Case Studies: Risk management strategies and Analysis of a Dairy & Meat Farm (Analyses the safety management in animal farms considering in particular infrastructural aspects, management of machines and equipment and handling of animals).</td></tr>
<tr><td rowspan="3">10Cs/6

Learning Goals

SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
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<tr><td>ECTS Work Load</td><td colspan="3">Lecture</td><td colspan="3">Online</td><td colspan="3">Lab</td><td colspan="2">Reading</td><td colspan="3">Course activity</td><td colspan="3">Project</td><td colspan="2">Prepare exam</td><td colspan="2">Writing exam</td><td>Total</td></tr>
<tr><td></td><td colspan="3">4h</td><td colspan="3">2h</td><td colspan="3">6h</td><td colspan="2">7h</td><td colspan="3">3h</td><td colspan="3">3h</td><td colspan="2">-</td><td colspan="2">-</td><td>25h</td></tr>
<tr><td>Module 3</td><td colspan="16">Modern Livestock production and food security</td></tr>
<tr><td>Key Concepts</td><td colspan="16">Livestock production, breeding management, reproduction and food security</td></tr>
<tr><td>Overview</td><td colspan="16">Modern animal production deals with the caring, feeding, breeding and management of all classes of domesticated and aquatic animals, as well as wildlife. Animal production is often studied in terms of the various biological functions of animals, emphasizing those of economic importance.</td></tr>
<tr><td>Aim</td><td colspan="16">Students are able to know :
1. Different Livestock production methods and the livestock industry
2. Types of Animal production systems practices and requisites
3. Animal production environment and production factors</td></tr>
</table>

	4. Production cycles and commodities derived from animals. 5. The Animal products 6. Farm management and risk analysis 7. Economic of Livestock Systems 8. Market Supply and Demand
Learning Outcomes	At the end of this module learners will be able to: 1. Deal with the caring, feeding, breeding and management of all classes of domesticated and aquatic animals, as well as wildlife 2. Identify the different Livestock Production Systems 3. Produce for Purpose 4. Know the Economic of Livestock production Systems 5. Identify Market Supply and Demand 6. Understand the Case Studies of Risk Analysis of a Dairy Farm 7. Design an economically efficient and environmentally sustainable Dairy Farm
Units	**Modern livestock production and food security** - **Unit 3.1:** Whole Farm Planning: with Livestock (Meat & Milk Production) - **Unit 3.2:** Principles of Animal Nutrition (quality and quality of feeds). - **Unit. 3.3** Livestock plan management skillsUnit Unit 4.4: Unit 4.1: Principles of Animal Nutrition (quality and quality of feeds). - **Unit. 3.2:** Livestock production and the livestock industry - **Unit 3.3:** Animal production systems and requisites - **Unit 3.4:** Animal production environment and production factors - **Unit 3.5:** Livestock Breeds and Rare Breeds - **Unit 3.6:** Poultry & Ostrich Farms

Readings	**Compulsory reading:** https://www.angelo.edu/dept/agriculture/courses_animal_science.php B., Hafez, E.S.E. 2000: Reproduction in Farm Animals 7th ed. Lippincott Williams & Wilkins Publishing; Bearden, H.J., Fuquay, J.W., Willard, S.T. 2004: Applied Animal Reproduction, 6th ed. **Optional reading:** Pearson Prentice Hall Publishing; Squires, E.J. 2003: Applied Animal Endocrinology 1st ed. CABI Publishing; Pineda, M.H., Dooley, M.P. 2003: Mc Donald's Veterinary Endocrinology and Reproduction 5th ed. Blackwell Publishing.
Activity	1. Seminars / presentations; a series of seminars and student presentations. 2. Work in group student group to problem –based learning in (Production cycles and commodities derived from animals) Visit to (Veterinary & Agriculture College Farm)+ Practical work 3. Group exam task with presentation; with the acquired understanding achieved through the course. 4. The students will also be asked to write critical summaries on the lectures content. 5. For each unit the students will submit an individual reflection paper of approximately 1000 words. **Self study: Student Assignments on :** □ Principles of Animal Nutrition □ Animal ration formulation and evaluation □ Nutrient digestion and metabolism □ Reproductive Techniques (pregnancy diagnosis and Artificial insemination) □ Applied Animal Nutrition (food analysis procedures)

10Cs/6	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA

Learning Goals	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	5	16	17
	√	√											√				
ECTS Work Load	Lecture		Online		Lab		Reading		Course activity		Project		Prepare exam		Writing exam		Total
	6h		1h		6h		7h		3h		3h		-		-		25h
Module 4	**Livestock health, Disease management and production**																
Key Concepts	Livestock Health management, High impact diseases, epidemiology and emerging diseases																
Overview	Diseases are a major constraint for animal production and therefore constitute a threat to livelihoods and food security, and sometimes to the survival of a species. While any disease has negative effects and causes suffering, some diseases have higher impacts than others and are major targets for management and control.																
Aim	Based on a scientific and practical up-to-date level, students know 1. Goals of Primary Animal Health Care ('PAHC'). 2. The develop modern and effective livestock hygiene practices , disease isolation , control and eradication, health monitoring programs, 3. The difference between healthy and unhealthy animals , Disease epidemiology, 4. Types of infectious diseases of livestock, Causes of Diseases, transmission and Prevention, Emerging diseases, vaccination and Quarantine measures.																
	At the end of this module learners will be able to: 1. Know the role of high impact Diseases on Livestock Health, Management and Production. 2. Identify the Goal of PAHC System as follows: 1. To establish the knowledge, skills and tools needed at the first line of defines against livestock disease and production loss. 2. To ensure livestock handlers undertake a structured observation of their animals on an on-going daily basis.																

	3. To improve disease recording and reporting, so that veterinary services can develop seasonal disease prevention and treatment strategies.
Units	**Unit 4.1:** Livestock Health, Disease Management and Production **Unit 4.2:** Livestock High Impact Diseases (Disease epidemiology). **Unit 4.3:** Primary Animal Health Care ('PAHC') and good management practices **Unit.4.4:** Risk Assessment for Emergency Animal Diseases **Unit 4.5:** The Concept of One Health
Readings	**Compulsory reading:** Manual on Livestock Disease Surveillance and Information Systems FAO, www.fao.org/docrep/004/x3331e/X3331E01.htm OIE-Listed diseases, infections and infestations in force in 2018 - World Organization for Animal Health www.oie.int/animal-health-in-the-world/oie-listed-diseases-2018/ **and** www.fao.org/docrep/004/X2096E/X2096E05.htm **Optional readings:** Secretariat of the Convention on Biological Diversity (2008). Synthesis and Review of the Best Available Scientific Studies on Priority Areas for Biodiversity Conservation in Marine Areas beyond the Limits of National Jurisdiction. Montreal, Technical Series No. 37, 63 pages available from http://www.cbd.int/doc/publications/cbd-ts-37-en.pdf
Activity/ **Self Study**	**Farm visit (Veterinary College Farm)+ practical work: to Faculty Animal Farm** 1. Seminars / presentations; a series of seminars and student presentations. 2. Work in group student group to problem –based learning in (Caring of farm animals) 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5. Farm visit (Veterinary & Agriculture College Farm) + Practical work: Faculty of Vet Medicine Farm **6. Community-based service learning** : To contact with local communities and identify their needs and problems to achieve and help them. The community/service-based learning activity includes:

	The communication with the community service learning through sharing with livestock production problems (Caring and Husbandry of animal farms) through the following points: 1.**<u>Design the strategy plan with students in order to:</u>** a. Increase community Public awareness to know and overcome the problem b. Prepare of questionnaires about the problems, current or seasonal occurrence, recurrent or new. c. Set up strategy to improve (animal welfare, ethics, animal husbandry and health, animal environment, farming management and risk analysis, economic of livestock systems, welfare assessment (inputs and outputs), farming and animal nutrition, ethical animal breeding. Annual vaccination programs, animal treatment, Livestock production system. d. Define tools for better communication with local communities (direct contact) e. Evaluate the result of the strategy (effectiveness) (good or redefining or change the strategy) f. Establish a permanent community--based service g. Student learn the communication process and system to apply their knowledge in a future community service. 7. **Student Problem-based learning (PBL)** on Car and husbandry aspects of farm animals: depend on community-based learning to define and solve farm animal's health problems. This activity needs student basic skills, team work, data collection, response, reflection, define the problem and suggested solution in the form of group presentation and technical report. **Self study: Student Assignments on :** Assignment: Reflecting Upon Curriculum • Early disease identification and treatment • preventive measure and veterinary services • Ongoing disease management (Vaccination, Parasite Management and Udder Health) • Evaluating disease dynamics and livestock adaptation.

10Cs/6	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√			√	√		√	√	√

Learning Goals																	
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√											√				

ECTS Work Load	Lecture	Online	Lab	Reading	Course activity	Project /Preparation	Prepare exam	Writing exam	Total
	6h	1h	10h	7h	15h	15h	-	-	54h

Module 5	**Sustainable Livestock Production and Climate Change**
Key Concepts	Climate change, sustainable livestock production systems, mitigation and adaptation strategies
Overview	- Improving the efficiency of livestock production and its sustainability in developing countries, especially the productivity per animal, can double livestock productivity while halving its adverse environmental impacts, including reducing emissions of greenhouse gases, in those countries.
Aim	Students are able to know : This module assesses: - The overall aim with the module is to give the students the necessary basic information about sustainable livestock production and the effect of climate change on its productivity. - The key issues linking climate change and development practices in livestock and farming systems. - Livestock are central to achieving many of the Sustainable Development Goals (SDGs) and directly relevant to most of them. - Climate change mitigation and adaptation measures
Learning Outcomes	After completion of the module the student will Know that: • The roles of livestock in achieving the sustainable development goals • Responses to climate change includes the followings: (i) Farm adaptation measures (Livestock production and management systems, breeding strategies, farmer's perception and adaptive capacity) and (ii) mitigation

	measures (carbon sequestration, enteric fermentation, manure management, fertilizer management, and shifting human dietary trends),
Units	**Unit 5.1:** Livestock production and management system **Unit 5.2:** SDGs and Livestock production **Unit 5.3:** Livestock Systems, Produce for Purpose and Farm Management **Unit.5:4:** Economic of Livestock Systems and Market Supply and Demand **Unit.5.5:** The impact of livestock on climate change **Unit 5.6:** Climate change adaptation and mitigation measures.
Readings	• **Course Notes.** • **Compulsory readings:** • https://www.ifad.org/documents/ • https://www.uncclearn.org/sites/default/files/inventory/fao3.pdf • FAO. 2010a. Climate-smart agriculture: policies, practices and financing for food security, adaptation and mitigation. Report prepared for The Hague Conference on Agriculture, Food Security, and Climate Change. Rome. - **Optional readings:** • Bentley, D. & Hegarty, R. 2008. Managing livestock enterprises in Australia's extensive rangelands for greenhouse gas and environmental outcomes: a pastoral company perspective. Australian journal of experimental agriculture, 48: 60-64.
Activity/ **Self Study**	Visit to **(Veterinary & Agriculture College Farm)**+ Practical work 1. Seminars / presentations; a series of seminars and student group presentations. 2. Work in group student group to problem –based learning in (How can you meet the growing global demand for animal products while minimizing climate impacts?) 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. **Self study: Student Assignments on :** • The roles of livestock in achieving the sustainable development goals (SDGs). • Livestock's production and management systems • Farm Management and Risk analysis

<table>
<tr><td></td><td colspan="16">• Potential types of adaptation and mitigation practices in the livestock sector.
• Livestock and soil carbon sequestration.
•How to improve animal environment to reduce impacts of livestock on climate change</td></tr>
<tr><td>10Cs/6</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
<tr><td>Learning Goals</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td>√</td><td>√</td><td></td><td>√</td><td>√</td><td></td></tr>
<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>5</td><td>16</td><td>17</td></tr>
<tr><td></td><td>√</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>√</td><td></td><td></td><td></td><td></td></tr>
<tr><td>ECTS Work Load</td><td colspan="3">Lecture</td><td colspan="3">Online</td><td colspan="3">Lab</td><td colspan="3">Reading</td><td colspan="3">Course activity</td><td colspan="3">Project /Preparation</td><td colspan="3">Prepare exam</td><td colspan="3">Writing exam</td><td>Total</td></tr>
<tr><td></td><td colspan="3">6h</td><td colspan="3">2h</td><td colspan="3">6h</td><td colspan="3">8h</td><td colspan="3">3h</td><td colspan="3">3h</td><td colspan="3">-</td><td colspan="3">-</td><td>26h</td></tr>
<tr><td>Module 6</td><td colspan="16">The Application of Animal Welfare Ethics</td></tr>
<tr><td>Key Concepts</td><td colspan="16">Identify the advantages of practicing animal welfare ethics</td></tr>
<tr><td>Overview</td><td colspan="16">- Livestock production, however, has a major impact on the environment. It is responsible for about 41% of the global emission of greenhouse gases from livestock, and one of the drivers of land degradation and deforestation. The demand for livestock products is expected to increase significantly. Without major changes, therefore, the above described environmental concerns about the livestock sector will increase only further. So we are facing an urgent question: how to reduce the environmental impact of production of animal-source food?</td></tr>
<tr><td>Aim</td><td colspan="16">Students are able to:
- Gain information and insight into future options and limitations of reducing the environmental impact of livestock production, we need sound environmental impact assessment tools.
- Gain knowledge, both theoretical and practical, on the environmental impact assessment of livestock systems
- Know the latest insights of environmental impact assessment tools
- Write an Assessment on the impact of livestock production on biodiversity?</td></tr>
</table>

Learning Outcomes	**At the end of this module learners will be able to:** 1. Understand of the advantage of practicing animal welfare ethics 2. Know the Ethics application as recommended good farming practices and General Farm Management 3. Animal housing and husbandry measures of Farm Animals. 4. Introduction to Environmental Ethics
Units	Unit.6.1: Ethical Animal Breeding Unit.6.2: Farming and Animal Nutrition Unit.6.3: Animal Housing & Husbandry Unit 6.4: Animal Welfare Impact on Productivity and Economics Unit 6.5: Utilitarianism Unit 6.6: Introduction to Environmental Ethics
Readings	**Rollin, B. (2006).** An Introduction to Veterinary Medical Ethics. Theory and Cases. Second edition, pp.34-37. Oxford: Blackwell. **Sandøe, P., & Christiansen, S. B. (2008).** Ethics of Animal Use, pp.67-153. Chichester: Blackwell **Desjardins, J. R. (2012).** Environmental Ethics: An Introduction to Environmental Philosophy. 5th edition. Kentucky: Wadsworth Publishing **Optional readings:** **Dawkins, M. S., & Layton, R. (2012).** Breeding for better welfare: genetic goals for broiler chickens and their parents. Animal Welfare, 21: 147-155. **D'Silva, J., & Webster, J. (eds) (2010).** The Meat Crisis. Developing more sustainable production and consumption. London: Earthscan. **Helelski, C. R., & Anthony, R. (2012).** Science alone is not always enough: The importance of ethical assessment for a more comprehensive view of equine welfare. Journal of Veterinary Behaviour, 7: 169-178. **Mepham, B. (1996).** Food Ethics. London: Routledge **Mullan, S., & Main, D. (2001).** Principles of ethical decision-making in veterinary practice. In Practice, 23: 394-401. **Palmer, C. (2012).** Does breeding a bulldog harm it? Breeding, ethics and harm to animals. Animal Welfare, 21: 157-166.

Activity and Self Study	Visit to (Veterinary & Agriculture College Farm)+ Practical work 1. Seminars / presentations; a series of seminars and student group presentations. 2. Work in group to problem –based learning in What are Environmental Ethics and What's Your Role in Saving Nature and Animal rights? 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. **Self study: Student Assignments:** Environmental Ethics Ethical Animal Breeding Feed Requirements of Animals Whole Farm Planning: with Livestock Livestock Breeds and Rare Breeds
	Farm visit (Veterinary College Farm)+ practical work: to Faculty Animal Farm 1. Seminars / presentations; a series of seminars and student presentations. 2. Work in group student group to problem –based learning in (Caring of farm animals) 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5. Farm visit (Veterinary & Agriculture College Farm) + Practical work: Faculty of Vet Medicine Farm **6. <u>Community-based service learning:</u>** To contact with local communities and identify their needs and problems to achieve and help them. The community/service-based learning activity includes:

	The communication with the community service learning through sharing with livestock production problems (Caring and Husbandry of animal farms) through the following **points:** **1.<u>Design the strategy plan with students in order to:</u>** a. Increase community Public awareness to know and overcome the problem b. Prepare of questionnaires about the problems, current or seasonal occurrence, recurrent or new. c. Set up strategy to improve the followings: □ Environmental Ethics □ Animal Breeding □ Feed Requirements of Animals □ Whole Farm Planning: with Livestock □ Livestock Breeds and Rare Breeds d. Define tools for better communication with local communities (direct contact) e. Evaluate the result of the strategy (effectiveness) (good or redefining or change the strategy) f. Establish of a permanent community--based service g. Student learn the communication process and system to apply their knowledge in a future community service. 7. Student Problem-based learning (PBL) on Ethics of farm animals: depend on community-based learning to define and solve farm animal's environmental problems. This activity needs student basic skills, team work, data collection, response, reflection, define the problem and suggested solution in the form of group presentation and technical report. Self-study: Student Assignments on : Assignment: Reflecting Upon Curriculum □ Environmental Ethics □ Ethical Animal Breeding □ Feed Requirements of Animals □ Whole Farm Planning: with Livestock □ Livestock Breeds and Rare Breeds

10Cs/6	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
Learning Goals	√	√	√	√	√	√	√	√	√			√	√		√	√	√
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	5	16	17
	√	√											√				

ECTS Work Load	Lecture	Online	Lab	Reading	Course activity	Project /Preparation	Prepare exam	Writing exam	Total
	4h	2h	6h	6h	3h	4h	26h	3h	57h

ECTS Workload

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**						**Work load**
				1	**2**	**3**	**4**	**5**	**6**	
Lectures (face-to-face)	10	3	30	4	4	6	6	6	4	30
Online	5	2	10	2	2	1	1	2	2	10
Lab work	10	4	40	6	6	6	10	6	6	40
Reading articles (3 pages per hour)	10	0.2	20	2	3	4	4	4	3	20
Reading book chapters (5 per/h)	10	0.2	20	3	4	3	3	4	3	20
Preparing course activities	3	10 (M)	30	3	3	3	15	3	3	30
Project work	1	30	30	2	3	3	15	3	4	30
Preparation for exam	1	26	26	-	-	-	-	-	26	26
Writing the exam	1	3	3	-	-	-	-	-	3	3
Total			**209**	22	2 5	25	54	26	57	**209**


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS


ICTs as enabling tools for the 10Cs
Constructing knowledge
Critical thinking and problem solving
Communi-cation
Collabo-ration
Creativity and innovation
Connectivity and networking
Critical conscious-ness
Critical reflection
Cross/inter-cultural competence
Co-responsibility

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CCSAFS COURSE SYLLABUS AND MODULES TEMPLATE

I- Course Syllabus

Course Number: **CSAF 870**

Applications of Biotechnology in Sustainable Agriculture

(7 ECTS)

Suez Canal University, Faculty of Agriculture

2nd Year , 3rd Semester

Instructor Information:

Instructor: Khalid El-Sayed Abd El-Hamed Ibrahim.

Office Location: Faculty of Agriculture, SCU, New Campus

Telephone: 01285142310- 01005759406

Office Hours: Monday, 10-12

Wednesday, 11-1

E-mail: isaoscu@gmail.com

Website: ----------

Course Identification:

Course Number: CSAF870

Course Name: **Applications of Biotechnology in Sustainable Agriculture**

Course Location: **Suez Canal University**

Class Times:

Prerequisites: None

Faculty Web Page: http://agr.aswu.edu.eg, http://agri.scuegypt.edu.eg/?page=pages&page_id=479

Course Description/Overview

Applications of Biotechnology in Sustainable Agriculture course will enable learning about the science behind biotechnology application in area of sustainable agriculture. This course is designed to produce graduates who have a solid understanding of science and technology skills required to use technological advances within a competitive environment.

In addition, the course is designed to introduce the most important and basic concepts, methods and techniques in molecular biology and genetic engineering for sustainable agriculture. Lectures and practical sessions will address concepts dealing with genome structure and organization, cell and tissue culture with particular emphasis on production of secondary metabolites, genetic transformation, the role of biotechnology to enhance crop productivity and quality. Special emphasize will be placed on bioethics in relation to biotechnology.

Course Learning Objectives

- Understand the scientific basis for biotechnology and applications in agriculture

- To develop a sufficient background on basic Plant cell organization and genome structure.

- To learn the fundamental, theoretical and applied aspects of molecular biology techniques.

- To describe the importance of using molecular marker in sustainable agriculture.

- To describe plant cell and tissue cultures and their applications for production of secondary metabolites

- To demonstrate and understanding genetic transformation in plants and animals.

- To understand the role of biotechnology to enhance crop productivity and quality.

- To develop an opinion concerning bioethics in relation to biotechnology

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Develop the strategies for improving production and quality of crops
2. Apply concept of biotechnology that adapt sustainable agriculture.
3. Suggest solutions to sustainable agriculture problems based on biotechnology.
4. Apply plant cell and tissue cultures techniques and applications for plant improvement and production of secondary metabolites.
5. Understand the role genetic transformation in improving plants and animals.
6. Employ biotechnology to enhance crop productivity and quality.
7. Build positive attitude concerning bioethics in relation to biotechnology

Course Resources

Course Website(s)

Required Course Texts and Materials

Hand-out prepared by the instructor for the class

Optional course Texts and Materials

1. Plant biotechnology and transgenic plants (2002) Kirsi-Marja Oksmah-Caldentey and Wolfgang H. Barz; Marcel Dekker, Inc.

2. Advances in Plant Breeding Strategies: Breeding, Biotechnology and Molecular Tools (2015) , Jameel M. Al-Khayri • Shri Mohan Jain and Dennis V. Johnson, Springer International Publishing Switzerland.

4. Plant Genotyping: The DNA Fingerprinting of Plants (2001), R. J. Henry (ed.), CABI Publishing

5. Plant Conservation Biotechnology (2003), E.E. Benson, CRC Press.

.6 Molecular Tools for Screening Biodiversity: Plants and Animals 2011. Angela Karp, Peter G. Isacc and David S. Ingram (eds.). Chapman & Hall.

7. Molecular Cloning: A Laboratory Manual, (4th Edition) By Michael R. Green and Joseph Sambrook, © 2012 by Cold Spring Harbor Laboratory Press.

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading policy

Grades can be based on the following:

Activities: Assignments, Presentations, Seminars	**10**
Oral Exam	**10**
Practical exam	**20**
Final Exams	**60**
Total Points	**100**

Course policies

Late Assignment

It is important that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive at on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and though about the assigned material before you come to class. I expect active class participation.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by-case basis.

Course schedule

Week	Date	Topics, Reading, Assignments and Deadline (details on assignments and more bibliography are available in the course modules)
1		**Course overview:**
2		Molecular Biology part1
3		Molecular Biology part 2
4		Genetic transformation of plants and animals
5		Biotechnology to enhance crop productivity & quality1
6		Biotechnology to enhance crop productivity & quality2
7		Green biotechnology part1
8		Green biotechnology part2
9		Biofuel
10		Bioethics in relation to biotechnology part1
11		Bioethics in relation to biotechnology part 2
12		Plant Cell Cultures part 1
13		Plant Cell Cultures part 2
14		Plant Cell Cultures part 3
15		Final Exam

II- Course Modules

Module 1	**Molecular Biology**
Key Concepts	polymerase chain reaction, recombinant DNA, restriction enzyme (endonuclease), reverse transcriptase, ribosomal RNA, RNA (ribonucleic acid), RNA polymerase, rRNA (ribosomal RNA), simple-sequence DNA, Southern blotting, Transcription, transfer RNA, transformation, transgene, transgenic, translation, tRNA (transfer RNA), vector, Western blotting,
Overview	Molecular Biology module introduces student to the structure and function of the molecules, including DNA and RNA, which allow genes to be expressed and be maintained from one generation to the next. Student will also learn about genetic engineering, its application, and the ethical issues associated with its use.
Aim	To provide a general introduction to the molecular basis of genetics, how genes are maintained from one generation to the next and how their expression is regulated in various systems.
Learning Outcomes	Students will understand the basis of genome maintenance and gene expression, and appreciate the concept of mutation at the level of the genotype and how this displays at the phenotypic level. The major concepts and principles underlying recombinant DNA technology will be understood, along with major applications and associated issues relating to the public understanding of science.
Units	I - Structure, Function and Replication of DNA II - Gene expression III - Recombinant DNA Technology
Readings	Recommended reading: • Alberts, B. et al. (2003) Essential Cell Biology 2nd Edition. Garland Science. • Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. (2002) Molecular Biology of the Cell (4th edition). Garland Science.

<table>
<tr><td></td><td>• Brown, T. (2012) Introduction to Genetics: A Molecular Approach. Garland Science.</td></tr>
<tr><td>Activity</td><td>• Assignment 1:
Students prepare seminars in Structure, Function and Replication of DNA
• Assignment 2:
Using the internet, search for educational video clips addressing DNA structure and function.</td></tr>
<tr><td>SD Pillars</td><td>environment | economy | social | Culture</td></tr>
<tr><td>21st ESD</td><td>Learning to know (√) | Learning to be (√) | Learning to do (√) | Learning to live together | Learning to transform oneself and society | Learning to give and share</td></tr>
<tr><td>SDGs</td><td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
√</td></tr>
<tr><td>Module 2</td><td>Plants for the Future</td></tr>
<tr><td>Key Concepts</td><td>Crops, Stable food, food security, GMO, climate change challenges</td></tr>
<tr><td>Overview</td><td>This module addresses an aspect of plant biology and how this is related to a future challenge faced by humanity. Students will learn: how plants capture the resources they require from the environment, how plants can maximize productivity and fitness in their environment and how they are adapted to tolerate extreme conditions. Students will find out how this knowledge is being used to address major societal and environmental challenges such as overcome climate change challenges, sustaining our food supply, and protecting the environment.</td></tr>
<tr><td>Aim</td><td>To provide a knowledge and understanding of:
• The role of plant research to promote our food security nowadays and in the future
• The role of plant research to adapt to climate change
• The role of GM approaches to understand and modify plant responses</td></tr>
<tr><td>Learning Outcomes</td><td>Upon completion of this module, students will have knowledge and understanding of:</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">The contribution of plant sciences to solving major societal and environmental challenges: sustaining our food supply and improving the environment.
The physiology behind the predicted impact of climate change on crop production
Ethical and practical aspects of using GM crops.</td></tr>
<tr><td>Units</td><td colspan="6">Lectures address various aspects of plant biology and how these are important to address challenges faced by humanity within the next 50 years.

The course will give an overview of the regulation of plant growth, the biology of flowering, seeds and plant nutrition.

Lectures will illustrate how understanding each of these principles allows to meet some of the challenges caused by climate change and by increased world population. These challenges include better climate change models; adapting crop flowering time to climate change; tailoring plant architecture to increased yield; enhancing wood formation in trees for biofuel, improving drought, cold and salt tolerance of crops; allowing bioremediation of contaminated soils using plants.</td></tr>
<tr><td>Readings</td><td colspan="6">Benkeblia N. (2012). Sustainable Agriculture and New Biotechnologies. CRC Press; Pages 341-368
Slater, A, Scott, N, Fowler, M (2008) Plant Biotechnology: The Genetic manipulation of plants (2nd edition). Oxford University Press;</td></tr>
<tr><td>Activity</td><td colspan="6">•Assignment 1:

Making group discussion on the role of plant research to adapt to climate change</td></tr>
<tr><td>SD Pillars</td><td colspan="2">environment</td><td>economy</td><td>social</td><td colspan="2">Culture</td></tr>
<tr><td>21st ESD</td><td>Learning to know (√)</td><td>Learning to be (√)</td><td>Learning to do (√)</td><td>Learning to live together (√)</td><td>Learning to transform oneself and society (√)</td><td>Learning to give and share (√)</td></tr>
</table>

SDGs	<table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr><tr><td></td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>
Module 3	**Green Biotechnology**
Key Concepts	Environment friendly, genetic manipulation, biofuel, biotic and abiotic stress
Overview	Green Biotechnology is a rapidly expanding field within modern biotechnology and involves the utilization of plants not only for the sustainable production of food, but also their utilization as a source of renewable energy as a biofuel, and as a novel means to generate pharmaceuticals and other novel products. In addition, Green Biotechnology is aimed at developing more environmentally friendly processes compared to traditional industrial agriculture or chemical industry methods.
Aim	This module will examine the technologies of plant genetic engineering and explore how these are used to generate more efficient crop plants, healthy and nutritious foods, and other commercially attractive products.
Learning Outcomes	Students will be able to: • Understand how sustainable biotechnology can be achieved using plants • Critically analyze and understand how to exploit the methods for how plants can be genetically manipulated • Understand and be able to discuss how plant genetic engineering can be used to improve food production, generate healthy and nutritious foods, deliver renewable energy via plants, and enable pharmaceutical production using plants • Understand how to make use of fundamental knowledge of plant processes in order to utilize plants for biotechnology
Units	Module content will be provided in the form of lectures, material on Blackboard, and student-led seminars where groups of students will address questions on recent research advances related to each topic. • Precision plant engineering: methods and mechanisms of plant genetic transformation and transgene integration; endogenous gene silencing and its applications; genome editing

<table>
<tr><td></td><td>• Engineering plants for improved nutrition: generating plants with improved vitamin and nutrient content - the golden rice story; alteration of plant metabolism
• Biotic stress tolerant crops: new approaches and strategies for tolerating plant pests and disease
• Biofuels from plants: biofuel potential, problems and solutions and ethical considerations
• Plants for biopharmaceuticals: plants as expression systems for pharmaceutical products</td></tr>
<tr><td>Readings</td><td>Kirsi-Marja Oksmah-Caldentey and Wolfgang H. Barz (2002). Plant biotechnology and transgenic plants. Marcel Dekker, Inc. Chapter 5 (pages 95-125) Chapter 6(126-156).
Jameel M. Al-Khayri • Shri Mohan Jain and Dennis V. Johnson (2015). Advances in Plant Breeding Strategies: Breeding, Biotechnology and Molecular Tools, Springer International Publishing Switzerland. Chapter 4 (95-112).
Slater, A, Scott, N, Fowler, M, Plant Biotechnology: The Genetic manipulation of plants (2nd edition), Oxford University Press, 2008,</td></tr>
<tr><td>Activity</td><td>• Assignment 1:
• Making discussion groups to discuss the role plant genetic engineering and explore how these are used to generate more efficient crop plants,
• Assignment 2:
• Students prepare presentation on: Biofuels from plants</td></tr>
<tr><td>SD Pillars</td><td>environment | economy | social | Culture</td></tr>
<tr><td>21st ESD</td><td>Learning to know (√) | Learning to be (√) | Learning to do (√) | Learning to live together | Learning to transform oneself and society | Learning to give and share</td></tr>
<tr><td>SDGs</td><td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
√</td></tr>
<tr><td>Module 4</td><td>Bioethics in relation to biotechnology</td></tr>
<tr><td>Key Concepts</td><td>Animal rights, Bioethics, Reproducibility, Research ethics, Research misconduct, Responsible conduct of research, Risk management, Social responsibility, Transparency, Values</td></tr>
</table>

Overview	This module provides an opportunity to engage in many of the central debates of bioethics and is an opportunity not only to gain knowledge of this area of inquiry but also to develop critical thinking skills and skills in arguing that can be applied to many areas of academic, professional and social interaction.			
Aim	To provide a stimulating, engaging and structured overview of ethical issues in the life sciences. To enable students to develop their knowledge of this area and their skills in analysis and critical thinking and enable them to explore these issues with confidence to come to a position on them that they can justify and defend convincingly.			
Learning Outcomes	The students will: • Be familiar with a range of contemporary ethical issues in science			
Units	The course consists of focused, engaging and accessible online material designed by bioethical experts to guide you through a variety of, often controversial, bioethical questions. Informal seminars support this online material and provide the opportunity to discuss these bioethical questions and develop your skills on analysis and critical thinking with the guidance of expertise in this area. Topics will include the following. • Introduction to ethics and bioethics • Genetic manipulation and enhancement including GM crops			
Readings	Talbot, M. (2012). *Bioethics: an introduction*. Cambridge University Press. O'Mathúna, D. P. (2007). Bioethics and biotechnology. *Cytotechnology*, *53*(1-3), 113-119. https://link.springer.com/content/pdf/10.1007%2Fs10616-007-9053-8.pdf			
Activity	• Assignment 1: • Students prepare a project for Application of agricultural biotechnology to contribute in sustainable agriculture such as improve crops tolerated to abiotic, biotic stresses and crops productivity & quality.			
SD Pillars	environment	economy	social	Culture

<table>
<tr><td>21st ESD</td><td>Learning to know (√)</td><td>Learning to be (√)</td><td>Learning to do (√)</td><td>Learning to live together (√)</td><td>Learning to transform oneself and society (√)</td><td>Learning to give and share (√)</td></tr>
<tr><td>SDGs</td><td colspan="6"><table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>√</td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Module 5</td><td colspan="6">Plant tissue culture</td></tr>
<tr><td>Key Concepts</td><td colspan="6">Micropropagation, culture media, plant growth regulators, regeneration, explant , media</td></tr>
<tr><td>Overview</td><td colspan="6">This module introduces the concepts of plant tissue culture and micropropagation. An understanding of in vitro plant tissue manipulation is developed. Tissue culture applications to genetic transformation, bioreactors and mutation breeding are introduced and discussed.</td></tr>
<tr><td>Aim</td><td colspan="6">Provide basic and advanced knowledge of plant cell, organ and tissue cultures, including protoplast culture, optimal conditions, culture media preparation, sterility management and laboratory equipment. Basic and advanced knowledge about use of plant biotechnology in breeding and micropropagation techniques. Practical and theoretical bases of main model in vitro cultures.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">- Discuss the Plant Biotechnology Industry.
- Carry out and evaluate the processes involved in introduction of plant material to the in vitro environment.
- Discuss and evaluate growth media technologies, composition, preparation and optimization.
- Complete culture media preparation and pouring
- Perform and discuss manipulations of in vitro material and environment for application to various usages to include: Micropropagation, variation, plant breeding and secondary metabolite production.
- Discuss and evaluate molecular methods as tools in plant breeding.</td></tr>
<tr><td>Units</td><td colspan="6">Plant tissue culture - definition, history
Basic in vitro culture conditions</td></tr>
</table>

	Laboratory of plant tissue cultures Vegetative organ cultures Generative organ cultures Micropropagation Callus cultures Cell culture and Protoplast culture
Readings	**George, E., Hall, M.A. and De Klerk, G. J. 2009, *Plant Propagation by Tissue Culture*, Volume 1, Springer Netherlands [ISBN: 978-9048172528]** **Arie Altman (Editor), Paul Michael Hasegawa (Editor) 2011, *Plant Biotechnology and Agriculture*, Academic Press [ISBN: 0123814669]** **Kyte L., Kleyn J.G., Scoggins H and Bridgen M. 2013, *Plants from test tubes*, 4th Ed., Timber Press Portland, Oregon [ISBN: 1604692065]** **Alan C. Cassells, Peter B. Gahan 2006, *Dictionary of plant tissue culture*, Food Products Press New York [ISBN: 978-1560229186]**
Activity	Visit the tissue culture laboratory to: Prepare media for plant subculture, Perform subculture process for selected plants,

SD Pillars	environment	economy	Social	Culture

21st ESD	Learning to know (√)	Learning to be (√)	Learning to do (√)	Learning to live together (√)	Learning to transform oneself and society (√)	Learning to give and share (√)

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	1	14	15	16	17
		√															

Learning Components	**No**	**Time Fact**	**Workload**	**Course Modules**					**Workload**
				1	**2**	**3**	**4**	**5**	
Lectures (face-to-face)	14	2	28	4	6	6	6	6	28

Lab work	14	1	14	2	3	3	2	4	14
Reading articles (3 pages per hour)	160	0.25	40	7	7	8	8	10	40
Reading book chapters (5 per/h)									
Preparing course activities	10	3	30	5	6	6	6	7	30
Project work	1	28	28	4	6	6	6	6	28
Preparation for exam	2	25	50	-	-	-	25	25	50
Writing the exam	1	4	4	-	-	-	-	4	4
Total			**194**	22	28	29	53	62	**194**

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Heliopolis University

Faculty of Business & Economics

Management & Human Development Department

CCSAFS COURSE SYLLABUS

Course Code: CSAF890

Social Entrepreneurship in the Organic Food Industry

(7 ECTS – Around 210 study hours)

Spring Semester 2019-2020

Instructor Information

Instructor: Associate Prof. Dr. Omar Ramzy

Office Location:

Telephone:

Office Hours:

E-mail: omar.ramzy@hu.edu.eg

Website: www.hu.edu.eg

Course Identification

Course Number: CSAF890

Course Name: **Social Entrepreneurship in the Organic Food Industry**

Course Location:

Class Times:

Prerequisites:

Faculty Web Page:

Course Description/Overview

This course inspires entrepreneurial innovation and creativity through interactive lectures, workshops, and case studies in contemporary issues to include energy, life sciences, healthcare, and technology. Students will gain awareness of entrepreneurial innovation sources, structures and dynamics. Students will develop individual and group skills for generating innovative ideas and find ways to apply these ideas to address current issues and problems in different industries and agricultural settings. Course topics include the history of entrepreneurship, the role of entrepreneurs, entrepreneurs in the 21st century global economy, and the identification of entrepreneurial opportunities. The elements of creative problem-solving, the development of a business concept/model, the examination of feasibility studies, and the social/moral/ethical implications of entrepreneurship will be incorporated. This course is designed to put the idea of teaching social entrepreneurship in the food industry and its direct relation with sustainable agriculture and climate change to its ultimate test—with the objective of incubating a series of food ventures through the course of the semester that have the potential to be viable businesses and positively impact public health outcomes.

Course Learning Objectives

Every course, lecture, interaction with a student plays a role in executing the strategy set for achieving the vision of Education for Sustainable Development. The role of this course in strategy execution is as follows:

a) To visualise the process of starting, managing and scaling a sustainable business in the realm of food sovereignty.
b) To recognize the challenges facing the organic food industry in Egypt and to understand the market situation for the organic food.
c) To empower students to visualise themselves as potential solution providers to pressing sustainability challenges, either through entrepreneurship or entrepreneurship.
d) To provide students already predisposed toward entrepreneurship with the concepts, frameworks and models to systematically incubate innovative food businesses that are both sustainable and public health-driven.
e) To provide access to domain-specific resources including key industry participants, industry experts and research partners, in order to identify need-gaps and create working products and solutions.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

- Recognize a need in the market that relate to food sovereignty and capitalize on it
- Explain or discuss the food industry needs
- Internalize the idea of making a social contribution when creating a business
- Create a model for risk assessment when it comes to food sovereignty projects
- Create a viability plan for the project or product

Course Resources

Course Website(s)

Required Course Texts and Materials

Hands-out prepared by the instructor for the class

Optional Course Texts and Materials

Wei-Skillern, J., Austin, J., Leonard, H., & Stevenson, H. (2007). Entrepreneurship in the Social Sector (ESS). Sage Publication

Peter C. Brinckerhoff. (2000). Social Entrepreneurship: The Art of Mission-Based Venture Development. Wiley; 1 edition (March 31, 2000).

Gary Erickson. (n.d.). Raising the Bar: Integrity and Passion in Life and Business. Jossey-Bass; 1 edition (August 28, 2012).

David Bornstein. (2004). How to Change the World: Social Entrepreneurs and the Power of New Ideas (illustrate). Oxford University Press, 2004.

David Bornstein. (2010). Social Entrepreneurship: What Everyone Needs to Know. Oxford University Press; 1 edition (April 16, 2010).

Olusegun, G., & Odularu, A. (2015). Food Sovereignty and Food Security : Where doesAfrica Stand ?, (May).

Casson, M. (2003). The Entrepreneur (revised). Edward Elgar Publishing, 2003.

Alex Nicholls. (2008). Social Entrepreneurship: New Models of Sustainable Social Change (1st ed.). Oxford University Press, USA; 1 edition (May 15, 2008).

Elkington, J. and Hartigan, P. (2008). The Power of Unreasonable People: How Social EntrepreneursCreate Markets That Change the World (1st ed.). Harvard Business Press.

Yunus, M. (n.d.). Banker to the Poor: Micro-Lending and the Battle Against World Poverty (Later Prin). PublicAffairs; Later Printing edition (January 8, 2008).

Thomas Dichter and Malcolm Harper. (2007). What's Wrong with Microfinance? Practical Action (July 9,2007).

Assignments and Grading Scheme

Grading System

0 to 100 (where 60 is the least pass mark)

Grading Policy

Grades can be based on the following: (Example)

Assignments	10%
Midterm Exam	20%
Final Exam	20%
Class attendance/participation	10%
Group Project	40%
Total Points	**100**

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come to ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assigned material before you come to class. I expect active class participation, which counts for 20% of the grade.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by- case basis.

Important Dates to Remember

Course Schedule

Lecture	Context	Content
1: Orientation	Co-creating classroom rules (Punctuality, side talks, project and team conduct…etc)	A. Setting expectations. B. Student Discussion 1: An Introduction to Entrepreneurship. C. Student Discussion 2: Differentiating between Entrepreneurship, Sustainable Entrepreneurship and Non-Profit organizations.
2: Creative Problem Solving	Lecture Guest: Inviting an Example of a previous student projects as lecture guests.	A. Community Problem solving Exercise B. Project Overview. C. Student Discussion

3: Vision and Mission Statements	Application: form their personal vision and mission as well as developing their own business vision and mission statements	A. What is a vision statement B. What is a mission statement C. Why should organizations have vision and mission statements
4: Market Validation	Teamwork/ Project Management workshop during the practice hour to prepare the teams for working in teams Industry Structure Analysis Overview	• BCG Model applied to entrepreneurs • What to Eat • In Defense of Food • Select readings based on the domain and problem your team identifies.
5: Operational Model (1).	1st Project follow up + practicing business pitch.	A. Presenting their assignments. B. Key partners: Stakeholder analysis and engagement. C. Meetings with industry players, suppliers, consumers and experts in sub-segment D. Readings: Select readings based on the domain and problem your team identifies
6: Operational Model (2).	Lecture Guest: Inviting an Example of a growing startup that started as a student project.	A. Value Chain: Key resources and Key Activities B. Meetings with industry players, suppliers, consumers and experts in sub-segment C. Readings: • The Blue Ocean Strategy • Select readings based on the domain and problem your team identifies
Lecture 7: Midterm Exam		
Lecture 8: Cost Structure	3rd Project follow up + practicing business pitch.	A. Presenting their assignments. B. Cost structure lecture.

		C. Application: Breaking down cost structure according to their business model canvas
Lecture 9: Revenue Streams		A. Revenue Streams lecture. B. Developing their revenue streams - Sales forecasting and Pricing - Breakeven point
Lecture 10: Marketing Mix	Presentation skills workshop during the practice hour.	A. Marketing Mix (Customer relation, Customer segments and value proposition) B. Discussion: how an entrepreneur can innovate through each of the 4 P's?
Lecture 11: Revision	Final Project follow up + practicing business pitch.	A. Presenting their assignments. B. Recap on previous material
Lecture 12	Final presentations	
Lecture 13	Final presentations	

The CCSAFS Course Modules Template.

Course	***Social Entrepreneurship in the Organic Food Industry***
Module 1	Social Entrepreneurship, Philanthropy, CSR
Key Concepts	Social Entrepreneurship, Philanthropy, CSR
Overview	Social Entrepreneurship is more than a set of tools and techniques for starting and growing a business. It's a mindset, a way of looking at things that is problem/opportunity focused and creative. It's about passion -- doing what you love. It's about creating wealth in all its forms: economic value, social innovation and sustainability, and making a difference in the communities we serve. While numerous different definitions of social entrepreneurship exist, there appears to be broad consensus about two issues: 1. Social entrepreneurship involves the creativity, imagination and innovation often associated with entrepreneurship; and 2. The outcomes of social entrepreneurship are focused on addressing persistent social problems particularly to those who are marginalized or poor. There is often great confusion between philanthropy and social businesses. Main differences are being addressed as well as giving various examples to distinguish between the two terms. Finally, CSR is one of the marketing tools used by many companies where they associate their brand with society improvement in the mind of their customers. However, this doesn't make the company social business by nature.
Aim	To change the idea of Entrepreneurship from a sources of gaining money to a source of helping the society and positively impact the community members.
Learning Outcomes	At the end of this module learners will be able to: • Identify and discuss the difference between entrepreneurship and social entrepreneurship • Differentiate between social business and CSR • Use the basic concepts in addressing different social challenges by a social business idea. • Apply the knowledge gained in their projects and in the market afterwards. •
Units	1.1 What is a Social Entrepreneur? 1.2 Defining Social Entrepreneurship 1.3 Seeing Social Entrepreneurship Theory Put Into Practice

Readings	Explainer: What's Social Entrepreneurship, Hilde Scwab and Katherine Milligan, 2015 https://www.theguardian.com/social-enterprise-network/2014/may/22/social-enterprises-disrupting-food-system https://www.theguardian.com/sustainable-business/tackling-food-waste-social-enterprise-model The Meaning of Social Entrepreneurship", J. Gregory Dees. • "Social entrepreneurship: What Are We Talking About? A Framework for Future Research", Mair and Marti. • "The Change Masters" in Fast Company Magazine, by Cheryl Dahle. • "Misery Loves Company: Rethinking Social Initiatives by Business", Margolis and Walsh in Administrative Science Quarterly. "Social entrepreneurship: Leadership that facilitates societal transformation— An exploratory study" by Alvord, Brown, and Letts. • "The Competitive Advantage of Corporate Philanthropy," Porter and Kramer. • "The Citizen Sector: Becoming as Entrepreneurial and Competitive as Business", Drayton Assigned Videos: - "What is a Social Entrepreneur?" Schwab Foundation television clip - "Key Traits of Social Entrepreneurs", interview of John Elkington. - "Nothing More Powerful" by Bill Drayton.
Activity	**Watch the following videos and prepare a paper about the meaning of Social Entrepreneurship mentioning 3 examples of social Entrepreneurship in the organic food industry?** Professor Jon Isham, Faculty Director at the MCSE, on *Social Entrepreneurship in the Liberal Arts* TED: Ernesto Sirolli, *Want To Help Someone? Shut Up and Listen* TED: Dan Pallota, *The Way We Think About Charity is Dead Wrong* ***Class Activity (Energizer):*** An activity for improving communication between students Line up according to your birthday. The instructor asks a simple question: "If you know the month of your birthday, raise your hand." This seemingly strange question is followed by a task: "Without talking, and with no questions asked, in 30 seconds, line up according to the month of your birthday." After lining up, the participants are allowed to talk and mention loudly, one by one, the month of their birthday. After the students get time to speak to each other and get to introduce them and find some similarities or common characteristics between them. The instructor after that starts to discuss this and ask them if they could find 3 common interests or characteristics between each other. By the end of the session most of the students would have talked to each other and got to know some brief idea about those who have common qualities and would be a potential to cooperate with within the group project.

<table>
<tr><td>SD Pillars</td><td colspan="4">environment</td><td colspan="4">economy</td><td colspan="4">social</td><td colspan="4">culture</td></tr>
<tr><td>21st ESD</td><td colspan="3">Learning to know
✓</td><td colspan="3">Learning to be
✓</td><td colspan="3">Learning to do
✓</td><td colspan="4">Learning to live together
✓</td><td colspan="4">Learning to transform oneself and society
✓</td><td colspan="3">Learning to give and share
✓</td></tr>
<tr><td>SDGs</td><td>1
✓</td><td>2
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✓</td><td>9</td><td>10</td><td>11</td><td>12
✓</td><td>13</td><td>14</td><td>15</td><td>16
✓</td><td>17</td></tr>
<tr><td rowspan="2">ECTs Workload</td><td colspan="2">Lecture</td><td colspan="2">Online</td><td colspan="2">Lab</td><td colspan="2">Reading</td><td colspan="2">Course activity</td><td colspan="2">Project</td><td colspan="2">Prepare exam</td><td colspan="2">Writing exam</td><td>Total</td></tr>
<tr><td colspan="2">6</td><td colspan="2">4</td><td colspan="2"></td><td colspan="2">10</td><td colspan="2">10</td><td colspan="2">5</td><td colspan="2"></td><td colspan="2"></td><td>35</td></tr>
<tr><td>Vision 2030</td><td colspan="17">Decent work and green jobs initiatives that are inaugurated by UN represented by the International Labor Organization (ILO) are matching what Egypt launched in 2015 as Egypt vision for Sustainable development. Social entrepreneurship is the main umbrella for such initiatives and endeavors.</td></tr>
</table>

Module 2	Organic Food Industry in Egypt
Key Concepts	Social and environmental challenges, organic food industry in Egypt
Overview	There are many challenges facing the community nowadays. Students should be aware of their community problems. They should also be able to discuss possible solutions to some of these problems from an entrepreneurial perspective. With special focus on the organic food industry in Egypt. Where the student will get a detailed description about this industry and get the experience from successful entrepreneurs in this field.
Aim	- Introduce the main challenges facing organic food industry in Egypt. Being able to fully understand the market situation for the organic food. This would be done through various learning methodology such as case studies, guest, speakers field visits. etc.
Learning Outcomes	• Recognize the current community social and environmental challenges • Realize the organic food industry in Egypt and its challenges
Units	• Social and environment challenges • Organic food industry
Readings	**What are the main challenges facing Egypt in the organic food industry? SEKEM case study.** Social Conditions in Egypt According to the Millennium Development Goals Presented by Lowell Lewis on to the European League http://ucanr.edu/sites/uc_and_the_mediterraean_/files/110120.pdf The SEKEM Story (Egyptian Case Study), by: Nicholas Parrott & Terry Marsden Department of City and Regional Planning, Cardiff University
Activity	- Guest speakers who has success stories as entrepreneurs in the field of organic agriculture. (Mr. Helmy Abouleish Sekem CEO) - Field visits to SEKEM farm where they can meet key persons in marketing/sales or research departments who can tell them more about the real-life situation in this market and if there is any market gap. Young entrepreneurs in this field will be invited too to present their business ideas and challenges so it can be useful knowledge that they can use when they apply on their final projects. Students are going to develop a concept map that summarizes their understanding and experience for SEKEM. They are going to share this concept map via forum discussion in Moodle

SD Pillars	**environment**		**economy**		**social**	**culture**
21st ESD	Learning to know	Learning to be	Learning to do	Learning to live together	Learning to transform oneself and society	Learning to give and share

	✓		✓		✓		✓			✓				✓			
SDGs	1 ✓	2 ✓	3 ✓	4	5	6	7 ✓	8 ✓	9 ✓	10	11	12 ✓	13 ✓	14	15	16 ✓	**17**
ECTs Workload	Lecture		Online		Lab		Reading		Course activity		Project		Prepare exam		Writing exam		Total
	9		4				15		7								35
Vision 2030	One main pillar of the Egyptian vision 2030 is to ensure food sovereignty within the next 15 years from launching the vision 2015. Main focus in the vision was emphasized on the future of the organic agriculture and organic food industry in Egypt																

Module 3	Creative Problem Solving
Key Concepts	Problem solving, Social and environmental challenges, organic food industry in Egypt
overview	This module will examine when, why, and how we can be creative. It examines the cues that trigger us to consider being creative. It provides a road map of the creative process – the process of changing our perspectives – and the kinds of outcomes that result from creativity. It examines how we can go through the creative process more efficiently and more effectively by examining what is changing about our thinking and how we can make those changes. The end result is more flexible thinking that can be used to recognize and develop new opportunities. Students will be introduced to a variety of creative problem-solving techniques and approaches to use as 'tools' for re-interpreting problems, finding solutions and generating ideas. Practical demonstrations, exercises and task simulations will enable you to gain a deeper knowledge and understanding of these creative tools and the capacity to re-apply them or facilitate their use to generate concepts and ideas

Aim	The module been designed for the purpose of promoting and developing creative thinking and problem solving (CTPS) skills and addresses the need for individuals and teams who can 'think outside the box', and apply fresh thinking to practical, 'real world' problems. And To be able to further develop your knowledge and understanding of the theories and principles underpinning creative thinking.
Learning outcomes	• Demonstrate a broad yet highly developed understanding of creativity (theory and practice) together with the principles of idea generation. • Address problems from social creative perspective • Develop your practical creative problem-solving skills. • Apply reflective learning.
Units	2.1 Problem Solving Techniques
Readings	"the source of innovation and Creativity" by Karlyn Adams http://www.fpspi.org/pdf/InnovCreativity.pdf
Activity	As students met earlier young entrepreneurs from the field speaking of the main challenges that they faced in their business initiation. We will invite 2 of them again to speak of 4 challenges that they faced in the process of starting their business or during the operation. They describe the challenges in details and all the related matters. Students will be divided into 4 groups each group will be assigned one of the challenges and they will be asked to find a creative solution to come over the challenge. Each group of students will exchange their ideas for peer reviewing. After peer reviewing, students will collaboratively develop a Wiki providing a comprehensive overview of the challenges that face startups in general. The wikis developed will be presented and discussed in class during the second week. After they finish, a discussion will be held with the entrepreneurs and they start assessing the effectiveness of the proposed solution and finally revealing the way that they followed to overcome the challenges. This activity will take 45 minutes and will be done within class.

SD Pillars	**environment**		**economy**	**social**		**culture**
21st ESD	Learning to know	Learning to be	Learning to do	Learning to live together	Learning to transform oneself and society	Learning to give and share

	✓		✓		✓		✓			✓				✓			
SDGs	1 ✓	2 ✓	3 ✓	4	5	6	7 ✓	8	9	10	11	12 ✓	13 ✓	14	15	16	17
ECTs Workload	Lecture		Online		Lab		Reading		Course activity		Project		Prepare exam		Writing exam		Total
	6		4				10		10								30
Vision 2030	Fighting corruption and being among the countries that approach innovation in research and industry are main targets of the Egyptian vision 2030, this requires innovative entrepreneurs and creative problem solvers																

Module 4	Business Model Canvas
Key Concepts	Vision, Mission, Business model
Overview	A business model describes the rationale of how an organization creates, delivers, and captures value. The business model canvas is a tool that can be used to translate a business model into nine building blocks that show the logic of how a company intends to make money. The main purpose of a business model canvas is to foster understanding, encourage discussion, creativity and analysis. In order to start the business, it has to have a vision, mission and values. Students will learn how to utilize the business model canvas in their group projects, as well as developing their own vision and mission for the projects.
Aim	1. Ability to substantially ideate, describe, evaluate and discuss a business model using the Business Model Canvas 2. Hands-on understanding of how to user personas and problem scenarios to articulate the Offer's key drivers 3. Hands-on understanding of how to use the AIDA(OR) framework and storyboards to evaluate the effectiveness of Customer Relationships and Channels 4. Understanding of business type and how to evaluate Key Activities, Resources, and Partnerships in this context

Learning Outcomes	- Express Understanding the key elements of a business model - Recognize the special characteristics of different business models - Show Understanding the Business model generation process - Appreciate how technology can enhance and modify business models - Apply the concepts to develop different business models - Examine developments in market competition and technology development through Business Model opportunity analysis.
Units	3.1 Business Model Canvas
Readings	• Note on Business Model Analysis for the Entrepreneur • Creating Successful Business Models, Lessons from Social Entrepreneurship Business Model You: A One-Page Method For Reinventing Your Career Book by Alexander Osterwalder, Tim Clark, and Yves Pigneur
Project	• Students will be required to apply the business model canvas on their own project ideas. (their final projects will be presented in the last 3 lectures) • Students will develop their own personal vision and mission statements Lecture Guest: Inviting an Example of a growing startup in the field of organic agriculture that started as a student project. Assignment will be done as group work outside the classroom and its due date would be the following lectures. Virtual communication is a must among the groups' members of the project

SD Pillars	**environment**		**economy**		**social**		**culture**										
21st ESD	Learning to know ✓		Learning to be ✓		Learning to do ✓		Learning to live together ✓			Learning to transform oneself and society ✓			Learning to give and share ✓				
SDGs	1	2	3	4	5	6	7 ✓	8 ✓	9 ✓	10 ✓	11	12 ✓	13 ✓	14	15	16 ✓	17
ECTs Workload	Lecture		Online		Lab		Reading		Course activity		Project		Prepare exam		Writing exam		**Total**
	6		4				10				10		5				35
Vision 2030	The Egyptian economy to be capable of achieving sustainable inclusive growth and maximizing value added, generating decent and productive jobs. This part of the vision																

	is matching the idea of developing new startups that are based on solid research and valid models such as Business model Canvas

Model 5	Micro Financing Methodologies and Challenges
Key concepts	Micro finance, financial institutions
Overview	This module is all about raising startup financing. We will discuss both the reasons why startups typically need outside cash, and the appropriate sources and uses of startup financing. We will discuss how entrepreneurs can reach out to and negotiate with angel investors and venture capital firms. We will also discuss crowd funding options for startups. Finally, we will examine the micro financing from the initial idea developed by Muhammad Yunus, to the methodologies and products developed over the last decades, and the scale of replication which has taken place. Contributions by major developers in the field will be discussed. They will also examine the current status of the microfinance movement, consider critical opinions regarding the nature of the microfinance movement, and appraise current and future challenges to microfinance as Egypt is recently directing towards more encouragement for micro financing.
Aim	Students will learn ways to finance their ideas. As the most important aspect of the entrepreneurial projects is to be able to fund the idea.
Learning Outcomes	• Describe a variety of approaches and methods for measuring the impact of social entrepreneurial organizations • Analyze and evaluate microfinance, a systems-changing example of social entrepreneurship. • Assess social entrepreneurial opportunities (through case studies)
Units	4.1 Introduction to financial management concepts 4.2 Microfinance Methodologies and Challenges.

Reading	- Book: What's Wrong with Microfinance? by Thomas Dichter and Malcom Harper, editors. - Book: Banker to the Poor: Micro-Lending and the Battle Against World Poverty by Muhammad Yunus Assigned Videos: - Nobel Media depiction of the work of Yunus in Bangladesh and beyond - Speech of Muhammad Yunus at the 2006 Nobel Peace Prize Ceremony
Project	Apply on your project. Find the cheapest financing for your idea.

SD Pillars	**environment**				**economy**				**social**				**culture**			
21st ESD	Learning to know ✓		Learning to be ✓		Learning to do ✓		Learning to live together ✓		Learning to transform oneself and society ✓				Learning to give and share ✓			
SDGs	1 ✓	2	3	4	5	6	7 ✓	8 ✓	9 ✓	10	11	12 ✓	13	14	15	16 ✓	17
ECTs Workload	Lecture		Online		Lab		Reading		Course activity		Project		Prepare exam		Writing exam		Total
	9		6				10		5		10						40
Vision 2030	By 2030 real GDP per capita in Egypt reaching high-middle income countries level. This was stated in the vision 2030 and it has to be demonstrated in this module how to finance the small and medium enterprises and focus on the financial mechanisms															

Module 6	Final Projects Presentations
Key words	Presentation skills, idea Pitching,
Overview	As part of the course applications, students are asked to develop their own business ideas applying all the knowledge they gained from the course. The class will be divided into groups of 4-5 members according to the class capacity. A well-developed business model canvas will be presented along with a complete project idea in the field of organic food industry. The students will be given a workshop on presentation skills and how to be able to pitch their business ideas within minutes to convince investors with their ideas.

Aim	This module mainly aims to increase the entrepreneurial skills of the students where they can have the basic ability to understand business and market conditions. As well as making sure that all theoretical concepts given in the course was understood and able to be transformed into practical work.
Learning outcomes	- Apply the concepts to develop different business models - Examine developments in market competition and technology development through Business Model opportunity analysis. - Acquire needed business presentation skills - Apply micro financing techniques. - Utilizethe information gained from the guest speakers along the course.
Units	
Readings	Small Business Can: A website run by business people for business people http://www.smallbusinesscan.com
Activity	• Presenting their final projects. Students will take part in the evaluation process as they will be handed an evaluation sheets with certain criteria where they will evaluate other teams. Questions, active discussions and suggestions would be very much encouraged. • It is recommended that students organize an off-line (in class) and an online conference session to present and discuss their results.
Community Based-Learning Activity	The students will be engaged together in a Community Based-Learning Activity represented by taking students from start to finish through a business model. Give them a specific type of business to focus on, delving into the ins and outs of making this business work. For instance, if you were to focus on the chocolate industry, you could start with "www.hersheys.com", and then compare it to a European chocolatier, then to a local small business. Show students the differences and similarities while providing them with invaluable details about starting and maintaining a successful business. And then the instructor should create a sense of responsibility by giving each student a job and add a twist. First assign jobs such as white board cleaner, agenda and date manager, art director, and so forth. Assigning more important names to jobs works really well with older students. Then listen to complaints and allow them to switch out jobs for a couple of week. Ultimately ask a series of questions to get them thinking: Would you be happy doing this when you're out of school? How could you turn one of these skills learned into a business of your own? Or, do you prefer working for someone else? What are the benefits? What are the drawbacks? All of this will help

SD Pillars	**environment**		**economy**		**social**	**culture**
21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓

SDGs	1 ✓	2	3	4	5	6	7 ✓	8	9	10	11	12 ✓	13 ✓	14	15	16 ✓	17
ECTs Workload	Lecture		Online		Lab		Reading		Course activity		Project		Prepare exam		Writing exam		Total
	6						15				10		5				36

Learning Components	No	Time Factor	Workload	Course Modules						Workload
				1	2	3	4	5	6	
Lectures (face-to-face)	14	3	45	6	9	6	6	9	6	42
Online	12	2	24	4	4	4	4	6		24
Lab work										
Reading articles (3 pages per hour)	120	0.3	40	5	10	5	5	5	10	40
Reading book chapters (5 per/h)	150	0.5	30	5	5	5	5	5	5	150
Preparing course activities	6	5	32	10	7	10		5		32
Project work	5	7	35	5			10	10	10	35
Preparation for exam	5	3	15				5	5	5	15
Writing the exam										
Total			**211**	**35**	**35**	**30**	**35**	**40**	**36**	**211**

SDGs RUBRIC

SDGs		CLIMATE CHANGE	SUSTAINABLE AGRICULTURE	FOOD SECURITY	COURSE MODULE
1	End poverty in all its forms everywhere	√	√	√	1 & 2
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	√	√	√	1 & 2
3	Ensure healthy lives and promote well-being for all at all ages				
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				
5	Achieve gender equality & empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all	√	√	√	2
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all	√	√	√	1 & 6 &5
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns	√	√	√	5
13	Take urgent action to combat climate change and its impacts	√			3
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss				
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, & build effective, accountable, and inclusive institutions at all levels	√	√	√	6

17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	√	√	√	3

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CCSAFS COURSE SYLLABUS

Sustainable Fisheries and Food Security (CSAF875)

Developed by Prof. Dr. Mamdouh Omar

& Assoc. Prof. Said E. Desouky

Al-Azhar University

Instructor Information

Instructor 1: Prof. Mamdouh Ahmed Omar

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Instructor Information

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Course Identification

Course Number:CSAF875

Course Name: Sustainable Fisheries and Food Security

Course Location: Al-Azhar University

Class Times:

Prerequisites:

Faculty Web Page:

Course Description/Overview

Fisheries and aquaculture play important roles in increasing food and income in many developing countries, either as a stand-alone activity or in association with crop agriculture and livestock rearing. The aim of this course is to identify how these contributions of fisheries and aquaculture to poverty reduction and food security can be enhanced while also addressing the need for a sustainability transition in over-exploited and over-capitalized capture fisheries, and for improved environmental performance and distributive justice in a rapidly growing aquaculture sector.

Sustainable Fisheries contribute to food security and nutrition and play a vital role in global, national and rural economies. Fish is highly nutritious and serves worldwide as a valuable supplement in diets lacking essential proteins, vitamins and minerals.

Climate change is expected to make the situation of sustainable fisheries governance even more urgent and critical. However, the full implications of climate change for international trade of fish and fishery products are not well known and require further study. The course provides insights on challenges faced by the fisheries sector and explores ways to strengthen its governance. Research is particularly needed on the links between changing resource abundance/distribution and fisheries and aquaculture production systems at regional and national levels.

Course Learning Objectives

1. Acquire experience in the use of new techniques and methods for the development of a more efficient fisheries management, adapted to the conditioning social and environmental factors
2. Design sustainable model for fishery taking in consideration, food security and climate change.
3. Link between sustainable development goals, food security and climate change.
4. Understand the market of fishery and gain skills of marketing.
5. Use online information sources to work on case studies in small groups to solve problems based on food security and sustainability.

6. Write accurate and balanced, well supported reports for a general educated and scientifically literate audience appropriate to communicating a rationale around sustainable fisheries.
7. Use mathematical skills to model and predict the performance of fisheries and aquaculture production systems

Course Content Learning Outcomes

After completion of this course participants should be able to:

1. Undertake activities and develop plans for the establishment of small-scale fishing projects.
2. Design and implement mathematical modelling and stock assessment in fish reproductive biology, dispersal, fish nutrition, health and genetics in aquaculture and fisheries.
3. Explain the role of fisheries in food security and nutrition in global, national and rural economies.
4. Understand the response of sustainable fisheries to the seasonal variations.
5. Design marketing plan for sustainable fishery.

Course Resources

Course Website(s)

Required Course Texts and Materials

1. Sustainable fisheries and aquaculture for food security and nutrition A report by The High Level Panel of Experts, on Food Security and Nutrition, June 2014 https://ec.europa.eu/knowledge4policy/sites/know4pol/files/a-i3844e.pdf

2. A Fishery Manager's Guidebook, 2009http://www.fao.org/3/i0053e/i0053e.pdf

3. Handbook of Seafood Quality, Safety and Health Applications August, 2010https://onlinelibrary.wiley.com/doi/book/10.1002/9781444325546

4. The State Of World Fisheries And Aquaculture http://www.fao.org/3/a-i2727e.pdf

Optional course Texts and Materials

Allison, E.H. and Ellis, F. (2001). The livelihoods approach and management of small-scale fisheries.Marine Policy. 25(5). pp. 377-388. Available at URL:

https://www.sciencedirect.com/science/article/pii/S0308597X01000239

Coping with the food and agriculture challenge: smallholders' agenda

http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Coping_with_food_and_agriculture_challenge__Smallholder_s_agenda_Final.pdf

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading policy

Grades can be based on the following:

Assignments	20 %
Class attendance/participation	20 %
Final Exams	60 %
Total Points	100

Course policies

Late Assignment

It is important that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and

counted as absent. You are expected to have read and thought about the assigned material before you come to class. I expect active class participation, which accounts for 20% of the grade.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by-case basis.

Important Dates to Remember (Course schedule)

week	Teaching/class hours	date	Topics, Reading, Assignments and Deadlines (details on assignments and more bibliography are available in the course modules)
1-2	2		Course overview:Discussion of syllabus and assignments, course requirements and prerequisites, criteria for student selection. Introduction and concepts of sustainable fisheries and food security
3-4	2		Farming and fishing in response to seasonal and inter-annual variations.
5-6	2		Farming and fishing in response to climate change.
7-8	2		Fishing in inland lagoons
9-10	2		Full-time migrant fishers
10-11	2		Global ocean governance and the fisheries crisis
12-13	2		Fisheries Statistics
14-15	2		The dynamics of fisheries expansion in developing countries

SUMMARY OF 7 ECTS STUDENTS WORKLOAD

Learning Components	No	Time Factor	Workload	Course Modules					Workload
				1	2	3	4	5	
Lectures (face-to-face)	16	1	16	4	3	3	3	3	16
Online	3	2	6	2	-	2	-	2	6
Lab work	4	2	8	2	2	-	2	2	8
Reading articles (3 pages per hour)	110	0,3	33	6	6	8	7	6	33
Reading book chapters (5 per/h)	120	0.2	24	5	5	5	5	4	24
Preparing course activities	4	10	40	8	8	8	8	8	40
Project work	3	10	30	5	5	5	5	10	30
Preparation for exam	1	50	50	-	10	-	20	20	50
Writing the exam	1	3	3	-	-	-	-	3	3
Total			**201**	**27**	**40**	**26**	**47**	**61**	**210**

Module (1)

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	4	2	2	11	8	5	-	-	27

Module (2)

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	3	-	2	11	8	5	10	-	40

Module (3)

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	3	2	-	13	8	5	-	-	26

Module (4)

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	3	-	2	12	8	5	20	-	47

Module (5)

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	3	2	2	10	8	10	20	3	61

Course	Sustainable Fisheries and Food Security
Key Concepts	Sustainable fisheries and food security
Overview	It is essential for students to develop a fundamental understanding of sustainable fisheries and food security concepts. Questions to be addressed in this module include the following: What is the nature of fisheries? Why are sustainable fisheries important to food security? What are the current applications of fisheries? How to deal with seasonal variations in regard to sustainable fisheries?
Aim	The aim of this module is to understand how sustainable fisheries can bedesigned and its importance for food security.
Learning Outcomes	By the end of this module, the students will be able to: 1. Demonstrate an ability to discuss the principles and practices of sustainable fisheries 2. Describe the primary fishery production systems 3. Understand the response of sustainable fisheries to the seasonal variations.
Units	1.1. Introduction and concepts of sustainable fisheries 1.2. Impact of seasonal variations on sustainable fisheries 1.3. Challenges to food security
Readings	1. Sustainable fisheries and aquaculture for food security and nutrition http://www.fao.org/3/a-av032e.pdf 2. Role of inland fishery and aquaculture for food and nutrition security in Nepal https://agricultureandfoodsecurity.biomedcentral.com/articles/10.1186/s40066-016-0063-7
Activity	

	Assignment 1.1: Write an article about, How are ocean temperature and civilian outfall impact on fishing stocks and suggest methods to reduce it. **Assignment 1.2:** Cooperate with one of your colleague and design a strategy for solving ocean pollution that affects the fishing. **Assignment 1.3: (field trip)**; two field trips to some fishing areas which have different seasonal variation effect on the fishing map.

10Cs/6 LEARNING GOALS	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	5	16	17
				√										√			

Key Concepts	Climate change and its impact on sustainable fisheries
Overview	In this module, students will learn about the current and potential climate change with regard to sustainable fisheries and food security.
Aim	The overriding aim of this module is to examine sustainable fisheries and food security in response to climate change.
Learning Outcomes	By the end of this module the students will be able to: 1. Identify suitable climate conditions to establish sustainable fishery. 2. Describe the primary effects of climate change on sustainable fisheries. 3. Describe basic retail sustainable fisheries.
Units	Unit 2.1. Basics of Climate Change. Unit 2.2. Sustainable Fisheries in response to Climate Change. Unit 2.3. Sustainable Fisheries and Food Security Challenges.
Readings	1. Strategy for fisheries, aquaculture and climate change http://www.fao.org/tempref/FI/DOCUMENT/aquaculture/aq2010_11/root/2011/climate_change_2011.pdf 2. Fisheries, aquaculture and climate change http://www.fao.org/3/a-i6383e.pdf
Activity **Module 2**	**Assignment 2.1.**Brain storming session to encourage students to think how the climatic changes affect the fish distribution and fisheries outputs.

	Assignment 2.2. (Movie show); comparing between sustainable fishery and the traditional one, taking in consideration food security aspect, and climate change rules. **Assignment 2.3.** (Practical demonstration showing the effect of pH variation on the fisheries component); laboratory installation of experimental design by using some available animal models.																
10Cs/6 LEARNING GOALS	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
	√	√	√	√	√	√	√	√	√	√	√		√		√		
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	√		√										√	√	√		
Key Concepts	Fisheries dynamics, fisheries development																
Overview	In this module, students will have sufficient knowledge and understanding about local and universal dynamics of fisheries.																
Aim	The aim of this module is to turn students able to develop fishery strategies for overcoming challenges in correspondence with SDG no. 2																
Learning Outcomes	he end of this module the students will be able to: 1. Describe strategies for overcoming basic challenges in developing fisheries. 2. Use mathematical skills to model and predict the performance of fisheries and aquaculture production systems																
Units	Unit 3.1. Dynamics of fisheries overview Unit 3.2. Developing research applications in fishery dynamics																
Readings	1- FAO technical guidelines for responsible fisheries http://www.fao.org/3/a-i2708e.pdf 2- The state of world fisheries and aquaculture http://www.fao.org/3/a-i2727e.pdf																
Activity	**Assignment 3.1.** Provide a summary of the data from the practical and answer the questions on the practical sheet: Every student will visit 10 fisheries at least in his area and collect primary data about problems, challenges, needs and the production using open ended questions. This data will be presented through presentation in front of other colleagues.																

	Assignment 3.2. Every student will design a questionnaire based on his qualitative data and collect quantitative data. This data will be analysed and presented in class.																
10Cs/6 LEARNING GOALS	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		√												√	√		
Key Concepts	Fish production with sustainable market balance																
Overview	In this module, students will have sufficient knowledge and understanding about fish production. In addition to increase their awareness about sustainable fisheries and food security																
Aim	Demonstrate an ability to discuss the principles and practices of sustainable fisheries and food security as mentioned in SDGs no. 1 and 2.																
Learning Outcomes	By the end of this module the students will be able to: 1. Identify basic elements for producing high value fish. 2. Prepare marketing proposal for productions. 3. Understand the sustainable fish production and successful marketing.																
Units	Unit 4.1. High Value Fish Production Unit 4.2. Season Extension Techniques for High Value Fish. Unit4.3. Principles and Practices of Sustainable Fisheries and Food Security																
Readings	1. From low- to high-value fisheries: Is it possible to quantify the trade-off between management cost, risk and catch?, Author links open overlay panel,N.A.DowlingabC.M.DichmontcW.VenablesdA.D.M.SmithbD.C.SmithbD.PowereD.Galeanoehttps://www.sciencedirect.com/science/article/pii/S0308597X12002503 2. Production, Accessibility, Marketing and Consumption Patterns of Freshwater Aquaculture Products http://www.fao.org/3/Y2876E/y2876e1k.htm#bm56 3. Kura, Y., Revenga, C., Hoshino, E., Mock, G., (2004). Fishing for answers: making sense of the global fish crisis. World Resources Institute, Washington DC. https://www.researchgate.net/publication/274077147_Fishing_for_Answers_Making_Sense_of_the_Global_Fish_Crisis																
Activity	**Assignment 4.1.**(Personal case study) Prepare qualitative study about whole-of-fishery level.																

	Assignment 4.2. (Modelling design) Student will design full sustainable fishery model, Student should take in his consideration the following points, Economic impacts, sustainable development goals, Climate change, food security and marketing methods.																
10Cs/6 LEARNING GOALS	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	5	16	17
	√	√				√							√	√			

Key Concepts	Fish Nutrition, Formulation and Feeding as well as management strategies.
Overview	Fish nutrition constitutes an ever-increasing area of research and interest due to the fact that it is fundamental for the success and sustainability of the aquaculture industry. Poor nutrition would lead to stress, diseases, poor fish growth and environmental pollution and thus a thorough understanding of the requirements of the fish's nutrition together with how such requirements are met is essential in conformance with SDGs no. 1, 2, 3 and 6.
Aim	The aim of this module is to provide an analysis of how to determine the requirements of different aquatic species for the different nutrients. Also, it discusses how such requirements are met and the major differences between the nutrition of aquatic species at different stages of their life. In addition, the module will discuss the different feeds used by aquaculture and the needs for alternatives. Thus the learner will get a good understanding of the way aquaculture provides the best nutrition for the species being cultured and how essential this is in the way of enterprise economics.
Learning Outcomes	:he end of this module the students will be able to: 1. Understand how energetic and metabolism determine the nutrition requirements of aquatic species 2. Compare and contrast different feeds used in the aquaculture industry 3. Comprehend the general principles of larval and juvenile nutrition, formulation and feeding 4. Comprehend the general principles of grow-out and brood stock fish nutrition, formulation and feeding 5. Show impact of fish farm on economic situation by analysing data of production
Units	Unit 5.1. Fish Nutrition, Formulation and Feeding Unit 5.2. Aquaculture, Management and Policy Unit 5.3. International Fisheries Management
Readings	1. Colombo, S. (2014). Fish Nutrition and Current Issues in Aquaculture: The Balance in Providing Safe and Nutritious Seafood, in an Environmentally Sustainable Manner. Journal of Aquaculture Research and Development 03(03) · pp

	https://www.researchgate.net/publication/263807993_Fish_Nutrition_and_Current_Issues_in_Aquaculture_The_Balance_in_Providing_Safe_and_Nutritious_Seafood_in_an_Environmentally_Sustainable_Manner 2. ADCP/REP/80/11 - Fish Feed Technology http://www.fao.org/3/x5738e/x5738e0g.htm
Activity	**CCSAFS Community-Based / Service Learning Activity**: How to conserve fish and public lands in a hands-on way? The activity is designed to share a common desire among students through community to care and conserve fishes and public lands in a regional area. Students will be divided into groups according to their surrounding area. All activities aim at disseminating and raising their awareness of the surrounding community and the target activities goals. Activity (1): groups are asked to interview fishermen about solution of pollution, new methods to increase production and what is the best way to avoid impacts of climate change. Data obtained are collected and qualitatively analyzed and written in a group report to be discussed in the classroom. Activity (2): the groups are asked to conduct plant and animal surveys and remove invasive species in the laboratory under the supervision of the instructor. The results of the experiments are discussed and written in group reports. All reports are analyzed and orally presented to the whole class. Activity (3): group representatives are asked to teach elementary school students about the importance of healthy ecosystems, conserve fishes and how to save public land. Others are asked to observe their teaching practices for feedback and enhancement in the materials, experiments, and teaching methods.

10Cs/6 LEARNINGGOALS	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	√	√											√		√		

SDGs RUBRIC

	SDGs	CLIMATE CHANGE	SUSTAINABLE AGRICULTURE	FOOD SECURITY	COURSE MODULE
1	End poverty in all its forms everywhere		√	√	2, 4, 5

2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		√	√	3, 4, 5
3	Ensure healthy lives and promote well-being for all at all ages				2
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				1
5	Achieve gender equality & empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all		√		4
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				3, 4, 5
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns		√	√	1, 4
13	Take urgent action to combat climate change and its impacts	√		√	2, 4, 5
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				2, 3, 4
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss		√		2, 3, 5
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, & build effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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Sustainability Justice of Food Security and Climate Change

Instructor Information

Instructor
Prof.Dr. Vassilios Makrakis

Office Location:

Telephone:

Office Hours:

E-mail

Website:

Course Identification
Course Number:

Course Name:

Course Location: Suez Canal University

Class Times:

Prerequisites: Sustainability literacy

Faculty Web Page:

Course Description/Overview

This course will focus on teaching students about the complexity of interactions and relationships between the concepts of food security & sustainability justice. Students will learn that sustainability justice is about creating a more equitable world that is conscious and direct addresses all pillars of sustainable development & sustainability justice (i.e., the ecological, cultural, economic, and societal pillars). Special emphasis will be placed on the proper understanding of food security within the context of nutrition security and self-sufficiency as well as how achieving sustainability justice will be the key in achieving these concepts. The course addresses the development of sustainable solutions towards sustainable-just food security, using systems thinking approaches. The course explores the Community food security (CFS) as a relatively new movement that promotes food security strategies within a region or community's food system. Using case studies that examine a number of community-based sustainable farming, the course promotes sustainability justice and greater equality to reduce poverty and hunger, prepare families to assume responsibility for ethical eating and revive the cultural values of solidarity. The course will use case studies to convey ways to strengthen ties to the regional economy, support local businesses, offer new entrepreneurial opportunities, and engage residents as well as local/state governments in seeking solutions to food insecurity and healthy food choices. More emphasis will be given to the Egyptian context in terms of empowering indigenous farmers to achieve food sovereignty based on sustainable agriculture and agro ecology principles.

Course Learning Objectives

1. To provide a concrete understanding of the concept of sustainability justice and its constituencies

2. To engage students to reflect on the ethical and political implications of food and agro ecology practices in relation to sustainability justice, with special attention to climate change

3. To clarify the role the food security plays in achieving sustainability justice.

4. To address the development of sustainable solutions towards sustainable-just food security, using systems thinking approaches within the Egyptian context

5. To apply systems thinking in dealing with sustainable farming, food security and climate change through the lenses of sustainability justice.

6. To understand the complexities that face indigenous communities and countries in terms of highly complex and interrelated systems.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Identify the key concepts of sustainability justice in terms of social, cultural, environmental and economic aspects.

2. Realize the relationship between sustainability justice and food security
3. Analyse the relationship between income inequality & social inequality and how they contribute towards food insecurity
4. Discuss the concepts of climate change and food security through the lenses of sustainability justice.
5. Realize the complex relationships between climate change, food security and sustainability justice.
6. Discuss how food justice and climate justice intersect with sustainability justice, and with inequities involving race, class, gender and governance.
7. Analyze how the food choices we make as individuals collectively influence: 1) political, socio-economic and ecological changes taking place locally, regionally and globally and 2) both climate change and food security.
8. Discuss how disadvantaged social groups are disproportionately affected by climate/food injustice policies and practices.
9. Assess how sustainability justice contributes to transforming climate and food injustices.
10. Discuss the problems & obstacles faced by minority and disadvantaged groups in achieving sustainability justice and food security
11. Synthesize between the role of the farms and society at large in achieving both sustainability justice and food security
12. Analyse the current situation of food security in Egypt in terms of using indigenous resources and global experiences.
13. Develop action plans to raise the awareness of indigenous resources and global experience to assure food security in Egypt.

Course Resources

Required Course Texts and Materials

Gottlieb, R., & Fisher, A. (1996). Community food security and environmental justice: Searching for a common discourse. *Agriculture and Human Values*, *13*(3), 23–32. https://doi.org/10.1007/BF01538224

Power, E. M. (1999). Combining Social Justice and Sustainability for Food Security. *For Hunger Proof Cities: Sustainable Urban Food Systems*, 30–40.

Longo, P. (2016). Food Justice and Sustainability: A New Revolution. *Agriculture and Agricultural Science Procedia*, *8*, 31–36. https://doi.org/10.1016/j.aaspro.2016.02.005

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading Policy

Grades can be based on the following: (Example)

Assignments	30%
Exams	50%
Class attendance/participation	20%
Total Points	**100**

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come to ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assigned material before you come to class. I expect active class participation, which counts for 20% of the grade.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by case basis.

Course Schedule

Week	Date	Topics, Reading, Assignments and Deadlines (Details on assignments and more bibliography are available in the course modules)
1		The Four Pillars of Sustainability Justice: Societal Sustainability Justice
2		The Four Pillars of Sustainability Justice: Economic Sustainability Justice
3		The four pillars of sustainability justice: ecological sustainability justice
4		The four pillars of sustainability justice: cultural sustainability justice
5		Clarifying the Concepts of Climate Justice and Food Justice.

6		Climate/Food Justice Policy Considerations and Actions in the Egyptian context
7		Food security, nutrition, and sustainable agriculture as part of the UN's SDGs
8		Climate Friendly Farming and Food Security
9		Empowering Community Farmers
10		Sustainability justice in rural and informal areas
11		Community-Based Sustainable Food System
12		Indicators of Community-Based Sustainable Food System
13		Community Food Security in Action: Case Studies
14		Revision

Course Modules

	Sustainability Justice of Food Security and Climate Change
Module 1	The Constituencies of Sustainability Justice
Key Concepts	Sustainability justice; environmental sustainability, social sustainability; economic sustainability; cultural sustainability
Overview	While social justice is a frequently employed concept in the deconstruction and reconstruction of the school curriculum and discussion of instructional practice in schools, sustainability-justice that, in addition to social justice, integrates environmental, economic and cultural justice, has not been discussed. Most people usually have only a basic or cursory understanding of Sustainability and Sustainable Development (SD). The concept of Sustainability Justice (SJ) has been recently advanced by Prof. Dr. Makrakis. The concept of "sustainability justice" as it has been conceptualised by Makrakis reflects the four pillars of sustainable development: environment, society, economy and culture. It is thus a concept that when students could be asked about it, they will mostly talk in terms of environmental issues and ignore the other dimensions or constituencies of sustainability justice.
Aim	The overriding aim of this module is for students to be able to understand the need and importance of the concept of sustainability justice and its constituencies
Learning Outcomes	At the end of this module learners will be able to: • Identify the key concepts of sustainability justice in terms of social, cultural, environmental and economic aspects. • Realize the rationale and critical importance of sustainability justice in the context of sustainability crisis. • Recognize the constituencies of sustainability justice and their connection to sustainable development pillars.

Units	Unit 1.1: The environmental dimension of sustainability justice Unit 1.2: The social dimension of sustainability justice Unit 1.3: The economic dimension of sustainability justice Unit 1.4: The culture dimension of sustainability justice
Readings	Makrakis, V. (2017). Unlocking the potentiality and actuality of ICTs in developing sustainable–justice curricula and society. Knowledge Cultures, 5(2), 103-122. doi: 0.22381/KC5220177 http://petarjandric.com/images/pdf/Knowledge-Cultures522017.pdf Makrakis, V. (2017). Developing and validating a sustainability justice instrument to transform curriculum, learning and teaching. 9th International Conference in Open & Distance Learning – November 2017, Athens, Greece–PROCEEDINGS https://eproceedings.epublishing.ekt.gr/index.php/openedu/article/viewFile/1368/1303 Vouzaksakis, G. & Makrakis, V. (2017). Embedding sustainability justice in secondary education economic courses enabled by ICTs (with G.). 9th International Conference in Open & Distance Learning - November 2017, Athens, Greece–PROCEEDINGS file:///D:/Downloads/1371-3200-1-PB%20(1).pdf https://eproceedings.epublishing.ekt.gr/index.php/openedu/article/viewFile/1368/1303
Activity	**Assignment 1a:** The main activity for this module will mainly focus on engaging students on the different dimensions or pillars of sustainability justice. As such, students will be organized in groups of 4. Each student will represent one of the pillars of Sustainability Justice and will be required to prepare one page report which will be discussed during an online session among the group members. **Assignment 1b:** Each group of students will exchange their reports for peer reviewing. After peer reviewing, students will collaboratively develop a Wiki providing a comprehensive overview of the pillars of Sustainability Justice and their connection to corresponding sustainable development pillars. The wikis developed will be presented and discussed in class during the second week. **Assignment 1c (Community-based learning project):**

	In this activity, the students have to disseminate their Wikis through the social media, especially through the development of a Facebook page, aiming to give and share knowledge and information as well as raising awareness on issues of sustainability justice, in relation to climate and food injustices. The deadline for both assignments will be two weeks after the end of the module.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	3h	**2h**		**10h**	**6h**	**4h**			**25**

Module 2	Climate Change, Food Security and Sustainability Justice in Context
Key Concepts	Climate justice, food justice, sustainability justice
Overview	In recent years, due to climate change humanity has witnessed wild weather and unpredictable seasons that have affected what farmers can grow and the prices and quality of the food. Besides that, millions of people, including children face inhumane working conditions to produce the food we all eat, while they do not have enough to eat themselves. Recent evidence (https://www.weadapt.org/knowledge-base/vulnerability/food-in-an-uncertain-future) shows that the MENA region is the only region outside of Sub-Saharan Africa where the number of undernourished people has increased since the early 1990s, Although, climate change and food security are two critical issues threatening humanity, the way these two interact in relation to justice has started to receive attention in recent years. Indeed, there is considerable discussion of climate justice and food justice and their interrelationship with climate change. Both climate justice and food justice are two emerging movements that can be seen in the context of sustainability justice, a concept that bridges together the four pillars of sustainable development. Sustainability justice reveals the critical intersection of climate change and food security issues in relation to the environmental, social, economic and cultural injustices emanating from climate change and food insecurity. In this sense, climate justice is food justice and sustainability justice offers a

	framework for addressing food and nutritional insecurity at levels from local to international in light of climate change. It is particularly effective in highlighting the injustices caused by climate change impacts on food security and the effects they have for the poorest and most vulnerable.
Aim	The overriding aim of this module is to bridge the gap between the academic discourse and the mainstream discourse by engaging students to reflect on the ethical and political implications of food and agricultural practices in relation to sustainability justice, with special attention to climate change.
Learning Outcomes	At the end of this module students will be able to: • Discuss the concepts of climate change and food security through the lenses of sustainability justice. • Realize the complex relationships between climate change, food security and sustainability justice. • Discuss how food justice and climate justice intersect with sustainability justice, and with inequities involving race, class, gender and governance. • Analyze how the food choices we make as individuals collectively influence: 1) political, socio-economic and ecological changes taking place locally, regionally and globally and 2) both climate change and food security. • Discuss how disadvantaged social groups are disproportionately affected by climate/food injustice policies and practices. • Assess how sustainability justice contributes to transforming climate and food injustices. • Identify and analyze the aims and actions of climate justice and food justice organizations and movements, locally, regionally and globally.
Units	Unit 2.1: Clarifying the Concepts of Climate Justice and Food Justice. Unit 2.2: Climate/Food Justice Policy Considerations and Actions in the Egyptian/Jordanian context.
Readings	Human rights: their role in achieving climate justice and food and nutrition security: A New Dialogue : Putting People at the Heart of Global Development https://www.mrfcj.org/media/pdf/Human-Rights-FNS-Climate-Justice.pdf Mares, T. M., & Peña, D. G. (2011). Environmental and food justice. Cultivating food justice: Race, class, and sustainability, 197-220. https://www.foodethicscouncil.org/uploads/publications/2010%20FoodJustice.pdf Schmidhuber, J., &Tubiello, F. N. (2007). Global food security under climate change. Proceedings of the National Academy of Sciences, 104(50), 19703-19708. file:///D:/Downloads/Global_Food_Security_under_Climate_Change.pdf

	Agriculture, Food Security and Climate change: Outlook for knowledge, tools and action. CCAFS Report No. 3 file:///D:/Downloads/ccafs_report_3-low-res_final.pdf Purifou, D. Food policy councils: Integrating food justice and environmental justice. https://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=1302&context=delpf Jobbins, G. & Henley, G. (2015). Food in an uncertain future: the impacts of climate change on food security and nutrition in the Middle East and North Africa. Overseas Development Institute, London / World Food Programme, Rome. Available at file:///D:/Downloads/wfp283866.pdf
Activity	
	Assignment 2 Visit the site http://www.icarda.cgiar.org/arab-food-security entitled "Enhancing Food Security in Arab Countries", led by ICARDA. Read carefully the cases of Egypt or Jordan and based on the list of readings, write a 4 pages (1.5 Times New Roman) essay, identifying critical aspects of food insecurity facing the country of choice in light of potential climate change effects. Each student will post his/her essay. Then, students will be required to engage in an online forum to identify and discuss the root causes of food insecurity in these specific circumstances. Students will be required to write a 3 page summary reflective report, including in an annex the forum post and replies. The **deadline** for this assignment is two weeks after the end of the module

10Cs/6 LEARNINGG OALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√			√		√		
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√											√				

ECTS WORK	**Lecture**	**Online**	**Lab**	**Reading**	**Course**	**Project**	**Prepare exam**	**Writing exam**	**Total**

LOAD					**activity**				
	6h	**2h**		**8**	**8**				**24**
Module 3	**Sustainable Farming and Food Justice/Security under Climate Change**								
Key Concepts	Sustainable agriculture, food security, climate change, food system								
Overview	The current agriculture and food system practices and climate threatening seem to damage sustainable farming and food security. Increasing agricultural and food production through intensive and pesticide means, and over-grazed lands, heavily pollutes air, water, and farmworkers health. As a whole, the food system, especially meat production is responsible for a significant portion of greenhouse gas emissions. In this module, particular attention will be given to the assumption that if our food and farming methods are to be sustainable over time, we must shift from unsustainable to sustainable farming. In doing so, maintain the health and productivity of land and must conserve water, energy, and the other natural resources upon which agricultural productivity ultimately depends. Any system of food and farming that fails to meet the needs of a sustainable society will fail in the long term. Climate change raises complex issues of science, economics, and politics; it also raises difficult issues of sustainable farming and food justice.								
Aim	The aim of this module is to allow students to begin to visualize the complex nature and interrelations of Food Security & Sustainability Justice.								
Learning Outcomes	At the end of this module students will be able to: • Discuss food and agriculture systems and how these are changing to impact on sustainable farming • Identify and understand the connection of sustainable farming with food justice • Get information about sustainable farming, food security and justice under climate change effects using online searching machines • Work with other students to define sustainable farming practices under climate change conditions through the lenses of sustainability justice • Analyse the current situation of food security/justice and think over what can be done • Develop action plans to raise the awareness of farmers and other stakeholders to assure sustainable farming and food security locally.								
Units	Unit 3.1: Climate Friendly Farming Unit 3.2: Sustainable Farming and Food Security Unit 3.3: Empowering Community Farmers Unit 3.4: Sustainability Justice and Sustainable Climate/Food Justice								

<table>
<tr><td>Readings</td><td>Wreford, A.A., Ignaciuk, A. & Guere, G. (2017). Overcoming barriers to the adoption of climate-friendly practices in agriculture. Papers 101. Paris: OECD

DOI:http://dx.doi.org/10.1787/97767de8-en

https://read.oecd-ilibrary.org/agriculture-and-food/overcoming-barriers-to-the-adoption-of-climate-friendly-practices-in-agriculture_97767de8-en#page1

European Commission (2012). Sustainable agriculture for the future we want. https://ec.europa.eu/agriculture/sites/agriculture/files/events/2012/rio-side-event/brochure_en.pdf</td></tr>
<tr><td>Activity</td><td></td></tr>
<tr><td></td><td>Assignment 3a

Each student should construct three digital concept maps, using any type of software (e.g. Cmap, Inspiration): one for sustainable farming, the other for climate justice and the last for food justice. Then, they will critically reflect on the association and links of the three concept maps to produce a new one that merges the three.

Each student should post his/her merged concept map in the blended learning environment and invite another student to comment on the concept map, highlighting similarities and differences using the discussion forum. The idea of this reflective assignment is to examine the need of revising the concept maps. Write down a comprehensive 1 page report on the conceptual changes in students' thinking for revising the initial concepts maps.

The deadline for this assignment is within the period of the module that lasts for two weeks.</td></tr>
</table>

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√	√										√			√	

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**

	6 h	**2h**		**8h**	**7h**				**23**
Module 4	**Sustainable Just Climate & Food Security: The Value of Systems Thinking**								
Key Concepts	Systems thinking, climate change, food security, values								
Overview	Systems thinking, in general, is the ability to think about a system as a whole, rather than in its parts. It also helps to see the world as a complex system and better understand its interconnectedness and interrelationships. In other words, systems thinking is a way of approaching complicated issues through connecting the dots and understanding them as inter-related parts of a greater whole that constitutes the system. Understanding and working with the complexity of sustainable food production systems requires the values of systems thinking. In this module, students will apply systems thinking in line with sustainability justice to tackle the sustainability of food production systems. In a way, this module synthesizes knowledge and skills from the previous modules, addressing the development of sustainable solutions towards sustainable-just food security, using systems thinking approaches. Thus, students will begin to understand how to apply systems thinking in dealing with sustainable farming, food security and climate change through the lenses of sustainability justice. Moreover, they will also begin to understand the complexities that face their local communities and countries in terms of highly complex and interrelated systems that this module deals with.								
Aim	The overriding aim of this module is: 1) to provide students with an understanding of the "big ideas" regarding systems thinking, complexity, and resilience as well as with an understanding of some of the methods and tools of analysis in the context of sustainable farming, food security and climate change. 2) To allow students to apply the principles of a systems thinking approach for a sustainable-just climate and food security.								
Learning Outcomes	At the end of this module students will be able to: • Understand the complexity and diversity of food production systems under climate change through the lenses of sustainability justice. • Understand the principles of system analysis and how it can be applied in sustainable farming and food production systems. • Evaluate strong and weak points of different food production in terms of sustainability justice. • Gain comparative and holistic knowledge of today's food systems (production, distribution, consumption, and waste). • Explore the idea of food justice and alternative food systems in the local context.								
Units	Unit 4.1: Systems Thinking: What, Why, When, Where and How? Unit 4.2: The Climate and Food System Concept Unit 4.3: The Values of Systems Thinking Unit 4.4: Climate Change and Food Security Systems in Action								

<table>
<tr><td>Readings</td><td>Arnold, R.D. & Wade, J.P. (2015). A Definition of Systems Thinking: A Systems Approach Procedia Computer Science 44 (2015) 669 – 678

Behla, D. & Ferreiraa, S. (2014). Systems Thinking: An Analysis of Key Factors and Relationships Procedia Computer Science 36 (2014) 104 – 109

Keegan, M. (n.d.).Systems thinking, rural Development and food security. Migration Institute of Australia. https://core.ac.uk/download/pdf/15125474.pdf

Kwamina E. Banson, K. et. al. A systems thinking approach to address the complexity of agribusiness for sustainable development in Africa.
http://journals.isss.org/index.php/proceedings57th/article/viewFile/2119/697

Mares, T. M., & Peña, D. G. (2011). Environmental and food justice. Cultivating food justice: Race, class, and sustainability, 197-220.
https://www.foodethicscouncil.org/uploads/publications/2010%20FoodJustice.pdf</td></tr>
<tr><td>Activity</td><td>Overview</td></tr>
<tr><td></td><td>Assignment 3

Students will write a 3 pages paper that analyses a given aspect of food security in light of climate change and its impacts and effects on environment, society, economy and culture. It will examine this as a social-ecological system and incorporate the knowledge acquired so far from previous readings and assignments. The report may cover the perspective of specific groups of people, at the local, national or regional level.

An online discussion forum will be arranged to discuss the key points of the papers written. A power point presentation will be prepared by each student for class presentation and discussion during the third week of the module.

This deadline of this assignment will be carried out during the three weeks of the module.</td></tr>
</table>

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	5	16	17
	√	√											√				

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	9h	2h		10	8		6		35

Module 5	Community Food Security and Sustainability Justice
Key Concepts	Community food security (CFS), hunger, sustainability justice, democratic decision-making
Overview	Community food security (CFS) is a relatively a new movement that promotes food security strategies within a region or community's food system. In this sense, CFS is concerned with the full range of food chain events including agriculture, the availability of supermarkets and other affordable outlets for quality and accessible food. It is also concerned with the involvement of the wider citizenry and local/state governments in seeking solutions to food insecurity and healthy food choices. While officially a movement since only 1994, CFS is now practiced by hundreds of organizations and communities worldwide, engaging thousands of groups, volunteers, government and non-government representatives in projects and activities that have improved their communities' capacity to meet their own food needs. Looking into past experiences, one can see projects and activities that include farmers' markets, food assistance program outreach, community gardens, youth food and agriculture programs, farmland preservation and farm viability projects, food system planning and food policy councils, nutrition education and health promotion strategies, farm-to-school projects and a range of public education and awareness campaigns. In general, CFS encourages progressive planning that addresses the underlying causes of hunger and food insecurity facing the current global food system. Although such a system has witnessed highly efficient food production, it has created many undesirable environmental, social, economic and cultural impacts. Small farmers' mostly profit margins that have significantly led to the abandonment of their agricultural activities. In general, the economic viability of small and medium-sized farms has reduced the number of farm-related local business and made farming less attractive to younger generations. Many studies show that food production has been less community-based, diminishing farmers' collective knowledge and sustainable agrarian practices. At the same time, the unprecedented demand for local and regionally identified foods has created many opportunities for agricultural producers and communities. In this module, we will bring a number of community-based sustainable farming and food case studies aiming to the promotion of sustainability justice and greater equality. Such case studies show how to reduce poverty and hunger, prepare families to assume responsibility

	for ethical eating and revive the cultural values of solidarity among families and social responsibility. Some case studies illustrate innovative methods of production, others demonstrate more efficient ways to distribute food, and some are exemplary methods of processing or waste recycling. The majority of case studies convey ways to strengthen ties to the regional economy, support local businesses, offer new entrepreneurial opportunities, and engage residents.
Aim	It is promoting greater compassion for the food insecure, expanding awareness of local food systems and the range of options available to build local food security, and engaging the talents, resources, and wisdom of more participants than ever before to end food insecurity and hunger .
Learning Outcomes	At the end of this module students will be able to: • Identify critical issues and problems related to SJ and FS • Understand the problems & obstacles faced by minority and disadvantaged groups in achieving food justice • Discuss how low-income communities are disproportionately impacted by food injustice • Explore the idea of food justice and alternative food systems in the local context • Describe key challenges for food justice from local and national governance perspectives
Units	Unit 5.1: What is a Community-Based Sustainable Food System? Unit 5.2: Indicators of Community-Based Sustainable Food System Unit 5.3: Community Food Security in Action: Case Studies
Readings	Building a Community-Based Sustainable Food System. University of Michigan Urban & Regional Planning Capstone Project April 2009. http://closup.umich.edu/publications/misc/Community-Based-Sustainable-Food-Systems.pdf Bendfeldt, E. et.al. (2011), A Community-based food system: Building health, wealth, connection, and capacity. Virginia Tech. https://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/3306/3306-9029/3306-9029-PDF.pdf Mares, T. M., & Peña, D. G. (2011). Environmental and food justice. Cultivating food justice: Race, class, and sustainability, 197-220. https://www.foodethicscouncil.org/uploads/publications/2010%20FoodJustice.pdf

	Ismail, S. et.al. (2003). Community-based food and nutrition programmes: What makes them successful -A review and analysis of experience. FAO Food and Nutrition Division 1. **BRAZIL CASE STUDY** 2. **KENYA CASE STUDY** 3. **BANGLADESH CASE STUDY** http://www.fao.org/docrep/006/y5030e/y5030e00.htm
Activity: **Community-based learning**	**Assignment 4a** Choose one out of the three case studies and 1) discover the strengths and weaknesses; 2) discuss how such a case study can be contextualized in your own community. Based on it, organise an online discussion forum to share best practices in community-based, sustainable food systems for application in your own local communities. Write-up an action plan to show how changes to the current local food system could enhance the presence of healthy, affordable food and serve as an economic development tool in your local community. **Assignment 4b**: **Community-based learning project "Sustainable-Just Dining"** Create a number of Sustainable-Just Food Working Groups, preferably 2-3 students in each group. Each group will focus on a community sector that has services for dining and/or selling food, such as university, supermarkets, hotels, etc. Each group will have to examine ways to increase sustainable food policies that can be turned into concrete actions. The aim will be to reduce landfill food waste and promote the idea of ethical eating and to ensure that unsold leftovers are suitable for donating to vulnerable groups in the community. Each group should write a reflective essay about their experience and develop a .ppt presentation to share them. For "Writing a Good Reflective Essay: from Introduction to Conclusion" visit the https://writemyessay4me.org/blog/reflective-essay Organise an off-line (in class) and an online conference session to present and discuss your results. The **deadline** of the last assignment will be at the end of the examination period.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√											√				

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	9h	**2h**		**8**	**8**	**8**	**6**	**3**	**44**

SUMMRY OF ECTS WORKLOAD

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**					**Workload**
				1	**2**	**3**	**4**	**5**	
Lectures (face-to-face)	11	3	33	3	6	6	9	9	33
Online	5	2	10	2	2	2	2	2	10
Lab work									
Reading articles (3 pages per hour)	100	0.3	22	5	4	4	5	4	22
Reading book chapters (5 per/h)	120	0.2	22	5	4	4	5	4	22
Preparing course activities	4	9	37	6	8	7	8	8	37
Project work	2	6	12	4				8	12
Preparation for exam	1	12					6	6	12

Writing the exam	1	3	3					3	3
Total			**151**	25	24	23	35	44	**151**

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CCSAFS COURSE SYLLABUS

Course Number:

Small Scale Farming, Indigenous Knowledge and Local Food Supply

Aswan University, Faculty of Agriculture and natural Resources

Semester,

Instructor Information

Instructor:	Dr. Wagdi Saber Soliman
Office Location:	Aswan University, Sahari Campus
Telephone:	office - +20 973 480 245
Office hours:	Sunday-Wednesday 09.00 – 14.00
E-mail:	wagdi79@agr.aswu.edu.eg
Website:	

Course Identification

Course Number:	
Course Name:	Small Scale Farming, Indigenous Knowledge and Local Food Supply
Course Location:	Aswan University
Class Times:	
Prerequisites:	
Faculty Web Page:	http://agr.aswu.edu.eg

Course Description/Overview

This course provides an adequate understanding of the fundamentals that apply to starting and managing a small farm business. Students will examine the basics of traditional and organic farming systems and learn about resources and strategies to get started running their own farm business. The

information and understanding gained from this course will prepare students to look at indigenous knowledge and local food supply chains from a holistic and realistic perspective.

Course Learning Objectives

- Students will gain a valuable understanding of the myriad of economic and regulatory issues involved in starting and managing a small farm.

- achieve in-depth local indigenous knowledge to solve the problems and face the challenges that reflect on sustainable development of the community

- Engage and collaborate with local, small farms and their entire ecosystem (e.g. local supply chains, farmers' markets, farming communities, etc.)

- Develop appropriate skills in scientific and community communication

- Develop cognitive, psychological, and social skills among students such as life-learning and transferable skills, promotion of students' active participation in the community, competence as responsible citizens, etc.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

- Identify the principles and practices of small-scale organic farming

- Analyze contemporary food and agricultural issues, opportunities, threats, and trends

- Demonstrate effective oral and written communication skills as well as the ability to work in teams.

- Manage resources available to help establish a small farm business

- Describe the primary agricultural production systems for small farms

- Map the entire local, agricultural supply chain from production to retail

- Develop strategies for overcoming basic challenges in new farm business start-ups.

- Investigate local, indigenous knowledge on agricultural practices and local supply chains

- Synthesize between qualitative research methods for identifying indigenous knowledge

Course Resources

Course Website(s)

Required Course Texts and Materials

Hand-out prepared by the instructor for the class

Optional course Texts and Materials

Wolfenson, K. D. M. (2013). Coping with the food and agriculture challenge: smallholders' agenda Preparations and outcomes of the 2012 United Nations Conference on Sustainable Development (Rio+20). http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Coping_with_food_and_agriculture_challenge__Smallholder_s_agenda_Final.pdf

Quan, J. (2011). Science review: SR25. A future for small-scale farming. part of the UK Government's Foresight Project on Global Food and Farming Futures. https://www.nri.org/images/documents/news2011/11-570-sr25-future-for-small-scale-farming.pdf

Irshad, H. (2010). Local Food - A rural opportunity. http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/ba3468a2a8681f69872569d60073fde1/593337cbd907813a8725782c0058ae97/$FILE/Local-Food-A-Rural-Opp.pdf

Murphy, S. (2012). Changing Perspectives: Small-scale farmers, markets and globalisation (revised edition), IIED/Hivos, London/The Hague

Ruben, R., Slingerland, M. & Nijhoff, H. (2006). Agro-food chains and networks for development. Exclusion of small-scale farmers from coordinated supply chains. pp. 209-217. Springer. Netherlands.

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading policy

Grades can be based on the following:

Assignments	**20**
Class attendance/participation	**20**
Final Exams	**60**
Total Points	**100**

Course policies

Late Assignment

It is important that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive at on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and though about the assigned material before you come to class. I expect active class participation.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by-case basis.

Important Dates to Remember

Course schedule

Week	Date	Topics, Reading, Assignments and Deadline (details on assignments and more bibliography are available in the course modules)
1		**Course overview:** Discussion of syllabus and assignments, course requirements and prerequisites, criteria for student selection
2		Introduction and Concepts of Small-Scale Farming
3		Challenges to small-scale agricultural production
4		Basics of Farm Business Management
5		Farm Management Tools for Success
6		Farm Management regulations and challenges
7		Production systems overview
8-9		Action Research & Participatory Action Research in the context of local farms
10-11		Design and structure of local food supply chains
12-14		Basics of rural sociology and indigenous knowledge

The CCSAFS Course Modules Template

Course	**Small Scale Farming, Indigenous Knowledge and Local Food Supply**
Module 1	**Agriculture Production and Small Farming**
Key Concepts	Concepts of small farming, indigenous knowledge, and local food supply
Overview	It is essential for students to develop a fundamental understanding of small-scale farming, indigenous knowledge, and local food supply concepts. Questions to be addressed in this module include the following: What is the nature of small-scale

<table>
<tr><td></td><td>farming? Why is small-scale farming important to food supply? What are the current applications of small-scale farming?</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is increase student's agricultural literacy with particular attention to sustainability and local food systems</td></tr>
<tr><td>Learning Outcomes</td><td>- Demonstrate an ability discuss the principles and practices of small-scale organic farming
- Describe the primary agricultural production systems for small farms</td></tr>
<tr><td>Units</td><td>- Introduction and Concepts of Small-Scale Farming, indigenous knowledge, and local food supply
- Challenges to Agricultural Production</td></tr>
<tr><td>Readings</td><td>Quan, J. (2011). Science review: SR25. A future for small-scale farming. part of the UK Government's Foresight Project on Global Food and Farming Futures. https://www.nri.org/images/documents/news2011/11-570-sr25-future-for-small-scale-farming.pdf

Irshad, H. (2010). Local Food - A rural opportunity. http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/ba3468a2a8681f69872569d60073fde1/593337cbd907813a8725782c0058ae97/$FILE/Local-Food-A-Rural-Opp.pdf

Ruben, R., Slingerland, M. & Nijhoff, H. (2006). Agro-food chains and networks for development. Exclusion of small-scale farmers from coordinated supply chains. pp. 209-217. Springer. Netherlands.</td></tr>
<tr><td>Activity</td><td>- Seminars/ Lectures; a series of lectures and seminars.
- Group exam task with presentation; with the acquired understanding achieved through the course.
- For each unit the students will submit an individual reflection paper of approximately 1000 words. This paper will express students reaction towards the subjects needed for this course</td></tr>
<tr><td>ECTS workload</td><td>
<table>
<tr><td>Lectures (face-to-face)</td><td>9</td></tr>
<tr><td>Online</td><td>3</td></tr>
<tr><td>Reading articles (3 pages/hr)</td><td>1</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>5</td></tr>
<tr><td>Preparing course activities</td><td>5</td></tr>
<tr><td>Project work</td><td>5</td></tr>
<tr><td>Total</td><td>28 hrs</td></tr>
</table>
</td></tr>
<tr><td>SDGs</td><td>1- End poverty in all its forms everywhere
2- End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
8- Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all</td></tr>
<tr><td>Module 2</td><td>Farm Management</td></tr>
<tr><td>Key Concepts</td><td>Farm management and its regulations and challenges</td></tr>
<tr><td>Overview</td><td>In this module, students will have sufficient knowledge about establishing small farm, managing the tools and resources, awareness with regulations and challenges as well as marketing techniques</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is turn student's able to manage their own small farms</td></tr>
<tr><td>Learning Outcomes</td><td>- Identify resources available to help establish a small farm business and resource management
- Describe the primary agricultural production systems for small farms with economic issues
- Describe basic retail and wholesale marketing techniques</td></tr>
<tr><td>Units</td><td>- Basics of Farm Business Management
- Farm Management Tools for Success
- Farm Management Regulations and Challenges
- Production systems overview</td></tr>
<tr><td>Readings</td><td>Wolfenson, K. D. M. (2013). Coping with the food and agriculture challenge: smallholders' agenda Preparations and outcomes of the 2012 United Nations Conference on</td></tr>
</table>

<table>
<tr><td></td><td>Sustainable Development (Rio+20). http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Coping_with_food_and_agriculture_challenge_Smallholder_s_agenda_Final.pdf
Murphy, S. (2012). Changing Perspectives: Small-scale farmers, markets and globalisation (revised edition), IIED/Hivos, London/The Hague
Ruben, R., Slingerland, M. & Nijhoff, H. (2006). Agro-food chains and networks for development. Exclusion of small-scale farmers from coordinated supply chains. pp. 209-217. Springer. Netherlands.</td></tr>
<tr><td>Activity</td><td>Students will be asked to prepare the following:
• Farm plan .
• A feasibility study of a small farm .
• Compare the feasibility and sustainability measures.</td></tr>
<tr><td>ECTS workload</td><td><table>
<tr><td>Lectures (face-to-face)</td><td>12</td></tr>
<tr><td>Online</td><td>3</td></tr>
<tr><td>Lab work</td><td>5</td></tr>
<tr><td>Reading articles (3 pages/hr)</td><td>2</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>10</td></tr>
<tr><td>Project work</td><td>5</td></tr>
<tr><td>Total</td><td>37 hrs</td></tr>
</table></td></tr>
<tr><td>SDGs</td><td>1- End poverty in all its forms everywhere
2- End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
8- Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all
9- Ensure sustainable consumption and production pattern</td></tr>
<tr><td>Module 3</td><td>The context of local food supply</td></tr>
<tr><td>Key Concepts</td><td>Local food supply, action research, local farms</td></tr>
<tr><td>Overview</td><td>In this module, students will have sufficient knowledge and understanding about local food supply chains. They will be able to analysis and apply action research and particularly action research in local farms, they be able to design and structure local food supply chains.</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is turn student’s able to analysis, design and structure local food supply chains</td></tr>
<tr><td>Learning Outcomes</td><td>- Apply a systems approach to analyzing the context of local farms
- Describe strategies for designing and structuring local food supply chains</td></tr>
<tr><td>Units</td><td>- Action Research & Participatory Action Research in the context of local farms
- Design and structure of local food supply chains</td></tr>
<tr><td>Readings</td><td>- I. P. C. C. (2017). Fourth Assessment Report: Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability: Indigenous knowledge systems. https://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch9s9-6-2.html
Velandia, T. M., Holcomb, R., Dunning, R. & Bendfeldt, E. (2013). "Local Food Systems Markets and Supply Chains". Choices. Quarter 4. Available online: http://choicesmagazine.org/choices-magazine/theme-articles/developing-local-food-systems-in-the-south/local-food-systems-markets-and-supply-chains
Holcomb, R.B., Palma, M.A. & Velandia, M.M.. (2013). "Food Safety Policies and Implications for Local Food Systems". Choices. Quarter 4. Available online: http://choicesmagazine.org/choices-magazine/theme-articles/developing-local-food-systems-in-the-south/food-safety-policies-and-implications-for-local-food-systems</td></tr>
<tr><td>Activity</td><td>- Seminars/ Lectures; a series of lectures and seminars.</td></tr>
</table>

<table>
<tr><td></td><td>- Group exam task with presentation; with the acquired understanding achieved through the course.
- Students will visit small farms. They will be asked for collecting and analyzing data as well as designing and structuring local food supply.</td></tr>
<tr><td>ECTS workload</td><td><table>
<tr><td>Lectures (face-to-face)</td><td>12</td></tr>
<tr><td>Lab work</td><td>5</td></tr>
<tr><td>Reading articles (3 pages/hr)</td><td>1</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>10</td></tr>
<tr><td>Preparing course activities</td><td>5</td></tr>
<tr><td>Project work</td><td>5</td></tr>
<tr><td>Preparation for exam</td><td>8</td></tr>
<tr><td>Total</td><td>46 hrs</td></tr>
</table></td></tr>
<tr><td>SDGs</td><td>1- End poverty in all its forms everywhere
2- End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
9- Ensure sustainable consumption and production pattern</td></tr>
<tr><td>Module 4</td><td>Rural Sociology and indigenous knowledge</td></tr>
<tr><td>Key Concepts</td><td>Rural sociology, indigenous knowledge</td></tr>
<tr><td>Overview</td><td>In this module, students will have sufficient knowledge and understanding about rural sociology and indigenous knowledge</td></tr>
<tr><td>Aim</td><td>Demonstrate an ability discuss the principles and practices of rural sociology and indigenous knowledge</td></tr>
<tr><td>Learning Outcomes</td><td>- Identify basic elements for small farmers associations
- Gain an understanding of indigenous knowledge</td></tr>
<tr><td>Units</td><td>- Basics of rural sociology</td></tr>
<tr><td>Readings</td><td>-Rural Sociology: Meaning, Scope, Importance and Origin. http://www.sociologydiscussion.com/rural-sociology/rural-sociology-meaning-scope-importance-and-origin/2599
-The Rural Sociological Society (RSS). http://www.ruralsociology.org/
Marsden, T. (1999). Research in Rural Sociology and Development. Available online at: http://www.emeraldinsight.com/series/rrsd</td></tr>
<tr><td>Activity</td><td>CCSAFS COMMUNITY-BASED/SERVICE LEARNING ACTIVITY
During the course from the 1st module ending to the 5th module, the student will be engaged together in a community-based learning activity to stimulate and evaluate Small Scale Farming, Indigenous Knowledge and Local Food Supply, through field visits. The objective of the communication based learning activity is to engage students with the farmers to define their problems, recommend the suitable application of precision agriculture to solve these problems, and evaluate its negative and positive impacts.
The recommended number of students in the course is 25 students. The students will be divided into groups (each group consists of 5 students). The groups will be distributed in 5 different agricultural areas near to Aswan city, Egypt.
- All students (25 students) under supervisor of the course Staff will be engaged into group discussion in the first week of the semester to define the work plan, select each group members and the tutor for each group, and select the target areas.
- Each group will develop a questionnaire and survey small community farmers. The questionnaire can target economic, managerial and marketing issues- in terms of production (local food supply), yield, marketing agricultural products, as well as indigenous knowledge
- Each group responsible to collect data about the real agricultural problems facing the farmers.
- Students will analyze the data to find out the real problems- addressing the main themes: climate change (water shortage, drought, high temperatures, etc.), sustainable agriculture, and food security) that the farmers face in their small farms.</td></tr>
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All students will be engaged again to discuss the problems and determine ONE PROBLEM to solve by all groups.
After defining the problem, each group will collect the related data to the problem such as distance from river Nile, distance from main road, injured areas, damaged, plant growth characterizations, ….etc.
Then, each group members together will do data analysis, group discussion to report the reasons of problem and how to solve it, …etc.
The students will engaged in practical field activities in the target area carrying out with traditional and organic farming system and small farm management.
Evaluate and stimulate the organic farming system and farm management.
The staff member with assistant of student will prepare and achieve training and workshops for the target farmers to transfer knowledge and technology of organic farming and farm management
Finally, each group will do final report. One of each group will join to present the final report and activities of the communication based learning activity in final conference inviting the staff members, tutors, farmers and all students.

For student assessment, each group will submit the collected data, data analysis repot, and field visits reports. Also, the tutor of each group will submit report about each group member about his efficiency and cooperation with team to the Staff member for final assessment.
</td></tr>
<tr><td>ECTS workload</td><td>
<table>
<tr><td>Lectures (face-to-face)</td><td>9</td></tr>
<tr><td>Online</td><td>3</td></tr>
<tr><td>Reading articles (3 pages/hr)</td><td>2</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>5</td></tr>
<tr><td>Preparing course activities</td><td>10</td></tr>
<tr><td>Project work</td><td>5</td></tr>
<tr><td>Preparation for exam</td><td>12</td></tr>
<tr><td>Writing the exam</td><td>3</td></tr>
<tr><td>Total</td><td>49 hrs</td></tr>
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<tr><td>SDGs</td><td>8- Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all
9- Ensure sustainable consumption and production pattern</td></tr>
</table>

5 ECTS Workload allocations

Learning components	No	Time Factor	Workload	Course modules				Workload
				1	2	3	4	
Lectures (face-to-face)	14	3	42	9	12	12	9	42
Online	4	3	12	3	3	--	3	9
Lab work	2	5	10	--	5	5	--	10
Reading articles (3 pages/hr)	18	0.3	6	1	2	1	2	6
Reading book chapters (5 pages/hr)	150	0.2	30	5	10	10	5	30
Preparing course activities	4	5	20	5	--	5	10	20
Project work	1	20	20	5	5	5	5	20
Preparation for exam	1	20	20	--	--	8	12	20
Writing the exam	1	3	3	--	--	--	3	3
Total			160	28	37	46	49	160

SDGs		CC	SA	FS	COURSE MODULE
1	End poverty in all its forms everywhere	✓		✓	1, 2, 3
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		✓	✓	1, 2, 3
3	Ensure healthy lives and promote well-being for all at all ages				
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				
5	Achieve gender equality and empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all				
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all		✓	✓	1, 2, 4
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation		✓	✓	2, 3, 4
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns				
13	Take urgent action to combat climate change and its impacts				
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss				
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions on all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS

Risk Analysis in the Food Chain

Developed by Prof. Dr. Khaled El-Khawas, Al-Azhar University, Faculty of Agriculture

Instructor Information:

Instructor 1	Prof. Dr. Khaled El-Khawass
Office Location	Al-Azhar University, Faculty of Agriculture, Plant Protection Department
Telephone	+201067704781
Office Hours	Monday – Tuesday 10.00 – 15.00
E-mail	khaledk5912@yahoo.com
Website	http://scib.alazhar.edu.eg/

Course Identification

Course Number:	CSAF 840
Course Name:	Risk Analysis in the Food Chain
Course Location:	Al-Azhar University
Class Times:	
Prerequisites:	
Faculty Web Page:	http://scib.alazhar.edu.eg/

Course Description/Overview

Ensuring food safety to protect public health and promote economic development remains a significant challenge in both developing and developed countries. Considerable progress to strengthen food safety systems has been achieved in many countries, highlighting the opportunities to reduce and prevent food-borne disease. During the last few decades, risk assessment, risk management and risk communication have been formalized and incorporated into a process known as risk analysis. This new approach enables students to be familiar with information on hazards in food and food chain to be linked directly to data on risks to human health. By providing a science-based approach to improve food safety decision-making processes, risk analysis contributes to a reduction in the incidence of food-borne

disease and consequently food security. This course has been developed to improve food safety regulators' understanding and use of risk analysis as the basic framework for a modern food safety and security system. It will provide students with essential background information and practical guidance on the application of food safety risk analysis for regulators and other officials responsible for managing and/or supervising food control activities. It presents a framework, internationally agreed principles and examples to structure and guide the application of risk analysis, rather than a prescriptive formula to implement risk analysis. It will also contribute in the 21st century sustainable development goals (SDGs).

Course Learning Objectives

1. Develop a basic understanding of risk assessment and its role within the risk management process in food safety and food chain.
2. Differente between risk assessment, risk management and risk communication.
3. Develop a basic understanding of how to conduct and evaluate an uncertainty analysis for a risk assessment.
4. Know the leveland distribution of hunger and malnutrition locally, nationally and globally, currently as well as historically.
5. Collaborate with others to encourage and empower them to combat hunger and promote sustainable agriculture and improved nutrition.
6. Work as a team in problem-based activities, workshops, research-based tasks, case studies, reflection papers and essays.

Course Content Learning Outcomes

Students will be able to:

1. Describe the key elements of risk analysis.
2. Explain how risk analysis is applied in different parts of the food chain.
3. Undertake risk assessment activities, identify appropriate risk management options and develop suitable risk communication strategies.
4. Monitor the efficacy of measures and reviews of new information.
5. Carry out case study analyses to combat hunger, reduce food waste and promote sustainable agriculture.
6. Develop an enquiry-based project: "How risk communication of food security influence people's healthcare?"

Course Resources:

1. Course Website(s)
2. Required Course Texts and Materials
3. Hands-out prepared by the instructor for the class

Course Website(s)

Required Course Texts and Materials

1. Risk Analysis at FDA: Food Safetyhttps://www.fda.gov/Food/FoodScienceResearch/RiskSafetyAssessment/ucm243439.htm
2. *Specializing in FDA Regulatory Matters*https://easconsultinggroup.com/services/foods/?gclid=EAIaIQobChMI6qPIwP3R4QIVAQvTCh3hegPrEAAYAiAAEgKna_D_BwE

Optional Course Texts and Materials

1. Food Industry: PolySto Hygienic Wall Protection https://www.polysto.com/en/food-industry?gclid=EAIaIQobChMI6qPIwP3R4QIVAQvTCh3hegPrEAAYAyAAEgIpVfD_BwE
2. A metadatabase of tools and models for food safety professionals in industry, academia, and government
   http://foodrisk.org/

Activitys and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading Policy

Grades can be based on the following:

Activities	30
Exams	50
Class attendance/participation	10
Practical exam	10
Total Points	100%

Course Policies

Late Activities

It is essential that papers and other Activities be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come to all classes. Student cannot pass the class under any circumstances if he/she misses more than three classes. Students are expected to arrive on time and stay until the class period ends. If a student knows that he has to leave early, he should notify the instructor before class starts. All are expected to treat faculty and other students with respect. During class, students are asked not to disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and will be counted as absent. The student is expected to have read and thought about the assigned material before he comes to class. The instructor expects active class participation, which counts for 10% of the grade.

Disability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodation. Establishing reasonable accommodation should be considered on a case-by-case basis.

Important Dates to Remember (Course Schedule)

Week	Teaching/class hours	Date	Topics, Reading, Activities and Deadline (details on Activities and more bibliography are available in the course modules)
1+2	2+2		Principles of risk analysis and its structure
3	2		Risk analysis process and necessaryconditions
4+5	2+2		Risk assessment of the following steps: 1. Hazard identification. 2. Hazard characterization. 3. Exposure assessment. 4. Risk characterization.
6	2		Risk management; selecting appropriate prevention and control options.
7	2		Risk management;the process, distinct from risk assessment, of weighing policy alternatives.
8	2		Risk communication.
9	2		Principles of risk communication.
10	2		Strategies for risk communication.
11	2		Risk management; selecting appropriate prevention and control options.
12	2		National Food Safety Control - Risk Analysis by Governments.
13	2		The Role of Risk Analysis in the Food Industry.
14	2		Chemical vs. Microbial Risk Analysis Methodology.

SUMMRY OF THE 5 ECTS STUDENTS WORKLOAD

Learning Components	No	Time Factor	Work load	Course Modules					Workload
				1	2	3	4	5	

Lectures (face-to-face)	10	2	20	4	4	4	4	4	20
Online	3	2	6	2	1	1	1	1	6
Lab work	8	2	16	3	4	3	3	3	16
Reading articles (3 pages per hour)	50	0,3	15	3	3	3	3	3	15
Reading book chapters (5 per/h)	50	0.2	10	2	2	2	2	2	10
Preparing course activities	2	10 (M)	20	4	4	4	4	4	20
Project work	1	10	10	-	2	-	2	6	10
Preparation for exam	1	50	50	-	10	-	20	20	50
Writing the exam	1	3	3	-	-	-	-	3	3
Total			**150**	**18**	**30**	**17**	**39**	**46**	**150**

Module (1)

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	4	**2**	**3**	**5**	**4**	**-**	**-**	**-**	**18**

Module (2)

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	4	**1**	**4**	**5**	**4**	**2**	**10**	**-**	**30**

Module (3)

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	4	**1**	**3**	**5**	**4**	**-**	**-**	**-**	**17**

Module (4)

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	4	**1**	**3**	**5**	**4**	**2**	**20**	**-**	**39**

Module (5)

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	4	1	3	5	4	6	20	3	46

Course	Risk Analysis in the Food Chain
Module 1	**Introduction to Risk Analysis**
Key Concepts	Definition, components, practices, conditions and concepts
Overview	A risk analysis framework provides a process to systematically and transparently collect, analyse and evaluate relevant scientific and non-scientific information about a chemical, biological or physical hazard possibly associated with food in order to select the best option to manage that risk based on the various alternatives identified.This chapter provides a broad introduction to the food safety risk analysis process and the conditions necessary to ensure its successful implementation.
Aim	The module will provide students with knowledge and understanding of key principles of risk analysis and its main applications. Students will learn the main steps of the risk assessment process, and gain the skills required to conduct qualitative risk assessments and to correctly identify data and key stochastic processes to use while performing quantitative risk assessments.
Learning Outcomes	At the end of this module, the students will be able to: 1. Outline and justify their understanding of the concepts of risk analysis. 2. Explain the principles of risk and risk management 3. Apply a structured approach comprising the three distinct components: risk assessment, risk management and risk communication. 4. Identify the operational risk and how to manage it. 5. Communicate effectively during the risk assessment process; present qualitative risk assessments to technical and non-technical audiences. 6. Interpret results of qualitative risk assessments to provide coherent and logical arguments in support of decision-making.
Units	Unit 1.1. Introduction to Risk Analysis in food chain Unit 1.2. The changing food safety environment Unit 1.3. Components of risk analysis Unit 1.4. Risk analysis at the international and national levels Unit 1.5. Essential characteristics of risk analysis
Readings	1. Assuring Food Safety and Quality http://www.fao.org/3/a-y8705e.pdf 2. Scientific Criteria to Ensure Safe Food(2003)https://www.nap.edu/catalog/10690/scientific-criteria-to-ensure-safe-food
Activity	**Activity 1a.**Each student will be responsible for serving as a class discussion leader twice during the quarter.

	Activity 1b. Practical visit for two agriculture companies with report requested from each student evaluate his knowledge from this course with practical visit. **Activity 1c.** Students will be divided into two groups. Each week there will be 5 min presentation from each group about their visit to surrounding restaurants and food court in campus at the beginning of class. The activity will be organised by class leaders as following steps **1c.1.**A brief opening oral presentation (4-7 slides) highlighting the most important two or three points highlighted from restaurants and food court surveys about risk analysis in food processing **1c.2.**Development of two or three questions intended to stimulate class discussion about food safety

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√		

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
			√	√								√					

Module 2	**Advanced Quantitative Risk Assessment**
Key Concepts	Definition, theories, practices and concepts
Overview	This module enables students to develop an in-depth knowledge and understanding of advanced quantitative risk assessment methods used in food safety through a combination of theoretical and practical activities including real-world examples and critical review of published quantitative risk assessment. Both practical aspects on how to implement quantitative risk assessment and advanced risk assessment modelling methods will be covered.
Aim	The aim of this module is to provide students with knowledge and understanding of advanced quantitative risk assessment methods. Students will gain the skills required for conducting scientifically robust quantitative risk assessment that also satisfy the international standards.
Learning Outcomes	By the end of this module, students should be able to: 1. Demonstrate knowledge and understanding of: 1.1.Stochastic processes used in quantitative risk assessment in food safety. 1.2.Specialized food safety modeling methods. 1.3.The importance of documenting quantitative risk assessment models and the communication of the results to scientific audiences and risk managers 2. Identify the modeling methods and data to be used in quantitative risk assessment. 3. Design and implement quantitative risk assessment models of moderate complexity in food safety. 4. Apply and integrate the risk assessment modeling methods into real world food safety situations following the main steps of quantitative risk assessment. Interpret results of quantitative risk assessment to provide coherent and logical arguments in support of decision-making.
Units	Unit 2.1: Principle of Risk Assessment. Unit 2.2: Items of risk assessment. Unit 2.3: The food safety risk assessment process.

	Unit 2.4: Chemical and microbial risk. Unit 2.5: Techniques used in food safety risk assessment. Unit 2.5: Characteristics of a good risk assessment.
Readings	1. Harvard Center for Risk Analysis. Risk in Perspective. http://www.hcra.harvard.edu/pdf/June2003.pdf 2. Sandman, P.M. 1994. Risk communication. In: Encyclopaedia of the Environment, Eblen, R.A. & Eblen, W.R. (eds.). 1994. Boston, MA: Houghton Mifflin, pp. 620-623. 3. Fischoff, B. 1995. Risk perception and communication unplugged: twenty years of process. Risk Analysis, 15: 137-145
Activity	**Activity 2a:** The module will comprise formal teaching (lectures), and directed learning sessions with individual and group exercises and case studiesthat will allow students to develop an understanding of the topics covered. **Activity 2b:**After the face-to-face teaching and before the module examination, students will have a reading week for consolidation of their learning. Problem-based learning, where students will be given a problem or scenario that requires students to formulate questions, analyze evidence, connect evidence to pre-existing theories, derive conclusions, and reflect on their learning.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√			√		√		

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
	√	√	√	√									√		√		

Module 3	**Risk Management**
Key Concepts	Definition, theories, practices and concepts
Overview	Risk management has been defined as “the process, distinct from risk assessment, of weighing policy alternatives, in consultation with all interested parties, considering risk assessment and other factors relevant for the health protection of consumers and for the promotion of fair trade practices, and, if needed, selecting appropriate prevention and control options” (Codex). Risk management therefore plays a key role at the beginning of the risk analysis process in identifying food safety problems and considering the best ways to manage them. Risk management must be carried out in consultation with interested stakeholders and in synergy with risk communication activities.
Aim	1. Development of Codex specifically for food safety risk management. 2. Ensure the scientific integrity of the risk assessment process by maintaining the functional separation of risk management and risk assessment. 3. Clearly determine and establish the organization’s risk assessment policy before the risk assessment is initiated. 4. Consider a full range of risk management options and arrive at a preferred option through a structured process that includes preliminary risk management activities 5. Monitor the efficacy of measures and review new information, as it becomes available, in order to assess whether the existing risk analysis needs to be reviewed.

Learning Outcomes	By the end of this module, students should be able to: 1. Inform about the strengths and weaknesses of the risk assessment including any limitation. 2. Describe the risk assessment protocol . 3. Understand the meaning and limitations of the absolute or relative risk estimates provided by the risk assessors. 4. Discuss the nature, source and extent of uncertainty and variability in the risk characterization 5. Consider all important assumptions made during the risk assessment and their impact on the risk characterization and risk assessment findings. 6. Implement risk management decisions.
Units	Unit 3.1.: Identify the food safety problem. Unit 3.2: Develop a risk profile. Unit 3.3: Rank hazards for risk assessment and set priorities for risk management. Unit 3.4: Establish a risk assessment policy. Unit 3.5: Commission the risk assessment. Unit 3.6: Interpret the results of the risk assessment.
Readings	1. CAC. 2004. Report of the thirty-sixth session of the Codex Committee on Food Hygiene, Washington DC, 29 March to 3 April 2004. ALINORM 04/27/13http://www.codexalimentarius.net/download/report/615/al04_13e.pdf 2. FAO/WHO. 1997. Risk management and food safety. FAO Food and Nutrition Paper No. 65. Report of a Joint FAO/WHO Consultation in Rome, Italy, 27-31 January 1997 http://www.fao.org/3/W4982E/w4982e00.htm 3. FAO/WHO. 2002. Principles and guidelines for incorporating microbiological risk assessment in the development of food safety standards, guidelines and related texts. Report of a Joint FAO/WHO Consultation. Kiel, Germany, 18-22 March 2002 ftp://ftp.fao.org/docrep/fao/006/y4302e/y4302e00.pdf
Activity	**Activity 3a:**Student in groups will perform module about risks during food industry and how to manage these risks. **Activity 3b:** Power point Presentation from student group discusses different ways of food management.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√		
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
		√	√												√		

Module 4	**Risk Communication and Perception**
Key Concepts	Definition, theories, practices and concepts

Overview	Risk communication is a powerful but often underutilized element of risk analysis. This module examines the role played by good risk communication in the application of the generic food safety. Critical steps within effective communication are identified, and the specific communication processes required at each stage are described. Practical aspects of communication are discussed. This module does not explain "how to talk about risk analysis in food chain" but readers are referred to the reference materials at the end of the module for advice on how to communicate between all types of risk in the food chain.
Aim	Understand the interactive exchange of information and opinions throughout the risk analysis process concerning risk, risk-related factors and risk perceptions, among risk assessors, risk managers, consumers, industry, the academic community and other interested parties, including the explanation of risk assessment findings and the basis of risk management decisions.
Learning Outcomes	By the end of this module, students should be able to: 1. Manage the risk communication component of risk analysis. 2. Plan, design and implement the risk communication process as part of the risk analysis team. 3. Define and delineate the responsibilities for risk communication from the outset. 4. Evaluate and compare the sustainability of cities and community systems in meeting their needs particularly in the areas of food, energy, transport, water, safety, waste treatment, inclusion and accessibility, education, and integration of green spaces and disaster risk reduction as a learning objective of (SDG no. 11). 5. Define risk perception 6. Evaluate the relevance of the psychometric paradigm in risk perception research. 7. Link between risk perception and protective behavior.
Units	Unit 4.1: Risk communication components Unit 4.2: Developing a risk profile Unit 4.3: Developing a risk assessment policy Unit 4.4: Commissioning a risk assessment Unit 4.5: Risk Communication strategies Unit 4.5: Risk perception
Readings	1. FAO/WHO. 1999. The application of risk communication to food standards and safety matters. Report of a Joint FAO/WHO Expert Consultation. Rome, Italy. 2–6 February 1998. FAO Food and Nutrition Paper No. 70 http://www.fao.org/DOCREP/005/X1271E/X1271E00.htm#TOC 2. Fischoff, B. 1995. Risk perception and communication unplugged: Twenty years of process. Risk Analysis, 15: 137-145. Joint Institute for Food Safety and Applied Nutrition. Web site of the Food Safety Risk Analysis Clearinghouse. https://www.cmu.edu/epp/people/faculty/research/Fischhoff-RAUnplugged-RA.pdf 3. A joint project between th e University of Maryland and the United States Food and Drug Administration. Collection of resources related to food safety risk communication http://foodrisk.org/risk_communication.cfm

<table>
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<ol start="4">
National Research Council. 1989. Improving Risk Communication. Washington, DC: National Academy Press.

https://www.nap.edu/catalog/1189/improving-risk-communication
National Research Council. 1996. Understanding Risk: Informing Decisions in a Democratic Society. Washington, DC: National Academy Press. https://www.nap.edu/catalog/5138/understanding-risk-informing-decisions-in-a-democratic-society
Scientific Standards for Studies on Modified Risk Tobacco Products (2012). Chapter: 5 Methods for Studying Risk Perception and Risk Communication

https://www.nap.edu/read/13294/chapter/7
Sjöberg, L., Moen, B. E., & Rundmo, T. (2004). Explaining risk perception. An evaluation of the psychometric paradigm in risk perception research. Rotunde publikasjoner Rotunde, 84, 55-76.

http://www.svt.ntnu.no/psy/Torbjorn.Rundmo/Psychometric_paradigm.pdf
Brewer, Noel T., et al. "Risk perceptions and their relation to risk behavior." Annals of behavioral medicine 27.2 (2004): 125-130.https://link.springer.com/content/pdf/10.1207%2Fs15324796abm2702_7.pdf

</td></tr>
<tr><td>Activity</td><td>Activity 4.aGive students problems about different risks in food industry by (Problem-based learning) to formulate questions, analyze evidence, connect evidence to pre-existing theories, derive conclusions, and reflect on their learning</td></tr>
<tr><td>
<table>
<tr><td>10Cs/6 LEARNINGGOALS</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
<tr><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td>√</td><td>√</td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td></td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Module 5</td><td>Framework for strengthening surveillance of and response to foodborne diseases (SDG no. 3)</td></tr>
<tr><td>Key Concepts</td><td>Definition, theories, practices and concepts</td></tr>
<tr><td>Overview</td><td>Foodborne diseases comprise a wide spectrum of illnesses that result from ingestion of foodstuffs contaminated with microorganisms or chemicals. Food may become contaminated at any stage in the process from production to consumption, and contamination may be the result of environmental contamination, such as pollution of water, soil or air. Foodborne diseases are a growing public health problem throughout the world and cause a considerable burden of disability and mortality. The most common clinical presentation of foodborne disease is gastrointestinal symptoms. Other serious</td></tr>
</table>

	consequences include kidney and liver failure, brain and neurological disorders, reactive arthritis and cancer.
Aim	Evaluation and assessment with control all aspects of surveillance, rapid risk assessment, response, investigation, and multi sectorial collaboration related to food-borne hazards (microbial, chemical and radiological) that can affect human health.
Learning Outcomes	By the end of this module, students should be able to: 1. Describe the meaning of food-borne disease. 2. List examples of common causative agents of food-borne diseases. 3. Define different related terms such as outbreak and cluster. 4. Explain the goals of a food-borne disease outbreak investigation. 5. Discuss the desirable knowledge and skills required in the food-borne outbreak investigation team. 6. Understand the concept of health, hygiene and well-being as a learning objective of SDG no. 3.
Units	Unit 5.1: Pathogenesis and clinical features of some food-borne disease. Unit 5.2: Food borne infections. Unit 5.3: Food poisonings and intoxications. Unit 5.4: Diagnosis of food-borne diseases. Unit 5.5: General management approaches of food-borne diseases. Unit 5.6: Prevention and control of food-borne diseases. Unit 5.7: Investigation of outbreaks of food-borne diseases
Readings	1- Centers for Disease Control and Prevention (2001) Updated guidelines for evaluating public health surveillance systems: recommendations from the guidelines working group. MMWR. 50 (No. RR-13) https://www.cdc.gov/mmwr/preview/mmwrhtml/%20rr5013a1.htm 2- EDES (2012) Role of competent authorities and food business operators. Handbook Brussels: https://www.google.com/search?client=firefox-b-d&q=edes.coleacp.org%2Ffiles%2Fdocuments%2Fedes%2Fpublications+%2FEDES_fascicule+1-7_EN_web 3- FAO (2006) Strengthening national food control systems: guidelines to assess capacity building needs. Rome: Food and Agriculture Organization of the United Nations ftp.fao.org/docrep/fao/009/a0601e/a0601e00.pdf 4- FAO (2008) Risk-based food inspection manual. Food and Nutrition Paper No. 89. Rome: Food and Agriculture Organization of the United Nations http://www.fao.org/docrep/010/i0096e/i0096e00.htm

	5- FAO/WHO (2003) Assuring food safety and quality: guidelines for strengthening national food control systems. Food and Nutrition Paper No. 76. Rome: Food and Agriculture Organization of the United Nations https://www.google.com/search?client=firefox-b-d&q=2.%09http%3A%2F%2Fwww.fao.org%2FDOCREP%2F006%2FY8705E%2FY8705E00.HTM 6- FAO/WHO (2007) Principles and guidelines for the conduct of microbiological risk management (MRM), CAC/GL 63-2007. Rome: Food and Agriculture Organization of the United Nations http://www.fao.org/input/download/standards/10741/%20CXG_063e.pdf
Activity	**Activity 1a:** In groups, students will design a project module how to evaluate risks from food born disease transported during food industry. **Activity 1b:** Development of three questions about Food poisonings and intoxications through interview with students at faculty restaurants to increase their awareness. Collected data briefly will be presented and followed by class discussion **Activity 1c**:Students will interview farmers and stakeholders to collect data about the following points then prepare a presentation about their data analysis: 1: Pathogenesis and clinical features of some food-borne disease. 2: Food borne infections. 3: Food poisonings and intoxications. 4: Diagnosis of food-borne diseases. 5: General management approaches of food-borne diseases. 6: Prevention and control of food-borne diseases. 7: Investigation of outbreaks of food-borne diseases **Activity 1d**: In groups, discuss how to connect and link between risk perception and risk behaviour. Students will compare between confusing hypotheses: behaviour motivation, risk reappraisal and accuracy hypothesis during interview with surrounding community about food-borne disease vaccines after vaccination time as a real case study. Data will be collected then analyzed.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√		
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
			√										√				

SDGs RUBRIC

SDGs	**CLIMATE CHANGE**	**SUSTAINABLE AGRICULTURE**	**FOOD SECURITY**	**COURSE MODULE**

1	End poverty in all its forms everywhere		√	√	2, 4
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		√	√	2, 3, 4
3	Ensure healthy lives and promote well-being for all at all ages				1, 2, 3, 4, 5
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				1, 2
5	Achieve gender equality & empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all		√		
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				4
12	Ensure sustainable consumption and production patterns		√	√	1, 4
13	Take urgent action to combat climate change and its impacts	√		√	2, 4, 5
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss		√		2, 3,
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, & build effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS TEMPLATE

Course Syllabus

Course Number:

Precision Farming

Aswan University, Faculty of Agriculture and natural Resources

Semester,

Instructor Information

Instructor: Dr. Wagdi Saber Soliman

Office Location: Aswan University, Sahari Campus

Telephone: office - +20 973 480 245

Office hours: Sunday-Wednesday 09.00 – 14.00

E-mail" wagdi79@agr.aswu.edu.eg

Website:

Course Identification

Course Number:

Course Name: Precision Farming

Course Location: Aswan University

Class Times:

Prerequisites:

Faculty Web Page: http://agr.aswu.edu.eg

Course Description/Overview

Precision agriculture is high technological farming where the aim is to adapt as much as possible management actions to local, detailed growing conditions, with the aid of GNSS (Global Navigation Satellite System) positioning or on-the-go crop monitoring with visual and non-visual sensors. This course provides principles and applications of technologies supporting precision farming and natural resource data management planning, as well as Global Navigation Satellite System (GNSS), geographic information system (GIS), variable rate technologies (VRT), data layering of independent variables, field sensors and computer software for precision farming.

Course Learning Objectives

-

Students will:

- Maximize the efficiency and efficacy of applied resources to optimize yield with a minimum impact on the environment

- Assess current and future perspectives of precision farming

- Develop appropriate skills in scientific and community communication

- Develop cognitive, psychological, and social skills among students such as life-learning and transferable skills, promotion of students' active participation in the community, competence as responsible citizens, etc.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

1. become familiar with terms and definitions typical to precision agriculture
2. discuss the magnitude and causes of production variability
3. describe the current objectives and emerging applications of precision agriculture
4. be familiar with global positioning systems and geographic information systems, and their application in precision agriculture
5. identify current remote sensing and other variability measuring technologies supported by image processing techniques and describe their applications in precision agriculture
6. knowledge of field guidance systems for exploitation of controlled traffic or variable rate technology approaches
7. become familiar with GIS (Geographic Information Systems) software and be able to utilize it
8. explore principles and applications of variable rate technologies
9. identify sensing technology for precision agriculture
10. apply precision agriculture to a real situation.
11. explain the economic and environmental benefits of precision agriculture, and quantify some aspects of the economic impact of precision controlled traffic farming.

Course Resources

Course Website(s)

Required Course Texts and Materials

- Hand-out prepared by the instructor for the class

- Bolstad, P. (2012). GIS Fundamentals: A first text on Geographic Information Systems (4th edition)-Chapters 3&4.

- Chang, K. (2013). Introduction to Geographic Information Systems, 7th edition-Chapter 10.

Optional course Texts and Materials

Banu, S. (2015). Precision agriculture: tomorrow's technology for today's farmer. J Food Process Technol 6(8): 468. doi:10.4172/2157-7110.1000468.

Burrough, P. A., McDonnell, R. A. & Lloyd, C. D. (2015). Principles of Geographical Information Systems, 3rd ed., Oxford University Press, 352 pp.

Whelan, B. & Taylor, J. (2013). Precision Agriculture for Grain Production Systems. CSIRO Publishing.

Heege, H. J. (2013). Precision in Crop Farming: Site Specific Concepts and Sensing Methods: Applications and results. Springer .

Oliver, M. A., Bishop, T. F. A. & Marchant, B. P. (2013)., Routledge Precision agriculture for sustainability and environmental protection,.

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading policy

Grades can be based on the following:

Oral Exam	**10**
Semester assignments	**10**
Practical Exam	**20**
Final Exams	**60**
Total Points	**100**

Course policies

Late Assignment

It is important that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive at on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and though about the assigned material before you come to class. I expect active class participation.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by-case basis.

Important Dates to Remember

Course schedule

Week	Date	Topics, Reading, Assignments and Deadline (details on assignments and more bibliography are available in the course modules)
1		**Course overview:** Discussion of syllabus and assignments, course requirements and prerequisites, criteria for student selection
2		Introduction to Precision Agriculture
3		Technology related to precision agriculture
4		Global Navigation Satellite System (GNSS)
5		Applications of Geographic Information System (GIS)
6		Soil sensors and soil variability
7		Appropriate data layers for precision agriculture
8		Phenotyping (the measurement of crop characteristics with digital image analysis)
9		Technical and environmental aspects of site-specific management
10-11		Applications for precision agriculture
12-13		Agricultural case studies
14		Economic/Environment aspects of precision agriculture

CCSAFS Course Modules

Course	**Precision Farming**
Module 1	**Introduction to Precision Agriculture**
Key Concepts	Definition, theories, and concepts
Overview	It is essential for students to develop a fundamental understanding of precision farming theory and concepts. Questions to be addressed in this module include the following: What is the nature of precision farming? Why is it important to

<table>
<tr><td></td><td>study precision farming? What are the current objectives and applications of precision agriculture?</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is to turn students able to discourse on precision farming theories, concepts as well as current applications</td></tr>
<tr><td>Learning Outcomes</td><td>- discuss the magnitude and causes of production variability
- describe the current objectives and emerging applications of precision agriculture</td></tr>
<tr><td>Units</td><td>- Definition of Precision Farming
- Theories and Concepts of Precision Farming</td></tr>
<tr><td>Readings</td><td>Whelan, B. & Taylor, J. (2013). Precision Agriculture for Grain Production Systems. CSIRO Publishing.
Heege, H. J. (2013). Precision in Crop Farming: Site Specific Concepts and Sensing Methods: Applications and results. Springer .
Oliver, M. A., Bishop, T. F. A. & Marchant, B. P. (2013)., Routledge Precision agriculture for sustainability and environmental protection.</td></tr>
<tr><td>Activity</td><td>- Two theoretical lectures will be given by the instructor.
- Interactive learning: instructor and students will discuss benefits of precision farming using and problems with adopting this technology. Students will apply what they learned about precision farming to develop a list of specific benefits of precision farming .
- Student presentation: Some of the students will be asked to prepare multimedia files on the use and benefits of precision farming with examples that can be adopted in the Arab region.</td></tr>
<tr><td>ECTS workload</td><td><table>
<tr><td>Lectures (face-to-face)</td><td>6</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>5</td></tr>
<tr><td>Preparing course activities</td><td>5</td></tr>
<tr><td>Total</td><td>16 hrs</td></tr>
</table></td></tr>
<tr><td>SDGs</td><td>2- End hunger, achieve food security and improved nutrition, and promote sustainable agriculture: this is clear on the outcomes and readings</td></tr>
<tr><td>Module 2</td><td>Precision Agriculture Technology</td></tr>
<tr><td>Key Concepts</td><td>GNSS, GIS, remote sensing, satellites equipped with multispectral cameras,</td></tr>
<tr><td>Overview</td><td>It is essential for students to be familiar with technological application in precision farming. These application include remote sensing, image processing, Global Navigation Satellite System (GNSS), and geographic information systems (GIS), Satellite providing multispectral information (such as Copernicus, Planet or Worldview satellites)</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is to turn students familiar with GNSS and GIS, and their application in precision agriculture</td></tr>
<tr><td>Learning Outcomes</td><td>- identify current remote sensing and other variability measuring technologies supported by image processing techniques and describe their applications in precision agriculture
- knowledge of field guidance systems for exploitation of controlled traffic or variable rate technology approaches
- become familiar with GIS (Geographic Information Systems) software and be able to utilize it
- explore principles and applications of variable rate technologies
- identify sensing technology for precision agriculture</td></tr>
<tr><td>Units</td><td>- Global Navigation Satellite System (GNSS)
- Geographic Information System (GIS)
- Soil sensors and soil variability
- homogeneous zones</td></tr>
<tr><td>Readings</td><td>Banu, S. (2015). Precision agriculture: tomorrow’s technology for today’s farmer. J Food Process Technol 6(8): 468. doi:10.4172/2157-7110.1000468.
Bolstad, P. (2012). GIS Fundamentals: A first text on Geographic Information Systems (4th edition)-Chapters 3&4.
Chang, K. (2013). Introduction to Geographic Information Systems, 7th edition-Chapter 10.
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</table>

<table>
<tr><td></td><td>Heege, H. J. (2013). Precision in Crop Farming: Site Specific Concepts and Sensing Methods: Applications and results. Springer .</td></tr>
<tr><td>Activity</td><td>- Four theoretical lectures will be given by the instructor.
- Practical sessions and student activities: each group of student will be asked to prepare a project that is based on a real case for an agricultural area in Aswan region. The students will be divided into groups, they will do field visits and communicate with farmers to define a real problems, then will join group discussion to know how to apply the precision agriculture technology for solving the problems.</td></tr>
<tr><td>ECTS workload</td><td><table>
<tr><td>Lectures (face-to-face)</td><td>9</td></tr>
<tr><td>Online</td><td>3</td></tr>
<tr><td>Lab work</td><td>8</td></tr>
<tr><td>Reading articles (3 pages/hr)</td><td>3</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>7</td></tr>
<tr><td>Project work</td><td>5</td></tr>
<tr><td>Total</td><td>35 hrs</td></tr>
</table></td></tr>
<tr><td>SDGs</td><td>7- Ensure access to affordable, reliable, sustainable, and modern energy for all</td></tr>
<tr><td>Module 3</td><td>Data Analysis for Precision Agriculture</td></tr>
<tr><td>Key Concepts</td><td>Satellites equipped with multispectral cameras, Digital image analysis</td></tr>
<tr><td>Overview</td><td>It is essential for students to use and apply the technological application of precision farming such as digital image analysis for measuring crop properties.</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is to turn students able to measure crop characteristics with digital image analysis techniques</td></tr>
<tr><td>Learning Outcomes</td><td>- apply the image processing techniques
- analysis the data of image processing in precision farming</td></tr>
<tr><td>Units</td><td>- Phenotyping .</td></tr>
<tr><td>Readings</td><td>Banu, S. (2015). Precision agriculture: tomorrow’s technology for today’s farmer. J Food Process Technol 6(8): 468. doi:10.4172/2157-7110.1000468.
Heege, H. J. (2013). Precision in Crop Farming: Site Specific Concepts and Sensing Methods: Applications and results. Springer.</td></tr>
<tr><td>Activity</td><td>- Two theoretical lectures given by the instructor, supported by handouts and short manuals for carrying out digital image processing functions that area relevant to precision farming.
- The student will be asked to apply their knowledge in precision agriculture by collecting image data and analysis it to determine crop characteristics
- Student assignment and presentation on a case study where remote sensing is implemented for precision farming. Multimedia files and presentations are encouraged and prioritized.</td></tr>
<tr><td>ECTS workload</td><td><table>
<tr><td>Lectures (face-to-face)</td><td>3</td></tr>
<tr><td>Online</td><td>3</td></tr>
<tr><td>Reading articles (3 pages/hr)</td><td>2</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>3</td></tr>
<tr><td>Preparing course activities</td><td>5</td></tr>
<tr><td>Project work</td><td>5</td></tr>
<tr><td>Total</td><td>21 hrs</td></tr>
</table></td></tr>
<tr><td>SDGs</td><td>12- Ensure sustainable consumption and production patterns
13- Take urgent action to combat climate change and its impacts</td></tr>
<tr><td>Module 4</td><td>Applications for Precision Agriculture</td></tr>
<tr><td>Key Concepts</td><td>Technical and environmental aspects of precision agriculture, vegetation indices</td></tr>
<tr><td>Overview</td><td>It is essential for students to be awareness of precision agriculture applications</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is to turn students able to apply the applications to develop precision agriculture management</td></tr>
<tr><td>Learning Outcomes</td><td>- identify the applications of precision agriculture
- select the suitable application for precision agriculture purposes</td></tr>
<tr><td>Units</td><td>- Technical and environmental aspects of site-specific management</td></tr>
</table>

<table>
<tr><td>Readings</td><td>Heege, H. J. (2013). Precision in Crop Farming: Site Specific Concepts and Sensing Methods: Applications and results. Springer.
Oliver, M. A., Bishop, T. F. A. & Marchant, B. P. (2013)., Routledge Precision agriculture for sustainability and environmental protection,.</td></tr>
<tr><td>Activity</td><td>- Three theoretical lectures and practical lessons will be given by the instructor.
- Student assignments and presentation on case studies where hyperspectral is used in precision farming. All presentation shall include multimedia files and demos.</td></tr>
<tr><td>ECTS workload</td><td><table>
<tr><td>Lectures (face-to-face)</td><td>3</td></tr>
<tr><td>Lab work</td><td>2</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>5</td></tr>
<tr><td>Preparing course activities</td><td>10</td></tr>
<tr><td>Project work</td><td>5</td></tr>
<tr><td>Total</td><td>25 hrs</td></tr>
</table></td></tr>
<tr><td>SDGs</td><td>2- End hunger, achieve food security and improved nutrition, and promote sustainable agriculture: this is clear on the outcomes and readings
7- Ensure access to affordable, reliable, sustainable, and modern energy for all</td></tr>
<tr><td>Module 5</td><td>Agricultural case studies</td></tr>
<tr><td>Key Concepts</td><td>Case study, vegetation indices, precision agriculture differences in case of big companies or small farms</td></tr>
<tr><td>Overview</td><td>It is essential for students to be simulate and evaluate the precision agriculture through field visits</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is to mingle student with the farmer to see the applications of precision agriculture and their negative and positive impacts</td></tr>
<tr><td>Learning Outcomes</td><td>- improve the communication skills, leadership, and team wok
- discuss the agricultural problems
- select the appropriate solutions for farmers</td></tr>
<tr><td>Units</td><td>- apply precision agriculture to a real situation.</td></tr>
<tr><td>Readings</td><td>Whelan, B. & Taylor, J. (2013). Precision Agriculture for Grain Production Systems. CSIRO Publishing. Heege, H. J. (2013). Precision in Crop Farming: Site Specific Concepts and Sensing Methods: Applications and results. Springer .
Oliver, M. A., Bishop, T. F. A. & Marchant, B. P. (2013)., Routledge Precision agriculture for sustainability and environmental protection.</td></tr>
<tr><td>Activity</td><td>- Two theoretical lectures and practical lessons will be given by the instructor.
- Field trip
- Data collection and discussion groups
- Practical field activities carried out with applications available for smartphones (such as for collection of GPS/Glonass/Galileo GNSS coordinates)
- analyzing the collected data from the field and reporting the recommended solution
- inviting the farmers for final presentation to declare the results</td></tr>
<tr><td>ECTS workload</td><td><table>
<tr><td>Lectures (face-to-face)</td><td>6</td></tr>
<tr><td>Online</td><td>6</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>5</td></tr>
<tr><td>Project work</td><td>10</td></tr>
<tr><td>Preparation for exam</td><td>6</td></tr>
<tr><td>Total</td><td>33 hrs</td></tr>
</table></td></tr>
<tr><td>SDGs</td><td>2- End hunger, achieve food security and improved nutrition, and promote sustainable agriculture: this is clear on the outcomes and readings</td></tr>
<tr><td>Module 6</td><td>Economic & Environmental Precision Agriculture</td></tr>
<tr><td>Key Concepts</td><td>Economic and environmental aspects of precision agriculture, weather</td></tr>
<tr><td>Overview</td><td>It is essential for students to be awareness with economic and environmental benefits of precision agriculture</td></tr>
<tr><td>Aim</td><td>The overriding aim of this module is to turn student able to compare precision agriculture with other agricultures, not only economically but also environmentally</td></tr>
</table>

<table>
<tr><td>Learning Outcomes</td><td>- explain the economic and environmental benefits of precision agriculture, and quantify some aspects of the economic impact of precision controlled traffic farming.</td></tr>
<tr><td>Units</td><td>- Economic Aspects of Precision Agriculture
- Environmental Aspects of Precision Agriculture</td></tr>
<tr><td>Readings</td><td>Whelan, B. & Taylor, J. (2013). Precision Agriculture for Grain Production Systems. CSIRO Publishing. Heege, H. J. (2013). Precision in Crop Farming: Site Specific Concepts and Sensing Methods: Applications and results. Springer .
Oliver, M. A., Bishop, T. F. A. & Marchant, B. P. (2013)., Routledge Precision agriculture for sustainability and environmental protection.</td></tr>
<tr><td>Activity</td><td>COMMUNITY-BASED/SERVICE LEARNING ACTIVITY
During the course from the 1st module ending to the 5th module, the students will be engaged together in a community-based learning activity to evaluate the precision agriculture through field visits. The objective of the community-based learning activity is to engage students with farmers to define their agricultural problems, recommend the suitable application of precision agriculture to solve these problems, and evaluate its negative and positive impacts.
The recommended number of students in the course is 25 students. The students will be divided into groups (each group consists of 5 students). The groups will be distributed in 5 different agricultural areas near Aswan city, Egypt.
- All students (25 students) under the supervision of the course Staff will be engaged into group discussions in the first week of the semester to define the work plan, select each group members and the tutor for each group, and select the target areas.
- Each group will be responsible to collect data about agricultural problems facing the farmers.
- All students will be engaged again to discuss these problems and determine ONE PROBLEM to be addressed by all the groups.
- After defining the problem, each group will collect the related data to the problem such as distance from the Nile river, distance from main road, injured areas, damaged???, plant growth characterizations, ….etc.
- Then, group members will analyze the data, and discuss the results within their groups in order to identify the reasons of problem and how to solve it using precision agriculture technologies such as GPS, GNSS, Satalite providing multispectral information, …etc.
- The students will be engaged in practical field activities in the target area carrying out with applications of precision agriculture.
- Students will evaluate the precision agriculture technology.
- The staff member, with the assistance of the students, will prepare and achieve training and workshops for the target farmers to transfer knowledge and technology of precision agriculture
- Finally, each group will write a final report. One of each group will present the report and activities of the community- based learning activity in a final conference inviting the staff members, tutors, farmers and all students.

For student assessments, each group will submit the collected data, data analysis repot, and field visits reports. Also, the tutor of each group will submit report about each group member to assess his efficiency and cooperation with the team to the Staff member for final evaluation by the instructor.</td></tr>
<tr><td>ECTS workload</td><td>
<table>
<tr><td>Lectures (face-to-face)</td><td>3</td></tr>
<tr><td>Reading book chapters (5 pages/hr)</td><td>5</td></tr>
<tr><td>Project work</td><td>5</td></tr>
<tr><td>Preparation for exam</td><td>14</td></tr>
<tr><td>Writing the exam</td><td>3</td></tr>
<tr><td>Total</td><td>30 hrs</td></tr>
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</td></tr>
</table>

SDGs	9- built resilent infrastructure, promote inclusive, and sustainable industrialization and foster innovation

ECTS Workload allocations

Learning components	No	Time Factor	Workload	Course modules						Workload
				1	2	3	4	5	6	
Lectures (face-to-face)	10	3	30	6	9	3	3	6	3	30
Online	4	3	12	--	3	3	--	6	--	12
Lab work	2	5	10	--	8	--	2	--	--	10
Reading articles (3 pages/hr)	15	0.3	5	--	3	2	--	--	--	5
Reading book chapters (5 pages/hr)	150	0.2	30	5	7	3	5	5	5	30
Preparing course activities	4	5	20	5	--	5	10	--	--	20
Project work	1	30	30	--	5	5	5	10	5	30
Preparation for exam	1	20	20	--	--	--	--	6	14	20
Writing the exam	1	3	3	--	--	--	--	--	3	3
Total			160	16	35	21	25	33	30	160

	SDGs	CC	SA	FS	COURSE MODULE
1	End poverty in all its forms everywhere				
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	✓	✓	✓	1, 4, 5
3	Ensure healthy lives and promote well-being for all at all ages				
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				
5	Achieve gender equality and empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all				
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	✓	✓	✓	2, 4
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation	✓	✓		6
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns		✓		3
13	Take urgent action to combat climate change and its impacts	✓			3
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss				
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive in				

17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS

Course Number:

Consumer behavior, Food Security, and Marketing

(5 ECTs - Around 150 Study hours)

Heliopolis University for Sustainable Development, Faculty of Business and Economics,

2019/2020

Instructor Information

Instructor: **Assoc. Prof. Omar Ramzy**

Office Location: Heliopolis University for Sustainable Development

Telephone:

Office Hours:

E-mail: **omar.ramzy@hu.edu.eg**

Website:

Course Identification

Course Number:

Course Name:

Course Location:

Class Times:

Prerequisites:

Faculty Web Page: http://www.hu.edu.eg

Course Description/Overview

Buyers of all types go through complex decision-making processes at some time before they commit themselves to a purchase. This course focuses on the buyer decision-making processes and the internal and external influences on the purchasing and consumption process in the context of Sustainable development. Considering that solving environmental problems will require behavioral changes, it is important that marketers as well as producers fully understand consumer behavior and ways to influence it. As such, the course dives into the behavioral, psychological, and sociological aspects of consumers and their relation to Food security, sustainability, and social responsibility that in turn affects the overall buying decision making process. Understanding how buyers and consumers behave is an integral part of correctly identifying their real needs not wants and how it fits with sustainable consumption and production as one of the SDGs. Through this course, students will be taught how the seller and the buyer can link up effectively, and also to investigate about consumers' concerns about the issue of food security and its impacts and consumers' willingness to adopt different behaviors in consumption.

Course Learning Objectives

The overarching goals of this course are: a) Describe the relevance of consumer behavior to the entire marketing process, the nature and stages of consumers' decision making and the factors influencing consumers' choice; b) Explain and analyze the major stages which consumers usually go through when making a consumption-related decision; c) To understand the social and environmental responsibility and ethical issues associated with consumer behavior in light of Transformative Consumer Research; d) Apply the concepts and theories covered in the course to devise effective solutions in enhancing business performance in the context of consumer behavior.

Course Content Learning Outcomes

On successful completion of this course, you will be able to:

8. Identify and explain factors which influence consumer behavior.
9. Demonstrate how knowledge of consumer behavior can be applied to marketing.
10. Display critical thinking and problem solving skills.
11. Gain, evaluate and synthesize information and existing knowledge from a number of sources and experience.

12. In a team, work effectively to prepare a professional, logical and coherent report on consumer behavior issues within a specific context.

13. Deliver an oral presentation in a professional and engaging manner.

14. Demonstrate awareness and ability to discourse on ethical issues.

15. Analyze the competitive advantages and risks associated with green consumption.

Course Resources

Course Website(s)

Required Course Texts and Materials

Hands-out prepared by the instructor for the class

Optional Course Texts and Materials

- Hawkins, Del I. (year) Consumer behavior: building marketing strategy / Del I. Hawkins, David L. Mothersbaugh.—11th ed.
- Schiffman, L, Bednall, D, O'Cass, A, Paladino, A, D'Alessandro, S & Kanuk, L (2010), Consumer Behaviour (5th ed), New South Wales, Pearson Australia.
- Hoyer, W. and Maclnnis, D. (2010), Consumer Behavior, Fifth Edition, South – Western Cengage Learning
- Lantos, G. (2012). Consumer Behavior in Action. Sharpe: US
- Blackwell, R. et al (2001), Consumer Behaviour, Harcourt College Pub, NY.
- YOUNG, W., HWANG, K., MCDONALD, S. and OATES, C. J., 2010. Sustainable consumption: green consumer behaviour when purchasing products. Available from OpenAIR@RGU. [online]. Available from: http://openair.rgu.ac.uk
- Gary Akehurst, Carolina Afonso, Helena Martins Gonçalves, (2012) "Re-examining green purchase behaviour and the green consumer profile: new evidences", Management Decision, Vol. 50 Issue: 5, pp.972-988, https://doi.org/10.1108/00251741211227726
- do Paço, A., Alves, H., Shiel, C. and Filho, W. L. (2013), Development of a green consumer behaviour model. International Journal of Consumer Studies, 37: 414–421. doi:10.1111/ijcs.12009
- Dr. Pierre Sonigo, J. B. (2012). Policies to encourage sustainable consumption.
- Terlau, W., & Hirsch, D. (2015). Sustainable Consumption and the Attitude-Behaviour-Gap Phenomenon - Causes and Measurements towards a Sustainable Development, 6(3), 159–174.

Assignments and Grading Scheme

Grading System

0 to 100 (where 60 is the least pass mark)

Grading Policy

Grades are based on the following:

Assignments	10%
Class attendance/participation	10%
Group Project	40%
Midterm Exam	20%
Final Exam	20%
Total Points	**100**

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to come to ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assigned material before you come to class. I expect active class participation, which counts for 20% of the grade.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by- case basis.

Important Dates to Remember

Course Schedule

Week	Topics to be covered
1	**Course Overview:** Discussion of syllabus and assignments, course requirements and prerequisites; Criteria for student selection
2	Cross-Cultural Consumer Behavior
3	Consumer Perception
4	Consumer Learning
5	Green Consumption
6	Consumer Motivation, Personality, and Emotion
7	Midterm Exam
8	Consumer Attitude
9	Consumer Influences
10	Consumer Decision Making Process
11	Consumer Decision Making Process
12	Projects Presentations
13	Revision

Course	Food security and consumer Behavior
Module 1	Introduction to Consumer Behavior
Key Concepts	Cross-Cultural Consumer Behavior, Consumer Perception, Consumer learning
Overview	Students will be introduced to consumers and the meaning of consumption. They will learn about the concept of culture and how does culture set boundaries for individual behavior which affects the consumer behavior in different ways. Moreover, they will get exposed to the nature of perception and how marketers use their knowledge of perception to enhance strategies. Questions to be addressed in this module include the following: who are the consumers? What is meant by the term culture? What is a norm? From what are norms derived? What is information processing? How does it differ from perception? What is learning? What is memory? All in relation to green and ecofriendly products.
Aim	The overriding aim of this module is to introduce students to the basics of consumer behavior.
Learning Outcomes	At the end of this module learners will be able to: • Identify and explain factors which influence consumer behavior. • In a team, work effectively to prepare a professional, logical and coherent report on consumer behavior issues within a specific context.
Units	4. Cross-Cultural Consumer Behavior 5. Consumer Perception 6. Consumer Learning
Readings	Hawkins, Del I. Consumer behavior: building marketing strategy / Del I. Hawkins, David L. Mothersbaugh.—11th ed.

<table>
<tr><td>Activity</td><td>5. Class Activity 1: Starbucks Keeps It Brewing in Asia Case

Students have to communicate via Moodle in a forum discussion to elaborate on this case

6. Assignment 2: Select a green product that you feel has a good product position and another one that has a weak position. Justify your selection. Describe an ad or package for each product and indicate how it affects the product's position. This assignment is a collaborative assignment as 3 groups have to communicate virtually to achieve it

7. Project Phase 1: Project Focus
This project is to apply the consumer behavior tools and concepts to the development of a real-world marketing strategy that fits the consumer behavior for a high involvement green and ecofriendly product. Students should integrate all the concepts discussed in the course. This phase will require
a. Selecting a company
b. Industry overview and business environment analysis
c. Product category identification</td></tr>
<tr><td>SD Pillars</td><td>environment</td><td>economy</td><td>social</td><td>culture</td></tr>
<tr><td>21st ESD</td><td>Learning to know
✓</td><td>Learning to be
✓</td><td>Learning to do
✓</td><td>Learning to live together
✓</td><td>Learning to transform oneself and society
✓</td><td>Learning to give and share
✓</td></tr>
<tr><td>SDGs</td><td>1 ✓</td><td>2 ✓</td><td>3 ✓</td><td>4</td><td>5</td><td>6</td><td>7 ✓</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12 ✓</td><td>13 ✓</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td>ECTs Workload</td><td>Lecture</td><td>Online</td><td>Lab</td><td>Reading</td><td>Course activity</td><td>Project</td><td>Prepare exam</td><td>Writing exam</td><td>Total</td></tr>
<tr><td></td><td>3</td><td>2</td><td></td><td>5</td><td>5</td><td>10</td><td></td><td></td><td>25</td></tr>
<tr><td>Vision 2030</td><td colspan="9">Directing consumer behavior towards green products aid the 2030 vision by decreasing the consumption of products that consume natural resources, water and non-renewable</td></tr>
</table>

	energy. Therefore, this module supports the SDGs 1, 2, 3, 7, 13, and particular Goal 12 that address sustainable consumption and production.

Module 2	Green Consumption and Consumer behavior
Key Concepts	Green Consumption, Consumer Motivation, Personality, and Emotions
Overview	Developing more environmentally sustainable consumption and production systems depends upon consumers' willingness to engage in greener consumption behaviors. Green consumption is a form of consumption that cope with the modern actions to protect the environment and the over consumption of natural resources. The change in consumer behavior toward green products is a long process that depends on several variables such as, personality, emotions, and motivations. Consumer motivations are energizing forces that activate behavior and provide purpose and direction to that behavior. There are numerous motivation theories. Maslow's need hierarchy states that basic motives must be minimally satisfied before more advanced motives are activated. The personality of a consumer guides and directs the behavior chosen to accomplish goals in different situations. Brands, like individuals, have personalities, and consumers tend to prefer products with brand personalities that are pleasing to them. Consumers also prefer advertising messages that portray their own or a desired personality. Emotions are strong, relatively uncontrollable feelings that affect our behavior. They affect consumers' thoughts and behaviors. Questions to be addressed in this module include the following: What is green consumption? How can Motivation, Personality, and Emotions grab consumer attention toward green products? What is a motive? What is the relationship between involvement and motivation? What is personality? What is an emotion?
Aim	The aim of this module is to emphasize the concept of Green Consumption and to link consumer motivation, personality, and emotions toward buying green products.
Learning Outcomes	• Demonstrate how knowledge of consumer behavior can be applied to green marketing. • Demonstrate awareness and ability to discourse on ethical issues in using social media and social networking tools in green marketing. • Analyze the competitive advantages and risks associated with green consumption.
Units	8. Green Consumption 9. Consumer Motivation, Personality, and Emotion

Readings	1. Hawkins, Del I. Consumer behavior: building marketing strategy / Del I. Hawkins, David L. Mothersbaugh.—11th ed. 2. João Pedro Pereira Luzio, Fred Lemke, (2013) "Exploring green consumers' product demands and consumption processes: The case of Portuguese green consumers", European Business Review, Vol. 25 Issue: 3, pp.281-300, https://doi.org/10.1108/09555341311314825 3. do Paço, A., Alves, H., Shiel, C. and Filho, W. L. (2013), Development of a green consumer behaviour model. International Journal of Consumer Studies, 37: 414–421. doi:10.1111/ijcs.12009
Activity	**Assignment 1:** Develop an advertisement for one of the following items in based on relevant motives from McGuire's set. • ISIS Organic Products (one of the eco-friendly products) • Sekem Herbs Sharing this advertisement on Moodle is one of the requirements to the assignment and each student select one advertisement and give a comment in a forum discussion via Moodle. **Project Phase 2:** Consumer Behavior Analysis e. Consumer perception f. Consumer Learning g. Green consumption h. Consumer Motivation, Personality, and Emotions

SD Pillars	**environment**	**economy**	**social**	**culture**

21st ESD	Learning to know	Learning to be	Learning to do	Learning to live together	Learning to transform oneself and society	Learning to give and share
	✓	✓	✓	✓	✓	✓

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals	✓	✓	✓				✓	✓				✓	✓				

ECTs Workload	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	6	2		10	5	3			26

Vision 2030	The consumer perception, motivation, personality, and emotions plays a key role in coping with environmental issues and climate change and will greatly aid the accomplishment of Vision 2030 by changing the mentality of the consumer and increasing his consciousness about the risks caused by consuming some conservative products rather than green products.
Module 3	**Consumer attitudes and Influences**
Key Concepts	Attitudes and influences
Overview	Attitudes can be defined as the way people think, feel, and act toward some aspect of their environment. Attitudes influence, as well as reflect, the lifestyle individuals pursue. Its change strategies can focus on affect, behavior, cognition, or some combination. Attempts to change affect generally rely on classical conditioning Change strategies focusing on behavior rely more on operant conditioning. Attitudes differ from situations, as that a situation is a set of factors outside of and removed from stable characteristics of the individual consumer and focal stimulus. Four categories of situations are communications, purchase, usage, and disposition situations. Situational influences may have direct influences, but they also interact with product and individual characteristics to influence behavior. In some cases, the situation will have no influence whatsoever, because the individual's characteristics or choices are so intense that they override everything else. But the situation is always potentially important and therefore of concern to marketing managers. Questions to be addressed in this module include the following: What is an attitude? What are the components of an attitude? What is meant by the term situation? Why is it important for a marketing manager to understand situational influences on purchasing behavior? Describe a process for developing a situation-based marketing strategy.
Aim	The aim of this module is to express the consumer attitudes and what influences these attitudes.
Learning Outcomes	• Identify and explain factors which influence consumer behavior. • Demonstrate how knowledge of consumer behavior can be applied to marketing. • Gain, evaluate and synthesize information and existing knowledge from a number of sources and experience. • Demonstrate awareness and ability to discourse on ethical issues.
Units	10. Consumer Attitudes 11. Consumer Influences
Readings	1. Hawkins, Del I. Consumer behavior: building marketing strategy / Del I. Hawkins, David L. Mothersbaugh.—11th ed.

Activity	**Assignment 1:** Find and copy two magazine or newspaper advertisements, one based on the affective component and the other on the cognitive component. Discuss the approach of each ad in terms of its copy and illustration and what effect it creates in terms of attitude. Also discuss why the marketer might have taken that approach in each advertisement. **Project Phase 3: Recommended Marketing Strategy that fits the following:** b. Consumer attitude c. Consumer influences

SD Pillars	**environment**	**economy**	**social**	**culture**

21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals	✓	✓	✓			✓		✓			✓	✓	✓		✓		

ECTs Workload	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	6			5	5	5	4		25

Vision 2030	Attitudes influence the lifestyle individuals pursue. Its change strategies can focus on affect, behavior, cognition, or some combination. Consumer attitudes are based on the environment and culture they were raised on. Also the surrounding consumer influences has a great impact on the consumer purchase decision. Therefore, it must aid the sustainable development aspects. the purpose of this module is to change the consumer attitude and to raise their conciseness about the misleading influences that they face in their daily life .

Module 4	**Consumer decision making process**
Key Concepts	Consumer decisions, process of problem recognition

Overview	Consumer decision making becomes more extensive and complex as purchase involvement increases. It starts from problem recognition, Problem recognition involves the existence of a discrepancy between the consumer's desired state (what the consumer would like) and the actual state (what the consumer perceives as already existing). Before marketing managers can respond to problem recognition generated by outside factors, they must be able to identify consumer problems. Surveys and focus groups using activity, product, or problem analysis are commonly used. Human factors research approaches the same task from an observational perspective. Emotion research focuses on the role of emotions in problem recognition and resolution. Managers may attempt to minimize or suppress problem recognition by current users of their brands.			
Aim	The aim of this module is to experience the different stages of the decision making process and to get familiar with the problem recognition process.			
Learning Outcomes	• Identify and explain factors which influence consumer behavior. • Demonstrate how knowledge of consumer behavior can be applied to marketing. • Gain, evaluate and synthesize information and existing knowledge from a number of sources and experience. • In a team, work effectively to prepare a professional, logical and coherent report on consumer behavior issues within a specific context. • Deliver an oral presentation in a professional and engaging manner. • Demonstrate awareness and ability to discourse on ethical issues.			
Units	8. Consumer decision making process			
Readings	1. Hawkins, Del I. Consumer behavior: building marketing strategy / Del I. Hawkins, David L. Mothersbaugh.—11th ed.			
Activity	**Assignment 1:** Interview three students and identify five products that each buys using a nominal decision process. Identify those that are based on brand loyalty and those that are merely repeated purchases. What characteristics, if any, distinguish the brand loyal products from the repeat products? Each student will do PPT presentation that summarize the interviews to be introduced via adobe connect. **Project Phase 3: Recommended Marketing Strategy that fits the following:** a- Consumer decision making process. b- Final Submission & Presentation.			
SD Pillars	**environment**	**economy**	**social**	**culture**

21st ESD	Learning to know ✓		Learning to be ✓			Learning to do ✓			Learning to live together ✓			Learning to transform oneself and society ✓					Learning to give and share ✓
SDGs **Sub goals**	1 ✓	2 ✓	3 ✓	4	5	6	7	8	9	10	11 ✓	12 ✓	13 ✓	14	15	16	17

ECTs Workload	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	3	6		5	5	5	3		27

Vision 2030	This module has a great effect in achieving vision 2030 goals. Problem recognition is the base of decision making. If the consumer can recognize the problem of the climate change, his decision will change regarding the products he consumes. Therefore, consumer can shift to consume green and environmental friendly products and services that will aid vision 2030

Module 5	Sustainable Consumption Behaviors
Key Concepts	Sustainable consumption Behaviors and motivations toward sustainable consumptions
Overview	Sustainable consumer behavior is consumers' behaviors that enhance social and environmental performance as well as meeting their needs. During the last decades, sustainable production has grabbed the attention of researchers and policy makers under the assumption that the growing green values of consumers will cause a growing sustainable consumption behavior. On the other side, the main barriers for consumer toward consuming sustainable products are the price and availability in the market. Consumers are motivated to consume sustainably. Their motivations are mostly driven by their inborn psychological need to be part of the society and care for other members of that society. The importance of sustainable consumption as a way to raise common links has practical influences for policy makers and firms toward promoting consumers to embrace sustainable consumption practices.
Aim	The aim of this module to explore the sustainable consumption behaviors, how consumers started adopting this consumption treats, how the sustainable consumption patterns are increasing worldwide, and why and how consumers are motivated towards such consumption.
Learning Outcomes	• Identify and explain factors which influence sustainable consumer behavior. • Demonstrate how policy makers and firms coping with sustainable consumer behavior. • Gain, evaluate and synthesize information and existing knowledge from a number of sources and experience. • Deliver an oral presentation in a professional and engaging manner. • Demonstrate awareness and ability to discourse on ethical issues.
Units	9. Sustainable Consumer Behavior 10 Motivations towards sustainable consumption
Readings	Dr. Pierre Sonigo, J. B. (2012). *Policies to encourage sustainable consumption*. Terlau, W., & Hirsch, D. (2015). Sustainable Consumption and the Attitude-Behaviour-Gap Phenomenon - Causes and Measurements towards a Sustainable Development, *6*(3), 159–174.

Activity	• **Activity 1:** There's not one universally accepted definition of "sustainable consumption." Based on what you've learned, how would you define the term? • **Activity 2:** In your opinion, what procedures shall your country's government take to promote and motivate sustainable consumption?

SD Pillars	**environment**	**economy**	**social**	**culture**

21st ESD	Learning to know	Learning to be	Learning to do	Learning to live together	Learning to transform oneself and society	Learning to give and share
	✓	✓	✓	✓	✓	✓

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals	✓	✓	✓			✓	✓					✓					

ECTs Workload	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	6	2		5	5	5	2		25

Vision 2030	This module addresses the strategic dimensions of Egypt's Vision 2030. The first dimension is the environmental pillar. By promoting sustainable consumption, consumers would consume green, organic, and environmental friendly products which by its turn will preserve natural resources. The second dimension is the economic pillar. Environment is related to all economic sectors, therefore, sustainable consumption would shift demand patterns toward environmental friendly products which will increase the competition between manufacturers in the industries that will lead to producing better quality products that will return on Egypt with a clean, safe and healthy environment leading to diversified production

	resources and economic activities, supporting competitiveness, and providing new jobs.

<table>
<tr><th>Module 6</th><th colspan="6">Sustainable Consumption & Production Success Stories</th></tr>
<tr><td>Key Concepts</td><td colspan="6">Actual success stories in promoting and applying sustainable consumption and production</td></tr>
<tr><td>Overview</td><td colspan="6">An introduction to the most succeeding and influencing stories. These success stories will demonstrate the practical work of the course. It will also emphasize how these stories' founders grabbed the public toward sustainable consumption, how did they motivated consumers to consume less and better products, what was the idea behind their thoughts, and what their vision is.</td></tr>
<tr><td>Aim</td><td colspan="6">The aim of this module is to familiarize the participants with real success stories in sustainable consumption and production and to give them an activity to innovate and idea that might grab the attention of consumers toward sustainable consumption and production in their local area, society, or even the whole country.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• In a team, work effectively to prepare a professional, logical and coherent idea on promoting sustainable consumption and production within a specific area or country.
• Gain, evaluate and synthesize information and existing knowledge from a number of sources and experience.
• Deliver an oral presentation in a professional and engaging manner.</td></tr>
<tr><td>Units</td><td colspan="6">11 Success Stories</td></tr>
<tr><td>Readings</td><td colspan="6">• Dr. Pierre Sonigo, J. B. (2012). Policies to encourage sustainable consumption.
• http://u4614432.fsdata.se/wp-content/uploads/2013/09/120629SuccessStoryNamibia.pdf
• http://www.whysgbs.org/responsible-consumption/</td></tr>
<tr><td>SD Pillars</td><td colspan="2">environment</td><td colspan="2">economy</td><td colspan="2">social</td><td>culture</td></tr>
<tr><td>21st ESD</td><td>Learning to know
✓</td><td>Learning to be
✓</td><td>Learning to do
✓</td><td>Learning to live together
✓</td><td>Learning to transform oneself and society
✓</td><td>Learning to give and share
✓</td></tr>
</table>

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals	✓	✓	✓			✓	✓					✓					

ECTs Workload	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	6	2		5	5	5	3		26

Vision 2030	This module ideas generated by participants would help the government to promote sustainable consumption and production because the ideas come from regular consumers that consume any products without being caution regarding it environmental damages.
Community Based learning Activity	**Overview:** The activity consists of a group project that covers most of the course modules. Participants will engage with the community to experience different consumer behaviors and attitudes through observation. They will also contact the targeted groups personally in their chosen community to influence them to consume green products. Students should be divided into groups of 4 – 5 Participants and each group will choose a community for the implementation of their activity. **Goal:** The goal is to engage students with the consumers and experience the different consumer behaviors and attitudes **purpose of community or service learning component:** to convince consumers to consume green products **The expected learning outcomes** Observe consumers behavior. Experience different consumers' attitude. **Actual Community Needs**

	Increase awareness regarding green consumption

Phase	Duration	Description
Phase 1	2 days	Each Group should search and select retail within a certain community where they will apply their activities. (must be organized with the reta
Phase 2	7 days	The group will make a field trip to their chosen community and observ the consumers' behaviour in that retail in the regards of the Ads they perceive, their purchased products, purchased amounts, and disposal method.
Phase 3	7 days	Analyse the observation of the community's consumption of food products and determine the most consumed products and is it a need a want.
Phase 4	14 days	Choose one of the most consumed products and seek its alternative green/sustainable product then engage with consumers and speak wi them about the product and its differences & advantages. And docume your engagement.
Phase 5	7 days	Analyse and Reflect on your engagement with the consumers and note the different consumers' attitude and motivation.
Phase 6		Presentation

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**						**Workload**
				1	**2**	**3**	**4**	**5**	**6**	
Lectures (face-to-face)	10	3	30	3	6	6	3	6	6	30
Online	6	2	12	2	2		6	2	2	12
Lab work										
Reading articles (3 pages per hour)	60	0.3	20	3	5	3	3	3	3	20
Reading book chapters (5 per/h)	75	0.5	15	2	5	2	2	2	2	15
Preparing course activities	2	12.5	25	5	5	5	5	5	5	25
Project work	2	16	33	10	3	5	5	5	5	33
Preparation for exam	4	3	12			4	3	2	3	12

Writing the exam	2	3	6							6
Total			**152**	**25**	**26**	**25**	**25**	**25**	**26**	**152**

SDGs RUBRIC

SDGs		**CLIMATE CHANGE**	**SUSTAINABLE AGRICULTURE**	**FOOD SECURITY**	**COURSE MODULE**
1	End poverty in all its forms everywhere	√	√	√	2 & 3 & 4
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture				
3	Ensure healthy lives and promote well-being for all at all ages				
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				
5	Achieve gender equality & empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all				
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation	√	√	√	1 & 6
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				

12	Ensure sustainable consumption and production patterns	√	√	√	1 & 6 & 5 & 4
13	Take urgent action to combat climate change and its impacts		√		2
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss				
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, & build effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS

Environmental Governance (CSAF 855)

Developed by Prof. Dr.Esam A. Hussein, Botany and Microbiology Department, Faculty of Science, Al-Azhar University

Instructor Information

Instructor: Prof. Dr. Esam A. Hussein

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Course Identification

Course Number: CSAF 855

Course Name: Environmental Governance

Course Location

Class Times:

Prerequisites:

Faculty Web Page:

Course Description/Overview

Governing our planet's rich and diverse natural resources is an increasingly complex challenge. In our globalized world of interconnected nations, economies and people, managing environmental threat, particularly those that cross political borders such as air pollution and biodiversity loss, will require new global, regional, national and local responses involving a wide range of stakeholders. This course provides an adequate understanding of the fundamentals of environmental governance, the limitations and challenges facing environmental governance, and applications of environmental governance; climate change and ecosystem degradation. This course, further, portrays the relationship between ecosystems and the human well-being giving prominence to the human transformation and the drivers of change, namely, the demographic, economic and socio-political drivers. The course provides a thorough detailed explanation of the rise of environmental politics and highlights the political, ethical, economic and legal perspectives of the environmental governance. Sustainable development relationship with environmental governance was also an aim of this course highlighting the SDGs offered by the United Nations. Environmental development, governance and tools are given a great portion in the course that would help students provide presentations about the different environmental governance issues in the Egyptian context.

Course Learning Objectives

By the end of the course, students will be familiar with:

1) The process through which international environmental governance is made;
2) The different actors in the environmental governance arena;
3) The effective environmental regimes: obstacles to creating strong environmental regimes, and opportunities to improve compliance with global environmental conventional;
4) The histories and strengths and weaknesses of environmental laws in Egypt and the entity primarily responsible for administering environmental statutes;
5) The important players in both global as well as national environmental politics and policymaking;
6) The scientific controversies related to estimating the human and environmental impacts of global biodiversity loss, ozone depletion, and climate change, the policy options available for addressing these impacts, and the political struggles

surrounding both the estimates of potential damage and the proposed policy responses;

7) The essential tools of environmental governance analysis, including the assessment of trade-offs, benefits, costs, cost-effectiveness, political feasibility, equity, and justice.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

- Understand basic environmental governance principles
- Recognize the complexity of the concept of sustainable development
- Define the essential tools of governance analysis
- Identify the various drivers of change in human transformation of ecosystem.
- Illustrate the rise of environmental politics.
- Link sustainable development and environmental governance.
- Identify the political, ethical, economic and legal perspectives of the environmental governance.
- Elaborate the importance of environmental policy-making.
- Identify the global environmental issues on the policy agenda.
- Demonstrate understanding of the environmental development.
- Define the SDGs of the United Nations.
- Relate the SDGs to the goals of the environmental governance.
- Provide presentations on different environmental governance issues in the Egyptian context.

Course Resources

Video class, texts, book chapters, papers and reports, etc

Course Website(s)

Required Course Texts and Materials

Hand-out prepared by the instructor for the class

Optional course Texts and Materials

Lemos MC, Agrawal A. 2006. Environmental Governance. Annu. Rev. Environ. Resour. 31: 297-325.

doi: 10.1146/annurev.energy.31.042605.135621

Armitage D, Loe R, Plummer R (2012). Environmental governance and its implications for conservation practice. Conservation Letters 5(4): 245-255. https://doi.org/10.1111/j.1755-263X.2012.00238.x

Ludwig K, Kok M. (2018). Exploring new dynamics in global environmental governance- literature review. PBL Netherlands Environmental Assessment Agency.

Activities and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading policy

Grades can be based on the following:

Activities	**40**
Class attendance/participation	**20**
Final Exams	**40**
Total Points	**100**

Course policies

Late Activity

It is important that papers and other activities be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to attend ALL classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive to class on time and stay until the class period ends. If you know that you have to leave early, you should notify me before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and/or leaving and re-entering

during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and though about the assigned material before you come to class. I expect active class participation.

Disability

Students who have disabilities should have a confidential appointment to discuss their need for accommodations. Establishing reasonable accommodations should be considered on a case-by-case basis.

Important Dates to Remember

Course schedule

Week	**Date**	**Topics, Reading, Activities and Deadline (details on Activities and more bibliography are available in the course modules)**
1		**Course overview:** Discussion of syllabus and Activities, course requirements and prerequisites, criteria for student selection
2		Global environmental governance and perspectives on environmental problems
3		Ecosystems and human well-being
4		Human transformation of the Earth: drivers of change
5		Rise of environmental politics
6		Sustainable Development and environmental governance
7		Political, ethical, economic and legal perspectives
8		Importance of environmental policy-making
9		Global Environmental issues on the policy agenda
10		Environmental development
11		Environmental governance tools

Week	Date	Topics, Reading, Activities and Deadline (details on Activities and more bibliography are available in the course modules)
12		The Sustainable Development Goals of the United Nations
13		Students' presentations on different environmental governance issues
14		Reporting and seminars

SUMMARY OF THE 5 ECTS STUDENTS WORKLOAD

Learning Components	No	Time Factor	Work load	Course Modules					Workload
				1	2	3	4	5	
Lectures (face-to-face)	16	1	16	4	4	4	2	2	16
Online	4	2	6	2	2	2	1	1	8
Lab work	9	2	16	4	4	4	3	3	18
Reading articles (3 pages per hour)	50	0,3	15	3	3	3	3	3	15
Reading book chapters (5 per/h)	50	0.2	10	2	2	2	2	2	10
Preparing course activities	2	10 (M)	20	4	4	4	4	4	20
Project work	1	10	10	-	2	-	2	6	10
Preparation for exam	1	50	50	-	10	-	20	20	50
Writing the exam	1	3	3	-	-	-	-	3	3
Total			146	19	31	19	37	44	150

Course	Environmental Governance

Module 1	**Global environmental governance and ecosystems-human well-being relationship**
Key Concepts	Concepts of environmental governance, sustainable development, natural ecosystems, environmental problems, social dilemma, environmental values
Overview	This module introduces the main concepts and ideas of environmental governance, giving the due weight to the natural ecosystems and their services. The module elaborates the tools that governments use to regulate the environmental behaviour of both companies and citizens. The module further highlights the environmental problems as social dilemma and portrays the values associated with the environment with reference to the global environmental governance. Ecosystems are also explored in relation to the human well-being via the exploration of the key components of human well-being as well as the linkages between ecosystem services and human well-being.
Aim	The overriding aim of this module is to familiarize students with the main concepts of the governance system in their country with a good understanding of the accompanying problems that might constitute a social dilemma for their people. The module also aims to raise the students' awareness of the natural ecosystems services and the values associated with the environment.
Learning Outcomes	By the end of this module, students will be able to: 1. Identify the natural ecosystems in their country. 2. Recognize the services provided by the natural ecosystems in their local community. 3. Understand environmental problems as social dilemmas 4. Identify the values associated with the environment 5. Identify the key components of human well-being 6. Acknowledge the importance of ecosystem services towards human well-being 7.
Units	Unit 1: Global environmental governance and perspectives on environmental problems 1.1. Natural ecosystems and their services 1.2. Environmental problems as social dilemmas 1.3. Values associated with the environment

	Unit 2: Ecosystems and human well-being 2.1.Key components of human well-being 2.2.Linkages between ecosystem services and human well-being
Readings	1. Lemos, M. C., & Agrawal, A. (2006). Environmental governance. Annu. Rev. Environ. Resour., 31, 297-325. 2. TDryzek, J. S. (2013). The politics of the earth: Environmental discourses. Oxford university press. 3. The Global Environmental Governance Project: https://www.environmentalgovernance.org/ 4. Kutting, G. (2011). *Global Environmental Politics: Concepts, Theories and Case Studies*. Oxon: Routledge. 5. Biermann, F. & P. Pattberg (2012). *Global Environmental Governance Reconsidered.* Cambridge: MIT Press. 6. Assessment, M. E. (2005). *Ecosystems and human well-being*(Vol. 5). Washington, DC: Island press. 7. Alcamo, J. (2003). *Ecosystems and human well-being: a framework for assessment* (p. 245p). Island Press, Washington, DC, USA.
Activities	**Assingment1a:**Students are asked to browse the sites below and write a report on each in at least one page for each site giving the due attention to the main concepts of the environmental governance and natural ecosystems: • World Meteorological Organization (WMO) • United Nations (UN) • United Nations Environment Programme (UNEP), (Geneva, Nairobi) • United Nations Framework Convention on Climate Change (UNFCCC) • United Nations and Climate Change • Convention on Biological Diversity (CBD) • Convention on Long-Range Tran boundary Air Pollution • Global Environment Facility (GEF) • Linkages by International Institute for Sustainable Development (IISD) • IPCC Data Distribution Centre • The Ozone Secretariat, UNEP • United Nations Convention to Combat Desertification **Activity1b:** In groups, students are asked to discuss the reports they wrote about the websites on Activity 1a and write a group report on

	issues that are very relevant to environmental governance to be presented to the whole class. **Activity1c:**In groups, students design a poster or a flowchart of the main concepts of the environmental governance and natural ecosystems.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
			√	√							√		√		√		

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	4	**2**	**4**	**5**	**4**	**-**	**-**	**-**	**19**

Module 2	**Human transformation of the Earth**
Key Concepts	Drivers of human change, demographics, economics, socio-politics, science and politics, culture and religion.
Overview	In this module, students will learn about the drivers of change in human transformation. The module covers the demographic drivers; namely, the population size, age and gender structure, and spatial distribution; the economic drivers, i.e. national and per capita income, macroeconomic policies, and international trade; the socio-political drivers such as democratization, roles of women and local communities, role of private sector; as well as the scientific and technological drivers in terms of research, development, and adoption of new technologies. The module also reviews the cultural and religious drivers that lie behind human transformation in earth in terms of choices individuals make about what and how to consume and what they value.
Aim	The overriding aim of this module is to analyse the major change drivers in human transformations and categorize them according to their types. Students are also expected to reflect on such drivers paving the way for solutions to some environmental problems related to such drivers.
Learning Outcomes	By the end of this module, students will be able to: 1. Identify drivers of change in human transformations.

	2. Categorize the drivers of change into its main categories. 3. Contrast the different drivers of change. 4. Collect and analyse data related to the different drivers of change. 5. Solve problems related to the human transformations drivers.
Units	**Unit 3: Human transformation of the Earth: drivers of change** 3.1. Demographic drivers (population size, age and gender structure, and spatial distribution) 3.2. Economic drivers (national and per capita income, macroeconomic policies, international trade) 3.3. Socio-political (democratization, roles of women and local communities, role of private sector) 3.4. Scientific and technological (research and development, adoption of new technologies) 3.5. Cultural and religious (choices individuals make about what and how to consume and what they value).
Readings	1. Armitage D, Loe R, Plummer R (2012). Environmental governance and its implications for conservation practice. Conservation Letters 5(4): 245-255. https://doi.org/10.1111/j.1755-263X.2012.00238.x 2. Bäckstrand, K and Saward, M. (2005) Democratizing Global Governance: Stakeholder Democracy at the World Summit for Sustainable Development. A paper presented at the annual meeting of the American Political Science Association; Chicago. 3. Bouteligier, S. (2013). Cities, Networks, and Global Environmental Governance: Spaces of Innovation, Places of Leadership. New York: Routledge. 4. Odada, E. O., Ochola, W. O., &Olago, D. O. (2009). Drivers of ecosystem change and their impacts on human well-being in Lake Victoria basin. *African Journal of Ecology*, *47*, 46-54. 5. Gunderson, L. H. (2001). *Panarchy: understanding transformations in human and natural systems*. Island press. 6. Roberts, N. (1996). The human transformation of the Earth's surface. *International Social Science Journal*, *48*(150), 493-510.
Activities	**Activity 2a:** In groups, with reference to the list of readings and the internet, students are asked to search for environmental problems that arouse from the human transformation, analyse the data, and suggest the solving of environmental problems in relation to the drivers of change. **Activity 2b:**Students are asked to design a table of the environmental problems matched with the drivers of change in human transformation and

<table>
<tr><td></td><td colspan="16">discuss the solutions with their groups. After discussions, all group reports are orally presented and discussed with the whole class.

Activity 2c:Students are asked to link some drivers of change to real problems in their community suggesting true solutions to them, such as choices individuals make about what and how to consume and what they value.</td></tr>
<tr><td>10Cs/6 LEARNINGGOALS</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
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<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
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<tr><td>ECTS WORK LOAD</td><td colspan="2">Lecture</td><td colspan="2">Online</td><td colspan="2">Lab</td><td colspan="2">Reading</td><td colspan="2">Course activity</td><td colspan="2">Project</td><td colspan="2">Prepare exam</td><td colspan="2">Writing exam</td><td>Total</td></tr>
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<tr><td>Module 3</td><td colspan="16">Environmental governance: political, ethical, economic, and legal perspectives</td></tr>
<tr><td>Key Concepts</td><td colspan="16">Environmental politics, environmental management and policy, public goods, externalities, sustainability and intergenerational justice.</td></tr>
<tr><td>Overview</td><td colspan="16">This module tackles the rise of the environmental politics giving due attention to those regulations related to Stockholm and Rio Earth Summit. It also explores the international environmental management and policy instruments including environmental regulations, market creation, market use, public engagement, direct provisions, and international treaties. The module also explores the political, ethical, economic and legal perspectives of environmental governance in terms of tragedy of the commons, public goods, externalities, and sustainability and intergenerational justice.</td></tr>
<tr><td>Aim</td><td colspan="16">The overriding aim of this module is turn student’s aware to the rise of environmental politics and instruments of international environmental management and policy. Special interest also is given to political ethical, economic and legal perspectives.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="16">By the end of this module, students should be able to:

1. Describe the rise of the environmental politics.
2. Exemplify the environmental policies and regulations in their local community.
3. Identify the political perspectives of the international environmental management and policy.</td></tr>
</table>

	4. Report on the tragedy of the commons and public goods. 5. Discuss the principles of sustainability and intergenerational justice. 6. Design some applications of the international environmental management and policy instruments that could be beneficial to natural environmental resources.
Units	**Unit 4:Rise of environmental politics** 4.1.Stockholm, Rio Earth Summit 4.2.International environmental management and policy instruments: voluntary, regulatory and socio-economic incentives **Unit 5:Political, ethical, economic and legal perspectives** 5.1.Tragedy of the commons 5.2.Public Goods 5.3.Externalities 5.4.Sustainability and intergenerational justice
Readings	1. Rosenbaum, W. A. (2016). *Environmental politics and policy*. CQ press. 2. Lester, J. P. (1995). *Environmental politics and policy: theories and evidence*. Duke University Press. 3. Hajer, M., & Versteeg, W. (2005). A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. Journal of environmental policy & planning, 7(3), 175-184. 4. Chasek, P. S., Downie, D. L., & Brown, J. (2009). *Global Environmental Politics (Dilemmas in World Politics)*. Westview Press Incorporated. 5. Steinberg, P. F., &Van Deveer, S. D. (Eds.). (2012). *Comparative Environmental Politics: theory, practice, and prospects*. MIT Press.
Activity	**Activity 3a:** Students will be asked for collecting and analyzing data related to a national, regional or global environmental problem as well as analysing the environmental policies adopted to face this problem **Activity 3b:** Each student will be responsible for serving as a class discussion leader twice during the quarter.

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
		√						√			√			√	√		

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	4	**2**	**4**	**5**	**4**	**-**	**-**	**-**	**19**

Module 4	**Sustainable Development and environmental governance**
Key Concepts	Sustainable Development, environmental governance, SDGs, strategies of natural ecosystems, ecosystem management
Overview	This module covers the 17 sustainable development goals of the united nations to be lined with the environmental governance. The module highlights the strategies that ensure sustainability of both natural ecosystems and human well-being, integrating economic, environmental, social and cultural aspirations into the SDGs. Integrating information from natural and social sciences and Harmonizing the use of ecosystem services with human needs as well as facilitating integrated ecosystem management is also covered by the current module.
Aim	The main aim of this module is to raise the students' awareness of the SDGs developed by the United Nations which entail 17 life goals. Such awareness-raising is used in developing a wide repertoire of strategies that ensure sustainability of both natural ecosystems and human well-being.
Learning Outcomes	By the end of this module, students should be able to: 1. Identify the Sustainable Development Goals of the United Nations. 2. Link the SDGs to the environmental governance principles and practices. 3. Develop strategies to ensure sustainability of both natural ecosystems and human well-being. 4. Integrate economic, environmental, social and cultural aspirations. 5. Integrate information from natural and social sciences. 6. Harmonize the use of ecosystem services with human needs. 7. Facilitate integrated ecosystem management.
Units	**Unit 6: The Sustainable Development Goals of the United Nations** **Unit 7: Sustainable Development and environmental governance** 7.1. Strategies to ensure sustainability of both natural ecosystems and human well-being 7.2. Integrating economic, environmental, social and cultural aspirations 7.3. Integrating information from natural and social sciences 7.4. Harmonizing the use of ecosystem services with human needs

	7.5. Facilitating integrated ecosystem management. **Unit 8: Environmental development** 8.1. Case study: climate change and the Kyoto Protocol (An Inconvenient Truth) 8.2. Other Case studies related to environmental development in Egypt
Readings	1- Kemp, R., Parto, S., & Gibson, R. B. (2005). Governance for sustainable development: moving from theory to practice. *International journal of sustainable development*, *8*(1-2), 12-30. 2- Glasbergen, P., Biermann, F., & Mol, A. P. (Eds.). (2007). *Partnerships, governance and sustainable development: Reflections on theory and practice*. Edward Elgar Publishing. 3- Lafferty, W. M. (Ed.). (2006). *Governance for sustainable development: the challenge of adapting form to function*. Edward Elgar Publishing. 4- Erkuş-Öztürk, H., &Eraydın, A. (2010). Environmental governance for sustainable tourism development: Collaborative networks and organisation building in the Antalya tourism region. *Tourism management*, *31*(1), 113-124. 5- van ZeijlRozema, A., Cörvers, R., Kemp, R., & Martens, P. (2008). Governance for sustainable development: a framework. *Sustainable Development*, *16*(6), 410-421. 6- Makarova, M. B., Yarkov, M. A., &Sevastyanova, I. G. (2018). About the Concept of Environmental Development of the Perm Region. *Intellekt. Sist. Proizv.*, *16*(2), 139-144.
Activity	**Activity 4a:** Students will read and report about global environmental issues on the policy agenda. **Activity 4b**. Classroom discussion.

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√						√			√		√	√			

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	2	**1**	**3**	**5**	**4**	**2**	**20**	**-**	**37**

Module 5	**Environmental policy-making**

Key Concepts	Environmental policy-making, policy agenda, Biodiversity, ozone, climate change, international environmental politics
Overview	This module covers the importance of environmental policy-making highlighting examples for Egypt and other countries all over the world. The module also explores the global environmental issues on the policy agenda regarding major laws, players and politics biodiversity, ozone, climate change, dealing with risk and uncertainty, trade issues and international environmental politics.
Aim	The override aim of this module is to raise the interest of students towards the significance of the environmental policy making through providing pertinent examples from many inside and outside communities. The module also aims to provide students with a wide repertoire of examples regarding the global environmental issues and policy agenda of many countries. This might in turn help students develop some strategies to adopt and adapt some policy agendas from other countries that might help develop their environments and natural ecosystems.
Learning Outcomes	By the end of this module, students should be able to: 1. Recognize the importance of environmental development. 2. Exemplify the issues of environmental development from Egypt and other countries. 3. Discuss the major laws that govern the global policy agenda of environmental development. 4. Identify the role of players and politics in the global environmental development. 5. Analyze global environmental issues on the global policy agenda (biodiversity conservation, ozone depletion, climate change, etc.) 6. Examine risk and uncertainty issues in global environmental development. 7. Analyse trade issues and international environmental politics in the global environmental development.
Units	**Unit 9: Importance of environmental policy-making** 9.1. Examples from Egypt and others from around the world **Unit 10: Global Environmental issues on the policy agenda** 10.1. Major laws; players and politics 10.2. Biodiversity, ozone, climate change 10.3. Dealing with risk and uncertainty

	10.4. Trade issues and international environmental politics
Readings	1- Stenmark, M. (2017). *Environmental ethics and policy-making*. Routledge. 2- Palm, R. I. (2019). *Earthquake insurance in California: Environmental policy and individual decision-making*. Routledge. 3- Steinebach, Y., &Knill, C. (2017). Still an entrepreneur? The changing role of the European Commission in EU environmental policy-making. *Journal of European Public Policy*, *24*(3), 429-446. 4- Ricaurte, L. F., Patiño, J. E., Zambrano, D. F. R., Arias-G, J. C., Acevedo, O., Aponte, C., &Estupinan-Suarez, L. M. (2019). A Classification System for Colombian Wetlands: an Essential Step Forward in Open Environmental Policy-Making. *Wetlands*, 1-20. 5- Esty, D. C. (2018). Measurement matters: Toward data-driven environmental policy-making. In *Routledge Handbook of Sustainability Indicators* (pp. 494-506). Routledge.
Activity	**Activity 5a:** Students will read and report about global environmental issues on the policy making and policy agenda. **Activity 5b**. Students will be divided in two groups. First group will work with local communities to find out their need to solve the problem of waste management and waste recycling. Second group will evaluate the respond of local communities to governmental regulation regarding to waste management and recycling. Each group will prepare surveys then data will be analyzed. Feedback will be presented to all stakeholders from decision makers and local community leaders. Finally, outcomes reports will be presented by each group.

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√						√			√			√			

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	2	**1**	**3**	**5**	**4**	**6**	**20**	**3**	**44**

SDGs		CLIMATE CHANGE	SUSTAINABLE AGRICULTURE	FOOD SECURITY	COURSE MODULE
1	End poverty in all its forms everywhere		√	√	2, 4, 5
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		√	√	3, 4, 5
3	Ensure healthy lives and promote well-being for all at all ages				1, 2
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				1
5	Achieve gender equality & empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all		√		
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				3, 4, 5
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				1 - 5
12	Ensure sustainable consumption and production patterns		√	√	
13	Take urgent action to combat climate change and its impacts	√		√	1, 2, 4
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				2 - 5
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss		√		1 - 3
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, & build				

	effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS

Jerash University
Course Syllabus

Course Number ()

Course Title

Climate Change, Sustainable Agriculture, and Food Security

First Semester

Instructor Information

Instructor: Prof Nezar Samarah
Office Location: Faculty of Agriculture.
Telephone: 962797368144.
Office Hours: Sun and Monday: 10:00-11:00.
E-mail: nsamarah@just.edu.jo
Website: http://www.just.edu.jo/Pages/Default.aspx

Course Identification

Course Number:

Course Name: Climate change, sustainable agriculture, and food security.

Course Location: Faculty of Agriculture
Class Times:
Prerequisites:
Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Description/Overview

This course aims to address climate change and global warming and how climate change has an impact on crop production, food supply, and food security. The course describes the issue of increasing world population and the growing pressure on food demand. The course also describes the best cultural practices for sustainable crop production to meet the rising demand on food. The course covers the principles of sustainable agriculture including soil, crop, and pest managements.

Course Learning Objectives:

1) Provide students with the knowledge related with the predictions and trends in human population, food supply, and food security **[related to Sustainable Development Goal (SDG 2)]**.
2) Explain the terminology and concepts of food security and how to measure food insecurity **(SDG 2)**.
3) Explore the concepts, trends, and impacts of climate change and global warming on crop production **(SDG 13)**.
4) Describe the concepts of sustainable agriculture **(SDG 2, 5, 6, 13, 15)**.
5) Explain how sustainable agriculture practices needed to maintain agriculture production to cope with the increase in human population and climate change **(SDG 2, 5, 6, 15)**.
6) Study different practices related to community, marketing, soil, water, animal husbandry **(SDG 2, 5, 6, 15)**.

Course Content Learning Outcomes:

Upon the completion of this course, students will be able to:

1) Connect the rise in human population and the change in climate with less ability to supply food and food insecurity **(SDG 2)**.
2) Discuss the impact of climate change on food production of agricultural crops **(SDG 13)**.
3) Use sustainable food production practices that help maintain soil, improve land and soil quality, reduce soil degradation, strengthen capacity for adaptation to climate change (extreme weather, drought, and flooding), and consequently improve food production and supply **(SDG 6, 13, 15)**.
4) Demonstrate how sustainable agriculture help ends hungers by improving food production and incomes of small farmers and ensure access by all people to safe, nutritious, and sufficient food **(SDG 2, 5, 15).**
5) Use sustainable practices in managing nutrients and controlling insects, weeds, and diseases **(SDG 15).**
6) Integrate the genetic resources and diversity of crop species in sustainable management **(SDG 15).**

Teaching and Learning Approach

The teaching and learning methods for this course will include:

- A typical lecture using PowerPoint presentation and the backboard to present the teaching materials and highlight essentials topics and points for discussion. The lecture usually starts with a short review of the previous lecture then delivers the new materials. During the lecture, questions are initiated to induce the students' thinking and to trigger classroom discussion. Fifteen minutes before the end of the class, the lecture will be summarized to highlight the main objectives of this lecture and the outcomes of the learning.
- Collaborative or active learning, where students should be active and involved in the learning process inside the classroom, will be emphasized in the delivery of this course using different approaches such as: engaged learning, project-based learning, cooperative learning, and problem-based learning.
- Classroom discussion is an essential part of the collaborative method of teaching where students are given the opportunity to interact and give their point views. The classroom discussion will be achieved by addressing questions to students during the lectures and by rephrasing the information received and trigger the critical thinking of the students to ask more questions and get engaged in the teaching process.

Course Resources:

Course Website(s)

Required Course Texts and Materials:

1) Magdoff, F., & Van Es, H. (2000). *Building soils for better crops* (pp. 80-82). Beltsville: Sustainable Agriculture Network.
2) Wuebbles, D. J. (2012). Introduction to Modern Climate Change. *Physics Today*, *65*(11), 59.
3) Farmer, G. T., & Cook, J. (2013). *Climate Change Science: A Modern Synthesis: Volume 1-The Physical Climate* (Vol. 1). Springer Science & Business Media.
4) Villalobos, F. J. (2016). *Principles of agronomy for sustainable agriculture*. E. Fereres (Ed.). Springer.
5) Bellon, S., & Penvern, S. (2014). *Organic farming, prototype for sustainable agricultures*. Springer.

Optional Course Texts and Materials:

Assignments and Grading Scheme

Grading System

0 to 100% (where 70% is the least pass mark)

Grading Policy:

Component	Grade
Assignments	10%
Midterm Exam	30%

Term paper	10%
Class Attendance/ Participation	10%
Final exam	40%
Total Points	**100%**

Course Policies

Late Assignments

Homework assignments will be given during this course. The due date for the students to submit their homework is a week from the assignment date. Students who fail to submit their homework on the due date will be not given extra time to do so and their grade on the homework will be "zero". The homework solution will be discussed in classroom.

Quizzes will be used in this course. A quiz can be given at any time during the class. No makeup will be conducted for the quizzes in case of student absence.

Students are required to conduct one term paper during the class. Students should work on group of five on their term paper. The students have a chance to select a specific topic for their term paper in coordination with the course instructor. The topic should be related to the contents of this course and should be approved by the instructor. At the end of the semester, the students should submit their term paper and make an oral presentation. All students should be involved in the term paper and in the presentation. The term paper should be typed and hand-written term papers are not accepted. The maximum number of pages for the term paper is 8 pages with time New Roman Font and double space.

Classroom Protocol

Attendance will be checked at the beginning of each class. University regulations will be strictly followed for students exceeding the maximum number of absences.

Students must follow University rules and regulations during the classroom and in all activities of this course. Some examples of student's misconduct which are not allowed in this class include (not limited to):

- Students engagement in any behaviour that disrupts classroom such as talking while other students speaking, offensive language, using cell phones or other electronic

devices, eating, sleeping, playing games, moving in the classroom, entering the classroom late, leaving the classroom early.

- Cheating in exams, homework, and term papers is not allowed. Students who conduct cheating will be subjected to University rules and regulations.

- Plagiarism is not acceptable in any means when students work on their term paper, or oral presentation.

Disability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Important Dates to Remember

Course Schedule

Week	SUBJECT	Date
1	Course overview: Discussion of syllabus and assignments	
2	General introduction about world population and food supply	
3	Food security	
4	Climate change: Principles and impacts	
5	Concepts and practices of sustainable agriculture	
6	Sustainable marketing and community vitality	
7	Rotational grazing	
10	Conservational tillage Cover crops	
11	Crop rotation	
12	Sustainable management of nutrients and water	
13	Organic farming	
14	Sustainability at the whole-farm	

CCSAFS COURSE MODULE

Course	Climate Change, Sustainable Agriculture, and Food Security
Module 1	**Introduction: World population, food supply and food security.**
Key Concepts	World population and food demand.
Overview	World population is the total number of humans currently living. Current World Population (October 2019) is 7.7 billion. World population is projected to rise to 9.1 billion by 2050 and 11.2 billion by 2100. With the rise in world population, food supply and security is becoming susceptible to perturbations in demographic growth. The increased world population rises hunger on Earth. The world food production should increase by 70% to meet the demand on food. Ninety percent of the growth in crop production globally is expected to come from higher yields and increased cropping intensity, with the remainder coming from land expansion. To achieve 70% increase in food production we have to overcome the: • Rising energy prices. • Growing depletion of underground aquifers. • Continuing loss of farmland to urbanization. • Increased drought and flooding resulting from climate change. • Increased in the greenhouse gas emission. Agriculture has to produce more food and adopt more efficient and sustainable production methods (**Sustainable Agriculture**).
Aim	To provide students with knowledge about the trends and predictions of the rise in world population and how this puts pressure on food supply and security.
Learning Outcomes	At the end of this module students will be able to: • Explain the trends and predictions in human population on Earth. • Demonstrate how the rise in human population puts pressure on food supplies, threatens food security, and enhances hunger. • Describe how the increase in agriculture production and the adoption of sustainable agriculture practices are needed to increase food supply and security to meet the increase in the world population's demand.
Units	Unit 1.2: Trends in world population.

	Unit 1.2: World population distribution. Unit 1.3: The rise in world population. Unit 1.4: Global state of agriculture. Unit 1.5: The rise of hunger and factors related to it. Unit 1.6: Multiple challenges to agriculture.
Readings	1) Dyson, T. (1996). *Population and food: global trends and future prospects*. Routledge. 2) Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., ... & Toulmin, C. (2010). Food security: the challenge of feeding 9 billion people. S*cience*, *327*(5967), 812-818. 3) www.fao.org/docrep/U3550t/u3550t02.htm.
Activity	**Assignment 1.1:** Reflecting upon world population: 1) Provide statistical data about the **renewable resources of Earth, number of people on Earth, population growth, availability of land per person, demand for natural resources and energy by 2050.** 2) **Suggest some solutions to solve the problem of world population.**

SD Pillars	**Environment**	**Economy**	**Social**	**Culture**
	✓	✓	✓	✓

21st ESD	**Learning to know**	**Learning to be**	**Learning to do**	**Learning to live together**	**Learning to transform oneself and society**	**Learning to give and share**
	✓	✓	✓	✓	✓	✓

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
		✓															

Module 2	**Food Security**
Key concepts	Food security perspectives
Overview	Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life; otherwise, food insecurity exists. There are four pillars for food security including food availability, access, utilization, and stability. In this module, we will show

	students how to measure food insecurity. The concepts of transitory food insecurity will be presented to students. Risks factors related to availability of food will be discussed.
Aim	To provide students with concepts of food security and measurements of food insecurity.
Learning Outcomes	At the end of this module students will be able to: • To describe the concepts of food security and how to use different tools to measure food insecurity.
Units	Unit 2.1: Definition of food insecurity. Unit 2.2: Pillars of food security. Unit 2.3: Measurements of food insecurity. Unit 2.4: Transitory food insecurity. Unit 2.5: Liberalization and transitory food insecurity. Unit 2.6: Risks factors to unavailability of critical food supply. Unit 2.7: The world's food scarcity and malnutrition.
Readings	1) Pinstrup-Andersen, P. (2009). Food security: definition and measurement. *Food security*, *1*(1), 5-7. 2) Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., ... & Toulmin, C. (2010). Food security: the challenge of feeding 9 billion people. *science*, *327*(5967), 812-818. 3) Porter, J. R., Xie, L., Challinor, A. J., Cochrane, K., Howden, S. M., Iqbal, M. M., ... & Ingram, J. (2014). Food security and food production systems. 4) Ingram, J., Ericksen, P., & Liverman, D. (2012). *Food security and global environmental change*. Routledge. 5) Ericksen, P. J., Ingram, J. S., & Liverman, D. M. (2009). Food security and global environmental change: emerging challenges. 6) Ingram, J. (2011). A food systems approach to researching food security and its interactions with global environmental change. *Food Security*, *3*(4), 417-431.
Activity	**Assignment 2.1:** Reflecting upon measurements of food insecurity: Prepare a short presentation about food security status in Jordan. Students have to make a short presentation in class using PowerPoint. The due date to submit this activity is week 2.

SD Pillars	Environment	Economy	Social	Culture
	✓	✓	✓	✓

21st ESD	Learning to know	Learning to be	Learning to do	Learning to live together	Learning to transform oneself and society	Learning to give and share
	✓	✓	✓	✓	✓	✓

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		✓															

Module 3	**Climate change: Perspectives and impacts**
Key concepts	Climate change concepts, global warming, impacts
Overview	With the change in climate, there is an increase in CO2 level in the atmosphere as well as an increase in air temperature, which results in global warming. These changes can lead to melting the glaciers in the poles and consequently lead to an increase in sea level and threatens the coastal cities. The changes in the climate has also a great impact on agriculture production and food supply. Model scenarios related to climate change can predict crop yield for a specific region or country. The reduction in food production due to climate change has an impact on food supply and prices and consequently increases the number of people at risks of hunger. In this module, we will explore the concept of climate change and describe the predictions and trends in climate. We will also discuss how climate change affecting food production and supply.
Aim	The aim of this module is to describe the change in climate and how this change has an impact on food production and supply.
Learning Outcomes	At the end of this module students will be able to: • Describe the change in the climate and how this change affects on agriculture and food supply.
Units	Unit 3.1: General terminology of climate and weather. Unit 3.2: Causes of climate change. Unit 3.3: Climate change trends: Rising temperature. Rising CO2. Emission of greenhouse gases.

	Extreme weather events (drought and flooding). Rising in sea level. Unit 3.4: Global warming and greenhouse effect. Unit 3.5: Impact of climate change on food production and security. Unit 3.6: Impact of climate change on hunger and poverty. Unit 3.7: Measures to slow the rise in human population and to reduce the emission of greenhouse gases.
Readings	1) Wuebbles, D. J. (2012). Introduction to Modern Climate Change. *Physics Today*, *65*(11), 59. 2) Farmer, G. T., & Cook, J. (2013). *Climate Change Science: A Modern Synthesis: Volume 1-The Physical Climate* (Vol. 1). Springer Science & Business Media. 3) Rosenzweig, C., & Parry, M. L. (1994). Potential impact of climate change on world food supply. *Nature*, *367*(6459), 133-138. 4) Lobell, D. B., Schlenker, W., & Costa-Roberts, J. (2011). Climate trends and global crop production since 1980. *Science*, *333*(6042), 616-620. 5) Lobell, D. B., & Asner, G. P. (2003). Climate and management contributions to recent trends in US agricultural yields. *Science*, *299*(5609), 1032-1032. 6) Lobell, D. B., Burke, M. B., Tebaldi, C., Mastrandrea, M. D., Falcon, W. P., & Naylor, R. L. (2008). Prioritizing climate change adaptation needs for food security in 2030. *Science*, *319*(5863), 607-610. 7) Nelson, G. C., Rosegrant, M. W., Koo, J., Robertson, R., Sulser, T., Zhu, T., ... & Magalhaes, M. (2009). *Climate change: Impact on agriculture and costs of adaptation* (Vol. 21). Intl Food Policy Res Inst. 8) Fischer, G., Shah, M. M., & Van Velthuizen, H. T. (2002). Climate change and agricultural vulnerability. 9) Schlenker, W., & Roberts, M. J. (2009). Nonlinear temperature effects indicate severe damages to US crop yields under climate change. *Proceedings of the National Academy of sciences*, *106*(37), 15594-15598.
Activity	**Assignment 3.1:** Student presentation for a selected Journal article: Students have to present a Journal article related to climate change. The presentation should not exceed 5 minutes and an extra 10 minutes for discussion. Students should use PowerPoint and submit a short summary for the article (one paragraph). The due date is the week 3.

SD Pillars	**Environment**	**Economy**	**Social**	**Culture**
	✓	✓	✓	✓

<table>
<tr><td>21st ESD</td><td colspan="3">Learning to know</td><td colspan="3">Learning to be</td><td colspan="3">Learning to do</td><td colspan="3">Learning to live together</td><td colspan="3">Learning to transform oneself and society</td><td colspan="3">Learning to give and share</td></tr>
<tr><td></td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td></tr>
<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
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<tr><td>Module 4</td><td colspan="17">Concepts and practices of sustainable agriculture.</td></tr>
<tr><td>Keys</td><td colspan="17">Sustainable agriculture concepts and practices</td></tr>
<tr><td>Overview</td><td colspan="17">Sustainable agriculture is the production of food, fiber, or other plant or animal products using new, innovative strategies or techniques that protect the environment, public health, human communities, and animal welfare. The three pillars of agriculture sustainability are financial sustainability, environmental sustainability, and social sustainability. Sustainable farms produce crops or animals without relying on toxic pesticides and chemicals, genetic modified crops, or agricultural practices that degrade soil, water, and other natural resources. The sustainable agricultural practices are essential to protect human from exposure to toxic chemicals. The sustainable agriculture should also provide farmers and other workers with fair wages and working conditions and enhance marketing their products locally and regionally in order to build a strong and vibrant community. In this module, we will address numerous aspects and practices related with sustainable agriculture including marketing, community vitality, ecological insect and weed management, rotational grazing, conservation tillage, cover crops, livestock and landscape diversity, nutrient management, and on-farm energy conservation and production.</td></tr>
<tr><td>Aim</td><td colspan="17">The aim of this module is to provide students with the knowledge and skills related to sustainable agriculture practices.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="17">At the end of this module students will be able to:
Implement agricultural practices to protect soil from erosion and degradation.
Describe the practices that prevent water from pollution and how to reuse the wastewater in agriculture.
Integrate ecological management for insects, weeds, and diseases.
Introduce sustainable management of nutrients.
Conserve and produce on-farm energy.</td></tr>
</table>

Units	Unit 4.1: Sustainable marketing and community vitality. Unit 4.2: Ecological insects, weeds, and disease management. Unit 4.3: Rotational grazing. Unit 4.4: Conservational tillage Unit 4.5: Cover crops. Unit 4.6: Crop, livestock, and landscape diversity. Unit 4.7: Crop rotation. Unit 4.8: Sustainable management of nutrients. Unit 4.9: Sustainable management of water: Irrigation and drainage. Unit 4.10: On-farm energy conservation and production.
Readings	1) Magdoff, F., & Van Es, H. (2000). *Building soils for better crops* (pp. 80-82). Beltsville: Sustainable Agriculture Network. 2) Villalobos, F. J. (2016). *Principles of agronomy for sustainable agriculture*. E. Fereres (Ed.). Springer. 3) Pretty, J. N. (1995). Participatory learning for sustainable agriculture. *World development*, *23*(8), 1247-1263. 4) Gliessman, S. R. (1990). Agroecology: researching the ecological basis for sustainable agriculture. In *Agroecology* (pp. 3-10). Springer, New York, NY. 5) Horrigan, L., Lawrence, R. S., & Walker, P. (2002). How sustainable agriculture can address the environmental and human health harms of industrial agriculture. *Environmental health perspectives*, *110*(5), 445. 6) Altieri, M. A. (2018). *Agroecology: the science of sustainable agriculture*. CRC Press. 7) Lichtfouse, E., Navarrete, M., Debaeke, P., Souchère, V., Alberola, C., & Ménassieu, J. (2009). Agronomy for sustainable agriculture: a review. In *Sustainable agriculture* (pp. 1-7). Springer, Dordrecht. 8) Roling, N. G., & Wagemakers, M. A. E. (Eds.). (2000). *Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty*. Cambridge University Press. 9) Lal, R. (2009). Soils and sustainable agriculture: A review. In *Sustainable agriculture* (pp. 15-23). Springer Netherlands. 10) Dordas, C. (2009). Role of nutrients in controlling plant diseases in sustainable agriculture: a review. In *Sustainable agriculture* (pp. 443-460). Springer, Dordrecht.
Activity	**Assignment 4.1:** Student presentation for a selected Journal article: Students have to present a Journal article related to sustainable agriculture practices. The presentation should not exceed 5 minutes and an extra 10

<table>
<tr><td></td><td>minutes for discussion. Students should use PowerPoint and submit a short summary for the article (one paragraph). The due date is week 4-10.

Assignment 4.2: Applying a community-service learning methodology to a local farm:

Students should select a local farm and apply one of the sustainable agricultural practices that had been taught in this module to the farm. Examples of these practices:

• Using chisel plow as a conservation tillage implement to do primary tillage instead of using traditional conventional tillage implements (moldboard or disc plow).
• Integrate a legume crop (vetch), which are capable of fixing a atmospheric N2 into ammonia, in a crop rotation before planting wheat and barley.
• Including a cover crop in cropping system to reduce soil erosion and enhance soil fertility and organic matter.</td></tr>
<tr><td>SD Pillars</td><td><table>
<tr><td>Environment</td><td>Economy</td><td>Social</td><td>Culture</td></tr>
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<tr><td>Module 5</td><td>Organic farming</td></tr>
<tr><td>Keys</td><td>Aspects of organic farming as a sustainable agriculture practice</td></tr>
<tr><td>Overview</td><td>There are many approaches to enhance agriculture sustainability by integrating sustainable practices highlighted in module 4. The focus of this module is on organic farming as one approach for agriculture sustainability. Organic farming is an agriculture system to produce food in a natural way using organic sources of fertilizers and biological control of pests while preventing the synthetic use of fertilizers and other chemicals. Crop rotation, cover crop, diversity of species, and including livestock in the farming system are practices used in the organic farming. There are many benefits for the expansion of organic farming. We will highlight these benefits and explore sources for organic fertilizers and the biological control of pests in the organic farming system.</td></tr>
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Aim	The aim of this module is to highlight the organic farming as an approach for sustainable agriculture.
Learning Outcomes	At the end of this module students will be able to: • Use manure and other organic sources of fertilizers and integrate the biological control of pests in organic farming system.
Units	Unit 5.1: Definition Unit 5.2: Benefits. Unit 5.3: Organic sources of fertilizers Unit 5.4: Biological control of pests.
Readings	1) Bellon, S., & Penvern, S. (2014). *Organic farming, prototype for sustainable agricultures*. Springer. 2) Lampkin, N. (1990). *Organic farming*. Farming press books. 3) Rigby, D., & Cáceres, D. (2001). Organic farming and the sustainability of agricultural systems. *Agricultural systems*, *68*(1), 21-40.
Activity	**Assignment 5.1:** Reflecting upon organic farming: Q.1) List organic farming practices Q.2) How do organic farming practices have less impact on environment? In other words, "how do organic farmers respect environment"? Q.3) How do organic practices have less impact on animals? Q.4) What are the principles of organic farming in food processing? **Assignment 5.2:** Students require to find videos about organic farming practices from an authentic scientific source and share them with the rest of the students. Videos should be 5 minutes in length to highlight one or two organic farming practices. For longer-videos, students are required to shorten these videos by using an online-free video processing software.

SD Pillars	**Environment**	**Economy**	**Social**	**Culture**
	✓	✓	✓	✓

21st ESD	**Learning to know**	**Learning to be**	**Learning to do**	**Learning to live together**	**Learning to transform**	**Learning to give and share**

												oneself and society					
	✓			✓			✓			✓			✓			✓	
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		✓			✓	✓									✓		

Module 6	**Sustainability for A whole-farm**
Keys	A whole-farm approach
Overview	A whole-farm approach combines all sustainable agriculture practices into one integrated management system that works with nature: • Reducing tillage and careful application of on-farm nutrient sources build soil organic matter. • Reducing energy costs when fuel is produced from waste or renewable sources. • Controlling pests are by plant and landscape diversity. • Boosting income by more efficient use of on-farm resources.
Aim	The aim of this module is to demonstrate to students how to integrate all sustainable practices into an integrated farm management system.
Learning Outcomes	At the end of this module students will be able to: Combine all sustainable practices in a farm integrated management system.
Units	Unit 6.1: General approach. Unit 6.2: What make sense on your farm? Unit 6.3: Practices to help remedies specific constraints.
Readings	1) Magdoff, F., & Van Es, H. (2000). *Building soils for better crops* (pp. 80-82). Beltsville: Sustainable Agriculture Network. 2) http://nisa.cals.wisc.edu/download/general/WholeFarmChecklist_DRAFT_3.pdf 3) file:///C:/Users/User/Downloads/A_Whole-Farm_Approach_to_Managing_Pests.pdf. 4) file:///C:/Users/User/Downloads/What_is_Sustainable_Agriculture.pdf
Activity	**Assignment 6.1**: Visit a local farm and use the checklist in the document No. 2 (Readings of the module) to check the issues and principles for all aspects of sustainability that growers encounter on their farms for: • Environmental sustainability.

	• Economic sustainability. • Social sustainability. Submit a short report for the sustainability practices in the farm.																
SD Pillars	**Environment**			**Economy**			**Social**			**Culture**							
	✓			✓			✓			✓							
21st ESD	**Learning to know**			**Learning to be**			**Learning to do**			**Learning to live together**			**Learning to transform oneself and society**			**Learning to give and share**	
	✓			✓			✓			✓			✓			✓	
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
		✓			✓	✓									✓		

Table 1. A 10 ECTS workload allocation for the course "Climate Change, Sustainable Agriculture, and Food Security".

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**						**Workload**
				1	**2**	**3**	**4**	**5**	**6**	
Lectures (face-to-face)	26	1.5	**39**	3	6	9	13	4.5	4.5	**39**
Online	5	2.2	**11**	-	1	2	5	1.5	1.5	**11**
Lab work										
Reading articles (3 pages per hour)	200	0.3	**60**	10	8	10	12	11	9	**60**
Reading book chapters (5 per/h)	135	0.2	**27**	3	5	6	4	5	4	**27**
Preparing course activities	6	9.5	**58**	3	5	10	20	10	10	**58**
Project work	6	8.5	**50**	6	3	9	20	5	7	**50**
Preparation for exam	2	23	**45**					20	25	**45**

Writing the exam	2	1.5	**3**						3	**3**
Total				**25**	**28**	**46**	**74**	**57**	**64**	**294**

Table 2. Connection of the 17 SDGs with the 3 key domains of the CCSAFS MSc.

No.	SDGs	Climate Change	Sustainable Agriculture	Food Security	Course Module
1	End poverty in all its forms everywhere				
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		✓	✓	1, 2, 4, 5, 6
3	Ensure healthy lives and promote well-being for all at all ages				
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				
5	Achieve gender equality and empower all women and girls		✓		4, 5, 6
6	Ensure availability and sustainable management of water and sanitation for all		✓	✓	4, 5, 6
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns				
13	Take urgent action to combat climate change and its impacts	✓			3, 4
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems,		✓	✓	4, 5, 6

	sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss				
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS

Jerash University
Course Syllabus

Course Number ( )

Course Title
Course Name: Climate Change Mitigation and Adaptation

Fall Semester, 2018

Instructor information

Instructor: Professor Abbas Al-Omari

Office location: Water, Energy and Environment Center

Telephone: 5355000 ext. 23903

Office hours: 09:00 – 11:00 Sunday, Tuesday and Thursday

E-mail: abbas.alomari@ymail.com

Web site: http://centers.ju.edu.jo/en/weec/Lists/CenterStaff/researchers_List.aspx

Course Identification

Course number:

Course Name: Climate Change Mitigation and Adaptation

Course Location: Jerash University

Class Times: defined each semester

Lecturer: Abbas Al-Omari

Practical Session: None

Prerequisites: None

Faculty Web Page: http://centers.ju.edu.jo/en/weec/Home.aspx

Course Description/Overview

The course is intended to introduce the students to the climate change science and physics, its drivers; natural and anthropogenic, mitigation measures, impacts (economic, environmental, social, health, and political), and adaptation measures. The course will address the important role climate change mitigation and adaptation measures play in realizing Sustainable Development Goals (SDGs).

The course will introduce the students to the international agencies working on climate change such as the Intergovernmental Panel on Climate Change (IPCC), World Meteorological Organization (WMO) and United Nations Environmental Program (UNEP). The course will familiarize the students with the international conventions on climate change, i.e. Kyoto protocol, UNFCCC, and Paris agreement

Course Learning Objectives

1. Introduce the students to climatology in general and to the concept of climate change, its physics, drivers, and history.
2. Familiarize the students with the climate change impacts.
3. Introduce the students to the mitigation measures to reduce the negative climate change impacts.
4. Introduce the students to adaptation measure that help adapt to the negative climate change impacts.
5. Familiarize the students with international agencies and international conventions on climate change.

Course Content Learning Outcomes

1. Students gain relevant knowledge of the basics of climatology,
2. Students are familiar with the natural and anthropogenic climate change drivers,
3. Students have thorough understanding of the physics of climate change,
4. Students are familiar with climate change models and predictions,
5. Students are aware of climate change history.
6. Students have thorough understanding of climate change impacts and consequences, i.e. economic, environmental, social, health, and political.
7. Students understand thoroughly the different climate change mitigation measures and their role in mitigating climate change:
8. Increase substantially the share of renewable energy in the energy mix,
9. Promote global resource efficiency in production and consumption,
10. Combat desertification and restore degraded land and soil,
11. Students are aware of the different adaptation measures to adapt to the negative climate change impacts:
12. Integrate climate change into national policies, strategies and planning,
13. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning,
14. Sustainable management and efficient use of natural resources,
15. Knowledge and awareness for sustainable development and life style in harmony with nature.

16. Students are familiar with the international agencies and international conventions on climate change,

Course Resources

Required Course Texts and Materials:

John Houghton, Global Warming: The Complete Briefing, 4th Edition, 2009. Cambridge Univ. Press.

Grading Policy

Assignments	15%
Mid. Term exam	25%
Project/term paper	20%
Final exam	40%
Total	100%

Course Schedule

Week	Topics
1	Course overview: Introduction to climatology: Basics of climatology; weather, climate, variables, elements, relationships.
2	Introduction to climatology: Climate properties (Normal, extremes and frequencies), climate history.
3	Physics of climate change and its drivers: Evidence of global warming and climate change, fossil fuel fingerprint, energy balance, natural and anthropogenic global warming,
4	Physics of climate change and its drivers: Greenhouse effect, greenhouse gases, sources and sinks, their relative roles in global warming,
5	Physics of climate change and its drivers: Impacts and consequences of climate change, examples of global warming consequences (Hurricane Katrina, Tornadoes, Alaska, Antarctica).
6	Climate change models and scenarios: Climate change models, scenarios, scale, limitations and uncertainties,
7	Mitigation measures of climate change: Carbon dioxide capture and storage (CCS), renewable energy (solar, wind, geothermal, bio-energy, hydro), land use change and management,

8	Mitigation measures of climate change: Traditional regulatory approach, emission trading, carbon taxes, information based approaches, investment and technology approaches,
9	Mitigation measures of climate change: Mitigation measures at the sector level, effect of water management policies and measures on Green House Gases (GHG) emission and mitigation, benefits and costs of climate mitigation.
10	Midterm exam
11	Climate change impacts and adaptation: Introduction, basic concepts: sensitivity, adaptive capacity and vulnerability, Impacts: sea level rising, global average surface temperature, impact on fresh water resources, impact on agriculture and food supply, impact on ecosystems, and health impacts,
12	Climate change impacts and adaptation: capacity building, education and training, public awareness, cooperation and synergies, implementing adaptation,
13	International agencies and bodies working on climate change: Intergovernmental Panel on Climate Change (IPCC), United Nations Environmental Program (UNEP), World Meteorological Organization (WMO).
14	International conventions on climate change: United Nations Framework Convention on Climate Change (UNFCCC), 1992 Earth Summit in Rio de Janiero, The 1998 Kyoto Protocol, Paris Climate Agreement,
15	Presentation of term paper/project
16	Final exam

Course	**Climate Change Mitigation and adaptation**
Module 1	**Introduction to climatology and climate history**
Key concepts	Climate physics and basics
Overview	Basics of climatology; weather, climate, variables, elements, relationships, climate properties (normal, extremes and frequencies), climate history at different time scales, i.e. hundreds, thousands and millions of years, evidence of climate change.
Aim	Introduce the students to the basics of climatology and climate history showing evidence of climate change over the last hundred fifty years.
Learning outcomes	Students gain relevant knowledge of the basics of climatology, and climate change history.
Units	Chapter 1: Global warning and climate change, text book Chapter 4: Climates of the past, text book

<table>
<tr><td>Readings</td><td>None</td></tr>
<tr><td>Activity</td><td>The students will be introduced to the following concepts through regular classroom lecturing:

✓ The basics of climatology will be presented to the students including basic terminology, elements, variables and their interdependencies,

✓ The students will be introduced to the climate history taking into consideration different time scales, i.e. hundreds, thousands and millions of years leading to evidence of climate change over the past hundred fifty years,

✓ Videos that introduce the students to the main global climate elements and to the main concepts in climatology and meteorology will be played in the class room to enhance the students comprehension of the main concepts of climatology and its global nature,

✓ Videos that show the occurrence of certain climatological events, i.e. hurricanes and tornados in the twentieth and twenty first centuries will be played in the class room as an evidence of climate change,

✓ Documentaries that show evidence of climate change and the rising concerns of the international community; scientists, politicians and regular people, to mitigate and adapt to it will be played in the class room,

✓ The students will be encouraged to engage in discussions during regular lecturing and videos playing,

✓ The students will given one homework to reflect on the concepts they have learned in this module,

✓ One quiz will be given to the students during this module to measure their understanding of the main concepts of this module.</td></tr>
<tr><td>SD Pillars</td><td><table><tr><th>Environment</th><th>Economy</th><th>Social</th><th>Culture</th></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
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<tr><td>ECTS workload</td><td>46</td></tr>
<tr><td>Module 2</td><td>Physics of climate change</td></tr>
<tr><td>Key concepts</td><td>Drivers of global warming, how it is happening and why?</td></tr>
<tr><td>Overview</td><td>Evidence of global warming and climate change, fossil fuel fingerprint, energy balance, natural and anthropogenic global warming, greenhouse effect, greenhouse gases, sources and sinks of Green House Gases, their relative roles in global warming.</td></tr>
<tr><td>Aim</td><td>Introduce the students to the concept of climate change, its drivers and physics,</td></tr>
<tr><td>Learning outcomes</td><td>✓ Students are familiar with the natural and anthropogenic climate change drivers,

✓ Students have thorough understanding of the physics of climate change,</td></tr>
<tr><td>Units</td><td>Chapter 1: Global warning and climate change, text book</td></tr>
</table>

<table>
<tr><td></td><td>Chapter 2: The greenhouse effect, text book

Chapter 3: The greenhouse gas, text book</td></tr>
<tr><td>Readings</td><td>Physics behind the climate change, by Jeevan Regmi, available at file:///C:/Users/abbassm/Downloads/12881-Article%20Text-44550-1-10-20150705.pdf</td></tr>
<tr><td>Activity</td><td>The students will be introduced to the following concepts through regular classroom lecturing:

✓ The electromagnetic spectrum,
✓ The greenhouse effect that causes global warming,
✓ Global energy balance,
✓ The occurrence of the different greenhouse gases in the atmosphere, their sources and sinks, and their relative contribution to climate change,
✓ History of greenhouse gases in the atmosphere,

The following videos that enhance the students' understanding of the main concepts in this module will be played in the classroom:

Introduction to earth's climate system
available at (https://www.youtube.com/watch?v=NIqJzpXiFfA),

Climate change, the crises: part 1
Available at (https://www.youtube.com/watch?v=4Nac_nIBD64)

The students will be given two homework to enhance their understanding of the concept they have learned in this module,

One quiz will be given to the students during this module to measure their understanding of the main concepts of this module.</td></tr>
<tr><td>SD Pillars</td><td><table><tr><th>Environment</th><th>Economy</th><th>Social</th><th>Culture</th></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
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<tr><td>ECTS</td><td>69</td></tr>
<tr><td>Module 3</td><td>Climate modeling and climate change scenarios</td></tr>
<tr><td>Key concepts</td><td>Modeling theory and implementation to climate change</td></tr>
<tr><td>Overview</td><td>✓ Introduction to modeling theory, climate models, inputs and outputs, limitations and uncertainties,

✓ Verification and validation of climate models,

✓ Climate change projections for the 21st century,</td></tr>
<tr><td>Aim</td><td>Introduce the students to climate models, modeling and projections</td></tr>
<tr><td>Learning outcomes</td><td>✓ The students are familiar with the modelling theory, climate modelling, climate change models, climate change projections for the 21st century,</td></tr>
</table>

<table>
<tr><td></td><td>✓ The students understand the models limitations' and the associated uncertainties</td></tr>
<tr><td>Units</td><td>Chapter 5: Modeling the climate, text book
Chapter 6: Climate change in the twenty first century and beyond, text book
Chapter 9: Weighing the uncertainty, text book</td></tr>
<tr><td>Readings</td><td>None</td></tr>
<tr><td>Activity</td><td>The students will be introduced to the following concepts through regular classroom lecturing:

✓ Modeling theory,
✓ Climate modeling,
✓ Climate models, their projections, limitations and uncertainties,
✓ Climate projections (scenarios) for the twenty first century,

The following videos that enhance the students' understanding of the main concepts in this module will be played in the classroom:

✓ Introduction to climate modeling
Available at (https://www.youtube.com/watch?v=XGi2a0tNjOo),

✓ Climate models and climate sensitivity
Available at (https://www.youtube.com/watch?v=EGJnXEKRnZ8),

The students will be encouraged to engage in discussions during regular lecturing and videos playing,

One quiz will be given to the students during this module to measure their understanding of the main concepts of this module.

The students will given one homework to enhance their understanding of the concept they have learned in this module,</td></tr>
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</table>
</td></tr>
<tr><td>ECTS</td><td>23</td></tr>
<tr><td>Module 4</td><td>Climate change impacts and Mitigation</td></tr>
<tr><td>Key concepts</td><td>Impacts of climate change, mitigation measures</td></tr>
<tr><td>Overview</td><td>Basic concepts: sensitivity, adaptive capacity and vulnerability,

Impacts: sea level rising, global average surface temperature, impact on fresh water resources, impact on agriculture and food supply, impact on ecosystems, and health impacts,

Carbon dioxide capture and storage (CCS), renewable energy (solar, wind, geothermal, bio-energy, hydro), land use change and management,</td></tr>
</table>

	traditional regulatory approach, emission trading, carbon taxes, information based approaches, investment and technology approaches, mitigation measures at the sector level, effect of water management policies and measures on Green House Gases (GHG) emission and mitigation, benefits and costs of climate mitigation.
Aim	Introduce the students to the mitigation measures to reduce the negative climate change impacts.
Learning outcomes	✓ Students have thorough understanding of climate change impacts and consequences, i.e. economic, environmental, social, health, and political. ✓ Students understand thoroughly the different measures to reduce the negative climate change impacts.
Units	Chapter 7: The impacts of climate change, text book Chapter 10: Strategy for action to slow and stabilize climate change, text book Chapter 11: Energy and transport for the future, text book
Readings	Chapter 2: Responding to climate change: Mitigation, Chris Wold, David Hunter and Mellissa powers, Climate Change and the Law (*Lexis-Nexis, 2d ed., 2013)* Climate change mitigation measures and water, available at https://archive.ipcc.ch/pdf/technical-papers/ccw/chapter6.pdf
Activity	The students will be introduced to the following concepts through regular classroom lecturing: ✓ Basic concepts: sensitivity, adaptive capacity and vulnerability, ✓ Climate change impacts: sea level rising, impact on global average surface temperature, impact on fresh water resources, impact on agriculture and food supply, impact on ecosystems, and health impacts, ✓ Mitigation measures: Carbon dioxide capture and storage (CCS), renewable energy (solar, wind, geothermal, bio-energy, hydro), land use change and management, traditional regulatory approach, emission trading, carbon taxes, information based approaches, investment and technology approaches, mitigation measures at the sector level, effect of water management policies and measures on Green House Gases (GHG) emission and mitigation, benefits and costs of climate mitigation. The following documentaries that enhance the students' understanding of the different mitigation measures presented in this module will be played in the classroom: ✓ Mitigation to climate change, available at (https://www.youtube.com/watch?v=LFane7eS9Ys), ✓ Climate Change: Mitigation, Adaptation, and Geoengineering, available at: (https://www.youtube.com/watch?v=fUhs0vSflZE), The students will be encouraged to engage in discussions during regular lecturing and documentaries playing,

<table>
<tr><td></td><td>One quiz will be given to the students during this module to measure their understanding of the main concepts of this module.

The students will given two homework to enhance their understanding of the concept they have learned in this module,</td></tr>
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<tr><td>✓</td><td></td><td>✓</td><td></td><td></td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td><td></td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>ECTS</td><td>69</td></tr>
<tr><td>Module 5</td><td>Adaptation to climate change</td></tr>
<tr><td>Key concepts</td><td>Adaption measures to lower the impacts of climate change</td></tr>
<tr><td>Overview</td><td>✓ Impact assessment, regional impacts, adaptation strategies, funding adaptation, sustainable development, adaptation integration into policy,

✓ Capacity building, education and training, public awareness, cooperation and synergies, implementing adaptation,</td></tr>
<tr><td>Aim</td><td>Introduce the students to adaptation measure that help adapt to the negative climate change impacts.</td></tr>
<tr><td>Learning outcomes</td><td>✓ Students are aware of the different adaptation measures to adapt to the negative climate change impacts,

✓ Students understand the role of integrating climate change into national policies, strategies and planning in adapting to climate change,

✓ Students are aware of the role of education, awareness-raising and human and institutional capacity building on climate change mitigation and adaptation,

✓ Students understand the impact of sustainable management and efficient use of natural resources on climate change adaptation,

✓ Students are aware of the role of knowledge and awareness in sustainable development as well as the impact of living in harmony with nature in adapting to climate change impacts.</td></tr>
<tr><td>Units</td><td>Chapter 10: Strategy for action to slow and stabilize climate change, text book</td></tr>
<tr><td>Readings</td><td>United Nations Framework Convention on Climate Change: Impacts, vulnerabilities and adaptation in developing countries,</td></tr>
<tr><td>Activity</td><td>The students will be introduced to the following concepts through regular classroom lecturing:

✓ Impact assessment, regional impacts, adaptation strategies, funding adaptation, sustainable development, adaptation integration into policy,

✓ Capacity building, education and training, public awareness, cooperation and synergies, implementing adaptation,</td></tr>
</table>

<table>
<tr><td></td><td>The following documentaries that enhance the students' understanding of the different adaptation measures presented in this module will be played in the classroom:

✓ Adaptation to Climate Change, available at: https://www.youtube.com/watch?v=C2p3MfD1pB8,

✓ Climate change adaptation, available at: https://www.youtube.com/watch?v=8vxIEyk7Dcs

The students will be encouraged to engage in discussions during regular lecturing and documentaries playing,

One quiz will be given to the students during this module to measure their understanding of the main concepts of this module.

The students will given one homework to enhance their understanding of the concept they have learned in this module,

Project

The students will be divided into four groups. The objective of each group is to design a questionnaire and conduct a survey that aims at:

✓ Measuring the level of awareness about climate change; its causes, impacts, mitigation and adaptation among one of the following target groups: farmers, public, school students, and university students,

✓ Identify knowledge gaps about climate change in general (causes, impacts, mitigation and adaptation) among each target group,

✓ Identify knowledge gap in understanding and linking climate change to the Sustainable Development Goals (SDGs),

✓ Identify gaps in linking climate change to consumption practices,

✓ Propose actions to bridge these gaps for the different target groups through education, training, public campaigns, and media.

Each group will report its findings and present it to the other groups.</td></tr>
<tr><td>SD Pillars</td><td><table><tr><th>Environment</th><th>Economy</th><th>Social</th><th>Culture</th></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
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<tr><td>SDGs</td><td><table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr><tr><td></td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td><td></td><td></td><td>✓</td><td></td><td></td></tr></table></td></tr>
<tr><td></td><td>2, 3, 4, 6, 8, 9, 11, 12, 15</td></tr>
<tr><td>Module 6</td><td>International Agencies and conventions on climate change</td></tr>
<tr><td>Key concepts</td><td>International agencies and conventions on climate change</td></tr>
</table>

<table>
<tr><td>Overview</td><td>Intergovernmental Panel on Climate Change (IPCC), United Nations Environmental Program (UNEP), World Meteorological Organization (WMO).

United Nations Framework Convention on Climate Change (UNFCCC), 1992 Earth Summit in Rio de Janiero, The 1998 Kyoto Protocol, Paris Climate Agreement,</td></tr>
<tr><td>Aim</td><td>Familiarize the students with international agencies and international conventions on climate change.</td></tr>
<tr><td>Learning outcomes</td><td>Students are familiar with the international agencies and international conventions on climate change,</td></tr>
<tr><td>Units</td><td>Chapter 10: Strategy for action to slow and stabilize climate change</td></tr>
<tr><td>Readings</td><td>United Nations Framework Convention on Climate Change, 1992
Koyoto protocol to the United Nations Framework Convention on Climate Change, 1998
Paris agreement, 2015</td></tr>
<tr><td>Activity</td><td>The students will be introduced to the following international agencies and conventions through regular classroom lecturing:

✓ Intergovernmental Panel on Climate Change (IPCC), United Nations Environmental Program (UNEP), World Meteorological Organization (WMO).

✓ United Nations Framework Convention on Climate Change (UNFCCC), 1992 Earth Summit in Rio de Janiero, The 1998 Kyoto Protocol, Paris Climate Agreement,

The following documentaries that enhance the students' knowledge about the international agencies and conventions will be played in the classroom:

✓ A history of climate change negotiations, available at: https://www.youtube.com/watch?v=WuriLuPSvZA

✓ Intergovernmental Panel on Climate Change, available at: https://www.youtube.com/watch?v=asNMocg5u-E,

✓ Intergovernmental Panel on Climate Change, available at: https://www.youtube.com/watch?v=h605n00I0xg,

The students will be encouraged to engage in discussions during regular lecturing and documentaries playing,

One quiz will be given to the students during this module to measure their understanding of the main concepts of this module.

The students will given one homework to enhance their understanding of the concept they have learned in this module,</td></tr>
<tr><td>SD Pillars</td><td>
<table>
<tr><th>Environment</th><th>Economy</th><th>Social</th><th>Culture</th></tr>
<tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
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<tr><td>21st ESD</td><td>
<table>
<tr><th>Learning to know</th><th>Learning to be</th><th>Learning to do</th><th>Learning to live together</th><th>Learning to transform oneself and society</th><th>Learning to give and share</th></tr>
<tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
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<tr><td>SDGs</td><td>
<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td></tr>
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</td></tr>
<tr><td>ECTS</td><td>46</td></tr>
</table>

ECTS Workload Allocation for the climate change mitigation and adaptation course

Learning Components	No	Time Factor	Work load	Course Modules						Work load
				1	2	3	4	5	6	
Lectures (face-to-face)	39	1	39	6	9	3	9	6	6	39
Online	9	1	9	0	3	2	2	2	0	9
Reading book chapters and	48	2	96	12	24	10	22	16	12	96
Homework	8	5	40	5	10	5	10	5	5	40
Project work	1	60	60	0	12	12	12	12	12	60
Preparation for exams	2	25	50	8	8	8	9	9	8	50
Writing the exam	2	2	4			1	1	1	1	4
Total			298	31	66	41	65	51	44	298

Sustainable Development Goals table

SDGs		CLIMATE CHANGE	SUSTAINABLE AGRICULTURE	FOOD SECURITY	COURSE MODULE
1	End poverty in all its forms everywhere	✓			4
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	✓			5
3	Ensure healthy lives and promote well-being for all at all ages	✓			4, 5
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	✓			5
5	Achieve gender equality & empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all	✓			4, 5
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	✓			4
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all	✓			5
9	Build resilient infrastructure, promote inclusive, and sustainable	✓			4, 5

	industrialization and foster innovation				
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable	✓			5
12	Ensure sustainable consumption and production patterns	✓			4, 5
13	Take urgent action to combat climate change and its impacts	✓			1, 2, 3,4
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss	✓			4, 5
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, & build effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	✓			6

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CCSAFS COURSE SYLLABUS

Jerash University
Course Syllabus

Course Number ( )

Course Title

GIS Applications in Climate Change, Sustainable Agriculture and Food Security

Semester ( )

Instructor Information

Instructor: Prof. Jawad Al-Bakri

Office Location: Office 116, Faculty of Agriculture, The University of Jordan

Telephone: +962-6-5335000, ext 22449

Office Hours: 9-10 Mon., Wed.

E-mail: jbakri@ju.edu.jo

Website: http://eacademic.ju.edu.jo/jbakri/default.aspx

Course Identification

Course Number:

Course Name: GIS Applications in Climate Change, Sustainable Agriculture and Food Security

Course Location: **Faculty of Agriculture,**

Class Times: Will be identified for each semester

Prerequisites: **Computer skills**

Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Description/Overview

This course aims at enriching the knowledge of the graduate students in the fields of GIS applications in the areas of climate change, sustainable agriculture, and food security (CCSAFS main themes). The approach is based on both theory and applications of GIS needed to enable students understand both GIS technology and methodology. Special attention is given to spatial analysis and its implementation in real world, particularly in land and water management issues that are directly linked to CCSAFS. The lectures and practical sessions include material from international textbooks and web resources, ESRI manuals and GIS projects that have been implemented in Jordan by the course instructor. Both of lectures and practical activities are structured to complement each other. The practical exercises are based on ArcGIS software (v 10.5 and above) and include all aspects of data input, editing and analysis. It is also possible to use existing data from Jordan including soil maps, land use/cover maps, wildlife and vegetation and maps for irrigated areas in Jordan.

Course Learning Objectives:

The course is designed to provide MSc students with the knowledge and skills needed for the scientific use of GIS as an effective tool for data creation and analysis in the fields of CCSAFS. Specific objectives of the course are:

1. *To provide the students with the scientific background on GIS, its functions and capabilities in managing land and water resources* ***[Related to Sustainable Development Goals (SDG) 6, 11 and 15]****.*
2. *To empower the students with knowledge in spatial analysis and the functions needed for GIS application in CCSAFS research projects* ***(SDGs 1, 2, 12, 13, 15)****.*
3. *To enable the student to utilize GIS and to implement a GIS based analysis that includes the utilization of GIS functions* ***(SDGs 4, 5, 8, 9, 11)****.*

Course Content Learning Outcomes:

A. Knowledge and Understanding (SDGs 4, 5, 9, 11):

A1- GIS technology and methodology.

A2- Spatial analysis and geoprocessing within GIS.

A3- Coordinates and projections in GIS.

A4- Concept and characteristics of land and water geodatabases.

A5- Main cartographic models and the use of models in GIS.

B. Intellectual, Analytical and Cognitive Skills (SDGs 2, 4, 5, 9, 10, 12):

B1- Main components of map and the options for map symbolization.

B2- Possible sources of errors in GIS data and analysis.

B3- Evaluation of GIS data related to CCSAFS and outputs from GIS.

C. Subject- Specific Skills (SDGs 4, 5, 7, 9, 11):

C1- The use of spatial analysis to derive the main terrain components.

C2- Methods of interpolation implemented within GIS.

C3- Manipulation of attributes within GIS data.

C4- Main statistical functions used in GIS and map analysis to produce required outputs related to CCSAFS research areas.

D. Transferable Key Skills (SDGs 1, 2, 3, 6, 9, 11, 15):

D1- Sources and formats of data used within GIS, with emphasis on data needed for CCSAFS.

D2- Basic and advanced capabilities of GIS software in providing information related to land and water management.

D3- Key areas for GIS applications in CCSAFS.

Course Resources

1. http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html

2. ESRI, 2013. ArcGIS II: Essential Workflows (Student Edition), ESRI Press, Redland, California.

Course Website(s)

Will be announced

Required Course Texts and Materials

Bolstad, P., 2012. ***GIS Fundamentals: A first text on Geographic Information Systems*** (4th edition), Eider Press, White Bear Lake, Minnesota. (http://www.paulbolstad.net/gisbook.html).

Optional Course Texts and Materials

Chang, K., 2013. ***Introduction to Geographic Information Systems***, 7th edition, McGraw Hill, New York.

DeMers, M. N. 2009. ***Fundamentals of Geographical Information Systems***, 4th Edition, John Wiley and Sons.

Gorr W.L. and Kurland, K. S. 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, Redland, California, ESRI Press.

Allen, D. W. 2010. GIS Tutorial 2: Spatial Analysis Workbook, 2nd Edition for ArcGIS 10. Redland, California, ESRI Press.

Foody, G. M. and PETER M. Atkinson P. M. 2002. Uncertainty in Remote Sensing and GIS. UK: Wiley and Sons.

Gorr, W.L. and Kurland, K. S. 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, Redland, California, ESRI Press.

Assignments and Grading Scheme

The course consists of 5 ECTS, each equivalent to 25 hours of teaching and work. The total teaching hours are 30 for lectures and 10 for Lab (40 out of 125). The remaining 85 hours will be divided into 35 hours work of tutorial applied in GIS lab. Therefore, 50 hours of work are expected from the student's side during the semester, distributed as 4 hours per week for 13 weeks.

Grading System

0 to 100 (where 70 is the least passing grade)

Grading Policy

Assignments	20%
Exams	60%
GIS project	20%
Total Points	**100**

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Late assignments are not accepted and their grade will be set to zero.

Classroom Protocol

The course will be structured in lectures, discussions, students' assignments lab reports, in addition to a project that will be implemented and presented by each student. Visual aids will include mobile GIS units, GPS, hardcopy maps and satellite images. Material of the practical sessions (Lab.) will be based on ESRI manuals (GIS Tutorials 1 and 2). The training data is provided with the manuals. All practical sessions will be introduced during the lectures; however, students are required to finish the exercises on their own and to submit the required assignments and present case studies and their projects.

Disability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Course Schedule

Week	Subject
1	Introduction and definitions of GIS and its components, supporting technology and areas of applications.
2&3	Data models in GIS: Spatial data models, types of entities and attributes.
4	Attribute tables and geodatabases
5	Maps and their elements: Types of maps, map generalization, cartographic symbolization, map display and symbology
6	Coordinates and projections: earth geometry, geographic coordinates and projections, GPS technology and its applications.
7	Data input and editing: data for GIS, methods of data entry and editing in GIS
8	**Midterm Exam and student presentations**
9	Basic spatial analysis: vector data analysis, basic raster analysis
10	Advance spatial analysis: measurements, simple distance, functional distance,
11	Geo-processing and measuring geographic patterns
12&13	Terrain analysis: slope and aspect, hydrologic functions, viewsheds.
14&15	GIS project: identifying the application area (a case study for each student) problem, workflow of GIS analysis, student presentation
16	Final hour Exam

Course Modules

Course	***GIS Applications in Climate Change, Sustainable Agriculture and Food Security***
Module 1	**Introduction to GIS and its applications in CCSAFS**
Key Concepts	GIS, GIS components, GIS applications
Overview	This module defines GIS and its components with the supporting technologies to GIS. The need for GIS in organization and the concept of modeling real world are also introduced. The module provides examples on GIS applications with emphasis on climate change and sustainable agriculture. It also shows examples on the problem related questions that communities asked for solutions and how GIS follows a sequence of steps to provide solutions. Examples on soil erosion, flood mapping, improved water management and adaptation to climate change are explained and emphasized in terms of spatially based solutions and informed decisions.

Aim	The overriding aim of this module is to enable the students to understand the following: 1. GIS technology and its roles and areas of application in climate change and sustainable agriculture. 2. Basic and advanced capabilities of GIS software in providing information related to land and water management. 3. Provide a basic understanding of GIS layers and mapping of the real world.
Learning Outcomes	At the end of this module students will be able to: 1- Gain a general understanding of GIS and its components and the areas of applications 2- Understand the concept of GIS models and how data is combined to derive spatially based solutions.
Units	1- What is GIS? 2- GIS components 3- GIS in Organization 4- Mapping where things are 5- Mapping the most and Least 6- Mapping Density 7- Mapping Change
Readings	1- Bolstad P., 2012. GIS Fundamentals: A first text on Geographic Information Systems (4th edition)-Chapter 1 2- Chang K., 2013. Introduction to Geographic Information Systems, 7th edition-Chapter 1. 3- Mitchell, A., ESRI Guide to GIS Analysis, Volume 1: geographic patterns and relationships-Chapters 2-7 4- Gorr, W.L. and Kurland, K. S. 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, Redland, California, ESRI Press-Chapter 1.

<table>
<tr><td>Activity</td><td colspan="17">1- Practical session 1: Introduction to ArcGIS, ArcGIS, working with map layers, Making Measurements, Work with feature attributes, selecting and labelling features. The students are required to explore GIS functions and examine the type of data processed by GIS.

2- Student assignment: mapping locations and working with categories and applications of GIS in areas of CCSAFS. Students are required to prepare a power point presentation on examples on GIS applications and how these were implemented to solve real-world problems at the levels of decision making and the level of community. Examples on the use of GIS tools for disaster management for decision making shall be prepared and presented as a case for decision making, while an example on the use of GIS for adoption of interventions for climate change will be the example on community-based solutions. The presentations shall be presented by the end of the second week of the course.</td></tr>
<tr><td>SD Pillars</td><td colspan="5">Environment</td><td colspan="4">Economy</td><td colspan="5">Social</td><td colspan="3">Culture</td></tr>
<tr><td></td><td colspan="5">✓</td><td colspan="4">✓</td><td colspan="5">✓</td><td colspan="3">✓</td></tr>
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<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
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<tr><td>Vision 2030</td><td colspan="17">The module explains the GIS capabilities and examples of applications that provide solutions to environmental problems (SDG4) to end hunger and improve food security (SDG2) while ensuring sustainable use of water (SDG6) and production of food. The range of GIS applications extends to terrestrial and marine environments and serves the efforts of combating climate change (SDGs 13-15).</td></tr>
<tr><td>ECTS WORK LOAD</td><td colspan="17">The ECTS work load is 0.6, which is equivalent to 15 working hours (See the table of ECTS workload).</td></tr>
<tr><td>Module 2</td><td colspan="17">Data models and structure of data in GIS</td></tr>
<tr><td>Key Concepts</td><td colspan="17">Vector, Raster, Entity, Attributes, Geodatabase</td></tr>
</table>

Overview	The overall aim of this module is to enable the student to understand how features in the real world are presented in GIS and what is the most suitable data structure and model for representing the data. The types of features in GIS and the common spatial data models with entities and attribute types are discussed with the students with examples on sources of data for CCSAFS. The types of edits and data entry suitable for specific applications are also introduced. The module will include the geodatabase components and characteristics with functions and objectives of queries and joins in geodatabases.
Aim	The aim of this module is to provide a comprehensive understanding of GIS data models and their abilities to represent the real world in different layers of information. The module has three objectives: 1- Characterizing the differences in GIS models 2- Introducing the geodatabase and its advantages 3- Identifying sources of data for GIS and types of data entry in GIS
Learning Outcomes	At the end of this module students will be able to: 1- Understand the components of GIS models and the differences among them and their use in different applications 2- Identify the appropriate data entry method and the type of edits required for GIS data. 3- Know formats of data used within GIS and sources of these data, with emphasis on data needed for CCSAFS. 4- Understand the structure and advantages of geodatabases.
Units	1- GIS model structure 2- Vector data model 3- Raster data model 4- Data entry and editing 5- Geodatabases and GIS data representation
Readings	1. Bolstad, P., 2012. GIS Fundamentals: A first text on Geographic Information Systems (4th edition)-Chapters 2,4,8 2. Chang, K., 2013. Introduction to Geographic Information Systems, 7th edition-Chapters 3, 5, 6, 8, 9. 3. Michael, Z., Modeling Our World: ESRI Guide to Geodatabase Design-Chapters 1, 3, 4. 4. Gorr, W.L. and Kurland K. S. 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, Redland, California, ESRI Press-Chapters 4&5.

<table>
<tr><td>Activity</td><td colspan="17">1- Practical sessions: Students will work with file Geodatabases, Spatial data for different applications. The data represent different structures and types of models used in GIS. The student will be able to recognize these types at the end of the session delivered in the lab. The data of training will include applications on mapping of communities, agricultural areas, utilities and services of water and food.

2- Student assignment: each student will work on an assignment of using on spatial data sources, geodatabases and spatial edits for case studies related to CCSAFS.</td></tr>
<tr><td>SD Pillars</td><td colspan="4">Environment</td><td colspan="4">Economy</td><td colspan="5">Social</td><td colspan="4">Culture</td></tr>
<tr><td></td><td colspan="4">✓</td><td colspan="4">✓</td><td colspan="5">✓</td><td colspan="4">✓</td></tr>
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<tr><td></td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td><td></td><td></td><td></td><td>✓</td><td></td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Vision 2030</td><td colspan="17">The module explains the structure of data and type of data needed to tackle the issues of climate change and food security to provide solutions for poverty and hunger (SDGs 1&2). The teaching methods followed in the module and the use of GIS capabilities are related to SDGs 4 and 5, while the many of geodatabases examples are related to urban environment and infrastructure (SDGs 9 &11).</td></tr>
<tr><td>ECTS WORK LOAD</td><td colspan="17">The ECTS workload is 1.2 which is equivalent to 30 working hours, as shown in the Table of detailed Workload.</td></tr>
<tr><td>Module 3</td><td colspan="17">Coordinates and projections in GIS</td></tr>
<tr><td>Key Concepts</td><td colspan="17">Longitude, Latitude, projections, UTM, GPS, KML, Track, Way point</td></tr>
<tr><td>Overview</td><td colspan="17">The module will provide students with the background on map coordinates and projections used in GIS. The justifications and the use for local and universal projections are also explained. The use of GPS to record coordinates and plan for field surveys is also covered by this module with emphasis on the integration of GIS with open source data, topographic maps and high-resolution satellite images for implementing field surveys.</td></tr>
<tr><td>Aim</td><td colspan="17">To enable the students to deal with map coordinates and projection systems while achieving the following objectives:

1- differentiate between coordinates and projections.

2- identify the roles and applications of GPS

3- distinguish the different data formats that can be read and used with GPS</td></tr>
</table>

	4- utilize GPS reading as data source for GIS
Learning Outcomes	At the end of this module students will be able to: 1- understand the differences between coordinates and projections. 2- use GPS units in recording waypoint coordinates and tracks. 3- identify the components of an informative map and its components with the most appropriate map symbolization 4- plan field surveys by utilizing GPS and Topographic maps
Units	1- Earth surface and geographic location, map projections and datums 2- Coordinate Systems 3- Global Navigation Satellite Systems and Coordinate Surveying 4- Geocoding 5- Map basics 6- Maps, digital data and cartographic elements
Readings	1. Bolstad, P., 2012. GIS Fundamentals: A first text on Geographic Information Systems (4th edition)-Chapters 3&4. 2. Chang, K., 2013. Introduction to Geographic Information Systems, 7th edition-Chapter 10. 3. DeMers, M. N. 2009. Fundamentals of Geographical Information Systems, 4th Edition-Chapter 3. Michael, Z., A., Modeling Our World: ESRI Guide to Geodatabase Design-Chapters 1, 3, 4. 4. Mitchell, A., ESRI Guide to GIS Analysis, Volume 1: geographic patterns and relationships-Chapter 2. 5. Gorr, W.L. and Kurland K. S. 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, California, ESRI Press-Chapter 2.
Activity	1- Practical sessions: Students will be subjected to principles of map design and elements of maps needed to serve the communities. The maps of different purposes are produced in these sessions including those of themes related to CCSAFS and other applications related to SDGs (e.g. maps of demography and infrastructure).

<table>
<tr><td></td><td colspan="17">2- Student assignment: students are requested to prepare their dataset using the GPS for collecting and tracking inside the university campus so that data is prepared and analysed in GIS. Coordinates import and processing are also required from the students so that they can create map layouts that serve different purposes and community services like locations of farms and cropping areas, areas under the threat of drought and drought vulnerability.</td></tr>
<tr><td>SD Pillars</td><td colspan="5">Environment</td><td colspan="4">Economy</td><td colspan="5">Social</td><td colspan="3">Culture</td></tr>
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<tr><td></td><td></td><td>✓</td><td></td><td></td><td></td><td>✓</td><td></td><td></td><td>✓</td><td></td><td></td><td></td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Vision 2030</td><td colspan="17">The module is directly related to data collection and mapping for resources needed for planning food and water production (SDGs 2&6) and fostering innovation (SDG 9). Also, the module serves the studies and models of combating climate change (SDG 13)</td></tr>
<tr><td>ECTS WORK LOAD</td><td colspan="17">The working load for this module is 0.6 ECTS with a total of 15 working hours that are focused on the use of GPS and producing map layouts from existing databases and sources.</td></tr>
<tr><td>Module 4</td><td colspan="17">Spatial analysis and GIS capabilities</td></tr>
<tr><td>Key Concepts</td><td colspan="17">Overlay, buffer, proximity, reclassification, intersection, attribute, selection, measurements</td></tr>
<tr><td>Overview</td><td colspan="17">Spatial analysis is the heart of GIS methods and technology. The ultimate goal from the use of GIS in CCSAFS is to analyse data to obtain information and spatial patterns on most appropriate locations, environmental problems and trends. Therefore, this module will present and discuss the main functions that GIS can provide and the layers that can be produced when applying GIS models and operations. In addition, the module will provide the students with hands on experience needed for a GIS-project that will be implemented by each student enrolled in the course.</td></tr>
</table>

Aim	The overriding aim of this model is to understand the capabilities of GIS and the functions that can be used to analyze data within GIS so that solutions are provided. The specific objectives for this module are to: 1- recognize the different terms of spatial analysis for vector and raster models. 2- identify the and types of geo-processing techniques needed for certain application in CCSAFS.
Learning Outcomes	At the end of this module students will be able to: 1- understand the concept of GIS technology and methodology. 2- implement the basic and advanced spatial analysis and geo-processing within GIS. 3- evaluate the GIS data and outputs related to CCSAFS. 4- identify the key areas for GIS applications in CCSAFS.
Units	1- Spatial analysis 2- Topics in raster analysis 3- Measurements 4- Spatial arrangements
Readings	1. Bolstad, P., 2012. GIS Fundamentals: A first text on Geographic Information Systems (4th edition)-Chapters 9&10. 2. Chang, K., 2013. Introduction to Geographic Information Systems, 7th edition-Chapters 12&13. 3. DeMers, M. N. 2009. Fundamentals of Geographical Information Systems, 4th Edition-Chapter 3. 4. Michael, Z.,A., Modeling Our World: ESRI Guide to Geodatabase Design- Unit 4. 5. Mitchell A., ESRI Guide to GIS Analysis, Volume 1: geographic patterns and relationships-Chapters 3, 5, 6. 6. Gorr W.L. and Kurland K. S. 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, ESRI Press-Chapter 9.
Activity	1- Theoretical lectures given by the instructor. 2- Practical sessions: Spatial analysis from GIS Tutorial with assignments at end of chapter 3- Student presentation on a case study where spatial analysis is implemented.

SD Pillars	**Environment**	**Economy**	**Social**	**Culture**
	✓	✓	✓	✓

21st ESD	**Learning to know**	**Learning to be**	**Learning to do**	**Learning to live together**	**Learning to transform oneself and society**	**Learning to give and share**

	✓			✓		✓			✓			✓			✓	
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
						✓			✓		✓	✓					
Vision 2030	Spatial analysis is the heart of GIS that can serve all applications and help in achieving many SDGs. However, most of the spatial analysis are related to water (SDG6), urban and infrastructure planning (SDGs 9, 11&12).															
ECTS WORK LOAD	The total ECTS workload for this module is 1.4 and includes 35 working hours. See the Table of detailed Workload. The work includes exercise or sessions that will be implemented by the students and will be presented as a project for GIS application in CCSAFS.															
Module 5	**GIS modelling**															
Key Concepts	DEM, Terrain, watershed, slope, aspect, hydrology, spatial analysis, curvature, stream, cartographic models															
Overview	The goal behind the use of GIS is to provide means of analysis and solutions to problems related to environment. Therefore, this module intends to provide the student with the GIS tools and methods needed for modelling, particularly for devolving water resources. The module will be based on a student-project that will be based on a real data from Jordan. In this project, students are asked to analyse topographic and land use data to identify the borders of watersheds and its components needed for developing water and land resources within a study area. The other option for students is to apply cartographic modelling on real data to detect environmental changes.															
Aim	The model aims to provide students with modeling and terrain analysis functions needed in CCSAFS research areas. Other objectives for this module are to: 1- enable the student to apply GIS-hydrological functions and analysis. 2- characterize watershed components needed for developing surface water resources through water harvesting projects. 3- design and apply cartographic models needed for change detection.															
Learning Outcomes	At the end of this module students will be able to: 1- understand the GIS functions deployed in modeling, particularly those related to terrain and watershed. 2- Utilize GIS capabilities in providing information related to CCSAFS. 3- identify the main hydrological and terrain functions analysed within GIS.															

Units	1- Terrain mapping and analysis 2- Viewsheds and watershed 3- GIS models and modeling 4- GIS outputs
Readings	1. Bolstad, P., 2012. GIS Fundamentals: A first text on Geographic Information Systems (4th edition)-Chapters 11&13. 2. Chang, K., 2013. Introduction to Geographic Information Systems, 7th edition-Chapters 14&15. 3. Mitchell, A., ESRI Guide to GIS Analysis, Volume 1: geographic patterns and relationships-Chapters 1&7. 4. Gorr, W.L. and Kurland K. S. 2013. AGIS Tutorial 1: Basic Workbook, 10.1 Edition, ESRI Press-Chapter 11.
Activity	1- Practical sessions: The students are given specific practical sessions that focus on utilizing spatial analysis in GIS to serve communities through problem solving. The exercises include solutions to water shortage through analysis of data needed for building new dams, applications for finding best location for shopping canters and community services including farms and water facilities. 2- Student project on watershed and/or cartographic modelling examples and preparing examples where GIS is used to serve local communities at different scales (villages and towns, cities and governorates). The examples shall include real-world problems where GIS provides solutions through integration of data analysis methods

SD Pillars	**Environment**	**Economy**	**Social**	**Culture**
	✓	✓	✓	✓

21st ESD	**Learning to know**	**Learning to be**	**Learning to do**	**Learning to live together**	**Learning to transform oneself and society**	**Learning to give and share**
	✓	✓	✓	✓	✓	✓

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
		✓	✓	✓					✓			✓	✓	✓	✓	✓	

Vision 2030	GIS models are flexible to include a wide range of applications that can serve the CCSAFS and achieve healthy life and well-being (SDGs 2&3). The GIS applications include improving infrastructure (SDG9) and achieving sustainable farming and environment (SDGs12-16). The module also achieves objectives related to education and equality (SDG4)
ECTS WORK LOAD	The total ECTS workload for this module is 1.2 and includes 30 working hours. See the Table of detailed Workload.

ECTS Workload

The course consists of 5 ECTS, each equivalent to 25 hours of teaching and work. The total teaching hours are 30 for lectures and 10 labs under the supervision of the instructor. Following these labs, the student is given an assignment to carry out work that depends on the gained understanding during the lab practical. The assignment has critical questions to answer. These will show students gained knowledge during each course module. Each student is asked to prepare a project composed of five phases; each is related to the course module in sequence. The student will submit his project as a package of layout and analysed layers, in addition to a short report.

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**					**Workload**
				1	**2**	**3**	**4**	**5**	
Lectures (face-to-face)	30	1.5	**45**	3	13	6	12	11	**45**
Activities- 1) Lab work	10	2	**20**	4	5	2	4	5	**20**
Activities- 2) Assignment	10	2	**20**	2	5	2	6	5	**20**
Activities- 3) Project	5	5	**25**	5	5	2	8	5	**25**
Preparation for exam	2	6	**12**	1	2	2	4	3	**12**
Writing the exam	2	1.5	**3**			1	1	1	**3**
Total			**125**	**15**	**30**	**15**	**35**	**30**	**125**

SDGs RUBRIC

The course activities are connected with the SDGs and the three key domains of the CCSAFS Master program; i.e. climate change (CC), sustainable agriculture (SA), and food security (FS) as shown in the following table.

SDGs		**CC**	**SA**	**FS**	**Course Module**
1	End poverty in all its forms everywhere			✓	2
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		✓	✓	1,2,3,5

3	Ensure healthy lives and promote well-being for all at all ages	✓			5
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all			✓	1,2,5
5	Achieve gender equality & empower all women and girls	✓			2
6	Ensure availability and sustainable management of water and sanitation for all	✓	✓	✓	1,3,4
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation	✓	✓	✓	2,3,4,5
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable	✓		✓	1,2,4,5
12	Ensure sustainable consumption and production patterns		✓	✓	5
13	Take urgent action to combat climate change and its impacts	✓		✓	1,3,5
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development		✓		1,4,5
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss	✓	✓		1,5
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, & build effective, accountable, and inclusive institutions at all levels		✓		5

17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS

Jerash University

Course Number (?)

Course Title

Sustainable Soil and Water Management

First Semester

Instructor Information

Instructor: Prof Saeb Khresat
Office Location: Faculty of Agriculture.
Telephone: 962799900222.
Office Hours: Sun and Monday: 10:00-11:00.
E-mail: skhresat@just.edu.jo.

Website: http://www.just.edu.jo/Pages/Default.aspx

Course Identification

Course Number:

Course Name: Sustainable Soil and Water Management.

Course Location: Faculty of Agriculture
Class Times:
Prerequisites:
Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Description/Overview

Soil impacts our way of life in many aspects (e.g., food and fiber production, resources for building shelter and infrastructure, water supplies, etc.). Adverse impacts to soil and water affect the well-being of humans and other living organisms. It is essential that students (majors and non-majors alike) understand soil and water systems, and strategies to mitigate or manage these issues. Effective soil and water management are essential in order to optimize crop yields and maintain soil functionality for sustainable, profitable food production.

Soil and water are fundamental resources in the environment. This course aims to provide an understanding of important soil physical, chemical and biological properties and of water quality. Topics include: soil water retention, storage and movement, salinity, chemical fertility, the role of biology in soil processes, soil conservation and management, water quality factors and the impact of land management on these factors. The course covers topics in soil and water management and conservation important to students of agricultural, and environmental sciences. Processes that degrade the soil- and water-resources (e.g. erosion, salinity, alkalinity and sodicity, as well as degradation of soil structure) are examined, and their measurement, avoidance and management discussed.

The course will be of interest to students who are concerned with protecting land resources from inappropriate use and the restoration of these resources through sustainable management practices.

Course Learning Objectives:

The course is designed to foster multi-disciplinary and integrative problem-solving skills in soil and water management. It starts off with structured lectures and labs/homework assignments, but progresses towards more open-ended, student-driven and often group-based learning.

This course is designed to promote critical thinking about agricultural production practices, agricultural sustainability, limitations to agricultural production and agricultural impacts on the environment. These topics are especially relevant with increased public awareness and criticism of agricultural and food production practices and their environmental impacts.

At the completion of this course, the student should be able to:

1. Explain relationships among soil, water and air as they relate to environmental quality and agriculture

2. Interpret soil, landscape and climate data for the purpose of identifying potential environmental impacts of agricultural practices.

Learning Objectives:

Students mastering class material will be able to:

- Understand terminology used in soil & water conservation & management.
- Demonstrate knowledge within soil science at advanced level, which is relevant to various types of soil and water use, geographic areas and soil types.
- Understand how soil and water is used and handled in the landscape and about the dependence of soil and water use on the interaction between natural factors and societal factors.
- Understand how climate, soil type and land use impact on the water supply and the movement of water and its function as carrier substance for mineral substances.
- Evaluate the connections that exist between soil, water management, climate, production and environmental impact.
- Have insights about current research and development work within soil and water use.
- Investigate the methodology specifically relevant to soil and water use.
- Analyse soil and water problems, and develop methods to solve soil and water management & conservation problems.

Course Content Learning Outcomes:

These are complex systems and productions that may interfere with each other and the surrounding environment. The overall aim with the course is to give the students the necessary basic information about soil and water management. This should be set in an overall view so the students are able to critically evaluate the factors which are important for a sustainable use of these resources.

A student who has met the objectives of the course will be able to:

1. Examine and critically appraise the application of the fundamentals of soil management and hydrology in sustainable resource management.
2. Evaluate the sustainability of systems for managing the soil and water resources.
3. Evaluate water resource use within the environment.
4. Discuss important factors for performing a sustainable soil and water management.

Teaching and Learning Approach

- Active learning, where students should be active and involved in the learning process inside the classroom, will be emphasized in the delivery of this course. Different active learning methods/approaches such as: Engaged Learning, Project-Based Learning, Cooperative Learning, Problem-based Learning, Structured Problem-solving, will be used.

- A typical lecture would start with a short review (~ 5 minutes) using both PowerPoint presentations and the blackboard. This review will also depend on discussions which will gauge the students' digestion of the previous material. Then, the students would have a lecture on new materials using PowerPoint presentations and blackboard. The lecture presentation will be paused every 15 – 20 minutes with brainstorming questions and discussions that will allow the students to reflect and think in more depth about what they learned in that presentation. Then, some example problems will be presented and discussed with the students to illustrate the appropriate problem solving skills that the students should learn. The lecture will be continued for another 15 – 20 minutes, followed by examples and/or a quiz covering the materials taught in the previous two weeks.
- Assigned readings and activities are an integral component of the course. In addition to attending lecture, students are expected to read the required portions of the text and any supplementary materials, complete class assignments, and participate in class activities. Class assignments may include quizzes, problem sets, and summaries of science news articles. Class activities will include interactive critical thinking exercises which may be based on homework assignments. Assignments should be typed and proofed.

Course Resources:

Course Website(s)

Required Course Texts and Materials:

Frederick R. Troeh, J. Arthur Hobbs, and Roy L. Donahue. 2003. Soil and Water Conservation for Productivity and Environmental Protection Fourth Edition.

Optional Course Texts and Materials:

Assignments and Grading Scheme

Grading System

0 to 100% (where 70% is the least pass mark)

Grading Policy:

Component	Grade
Assignments	10%
Midterm Exam	30%
Term paper	10%
Class Attendance/ Participation	10%
Final exam	40%

Total Points	**100%**

Course Policies

Attendance

Attendance will be checked at the beginning of each class. University regulations will be strictly followed for students exceeding the maximum number of absences.

Homework

Working homework problems is an essential part of this course and they represent a key opportunity to learn the subjects discussed. All homework problems assigned during a given week are due at the beginning of class on the second meeting of the following week unless otherwise stated. Late homework will not be accepted. Failure to turn in this particular homework on time will result in a grade of 0 (zero) for the homework contribution to your final grade. Team work is encouraged; however, the work one hands in must represent his/her own effort. Homework solutions will be discussed in class. There will be no handouts of homework solutions.

Quizzes

Quizzes will be part of this course. No make-up quizzes will be conducted except in the case of a documented emergency

Term projects

Term projects will be conducted by a group of four students. Each group will select a project from a list of projects suggested by the instructor. The team should share and distribute responsibility. The group will submit a professional report and make an oral presentation. Making use of all resources, e.g., patents, journal publications, internet, labs, etc., is encouraged. The report must be typed. Hand-written reports are not accepted.

Student Conduct

It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavours. Cheating will not be tolerated in this course. University regulations will be pursued and enforced on any cheating student.

Disability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Important Dates to Remember

Course Schedule

Weeks	SUBJECT	Date
1, 2	Soil and Water Conservation	
3, 4, 5	Soil Resilience and Conservation	
6, 7, 8	Erosion Control and Soil Quality	
9, 10	Integrated Water Resources Management	
11, 12	Processes in the Soil Environment: Soil Formation	
13, 14	Soil Quality and Sustainable Land Management.	

CCSAFS COURSE MODULE

Course	**Sustainable Soil and Water Management**
Module 1	**Soil and Water Conservation**
Key Concepts	Soil, water, and conservation
Overview	There a high link between soil conservation and water conservation. The improvement in soil conversation by reducing run-off, soil erosion, formation of crusts, and the breakdown of soil structure, can ultimately lead to an improvement in water infiltration to soil and water conservation.
Aim	This module will cover: • The information to understand the main features of the global water cycle, the link between science of water and climate. • The effect of climate change on water cycle and by association the natural and human systems.
Learning Outcomes	At the end of this module students will be able to: • Understand the water cycle and its connection to climate. • Understand how variability and changes in climate affect water availability on land. • Understand how water impacts ecosystems. • Learn how to critically evaluate a scientific article and write a review. • Diagnose the cause of a climate-related water problem and develop solutions to address.
Units	• Why conserve soil and water? • Agents that degrade soil and water resources. • Soil erosion. • Consequences of soil erosion (on-site problems , off-site problems) • Drivers of soil erosion. • Restoration of eroded and degraded soils.
Readings	1) Barr N. & Cary J. (1992) *Greening a Brown Land. The Australian Search for Sustainable Land Use*. Macmillan, Melbourne. 2) Roberts B. (1995) *The Quest for Sustainable Agriculture and Land Use*. University of New South Wales Press, Sydney. 3) Sposito G. & Zabel A. (Eds) (2003) The assessment of soil quality. *Geoderma* **114**, Nos. 3–4.

<table>
<tr><td>Activity</td><td colspan="17">Assignment 1.1: Reflecting upon soil and water conservation:
3) Provide statistical data about soil and water conservation.
4) Suggest some solutions to solve the problem of soil and water conservation.</td></tr>
<tr><td>SD Pillars</td><td colspan="5">Environment</td><td colspan="5">Economy</td><td colspan="4">Social</td><td colspan="3">Culture</td></tr>
<tr><td></td><td colspan="5">✓</td><td colspan="5">✓</td><td colspan="4">✓</td><td colspan="3">✓</td></tr>
<tr><td>21st ESD</td><td colspan="4">Learning to know</td><td colspan="4">Learning to be</td><td colspan="3">Learning to do</td><td colspan="3">Learning to live together</td><td colspan="3">Learning to transform oneself and society</td><td colspan="3">Learning to give and share</td></tr>
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<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td></td><td></td><td>✓</td><td></td><td>✓</td><td></td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Module 2</td><td colspan="17">Soil Resilience and Conservation</td></tr>
<tr><td>Key concepts</td><td colspan="17">Soil resilience and conservation</td></tr>
<tr><td>Overview</td><td colspan="17">This chapter will cover the capacity of the soil to restore from the degradative processes. Soils are exposed to many degradative processes including erosion, compaction, salinization, and acidifications. The severity of these degradative processes depends on the severity and duration of the degradative processes and the capacity of soil to resist these processes and the ability to regain and recover. The capacity of the soil to recover from the degradative processes is an inherent attribute of soil. With the interaction with proper management, most soils are capable to reverse soil degradation.</td></tr>
<tr><td>Aim</td><td colspan="17">• This module will explain soil fertility, looking into nutrients needed for the growth of plants, and briefing the processes that cause a loss of soil fertility and the degradation effects.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="17">At the end of this module students will be able to:
• To identify basic soil fertility processes.
• Describe the natural factors influencing soil organic matter decomposition and accumulation rate.
• Explain the relationship between climate change and carbon sequestration.
• Identify the different processes leading to the stabilization of soil organic matter.
• Understand soil organic matter decomposition.
• Explain why soil organic matter is important for soil resilience.</td></tr>
<tr><td>Units</td><td colspan="17">• Concepts of soil resilience
• Soil erosion and resilience</td></tr>
</table>

<table>
<tr><td></td><td colspan="18">• Soil resilience and erodibility
• Management strategies to promote soil resilience</td></tr>
<tr><td>Readings</td><td colspan="18">1) Blanco-Canqui H., Lal R. (2010). Soil Resilience and Conservation. In: Principles of Soil Conservation and Management. Springer, Dordrecht.
2) Seybold CA, Herrick JE, Brejda JJ (1999). Soil resilience: A fundamental component of soil quality. Soil Sci 164:224–234
3) Papendick RI (1994). Maintaining soil physical conditions. In: Greenland DJ, Szabolcs I (eds) Soil resilience and sustainable land use. CAB Int. Wallingford, Oxon UK, pp 215–234</td></tr>
<tr><td>Activity</td><td colspan="18">Assignment 2.1: Reflecting upon measurements of soil resilience:

Prepare a short presentation about resilience. Students have to make a short presentation in class using PowerPoint. The due date to submit this activity is week 2.</td></tr>
<tr><td>SD Pillars</td><td colspan="5">Environment</td><td colspan="5">Economy</td><td colspan="4">Social</td><td colspan="4">Culture</td></tr>
<tr><td></td><td colspan="5">✓</td><td colspan="5">✓</td><td colspan="4">✓</td><td colspan="4">✓</td></tr>
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<tr><td></td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td></tr>
<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td></td><td></td><td>✓</td><td></td><td></td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Module 3</td><td colspan="18">Erosion Control and Soil Quality</td></tr>
<tr><td>Key concepts</td><td colspan="18">Erosion control and soil quality</td></tr>
<tr><td>Overview</td><td colspan="18">The concept of soil quality emerged to define the ability of soil to perform a specified function. This concept is associated with the ability of the soil to: 1) Sustain plant and animal productivity; 2) Maintain environmental quality (maintain and enhance air and water quality); 3) Promote plant, animal, and human health; 4) Promote plant growth and productivity without reducing soil erosion and degradation; 5) Hold and release nutrients to plants; 6) Hold and release water to plant and recharge; 7) Promote root growth; 8) Maintain abiotic habitat; 8) Resist degradation. This module will cover the conservation and management practices that improve the soil function to address the growing concerns about the depletion of natural resources, soil pollution, and the global climate change.</td></tr>
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<table>
<tr><td>Aim</td><td colspan="17">• The aim of this module is to present best management practices for managing erosion on agricultural soils for preventing and resolving erosion processes.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="17">At the end of this module students will be able to:
• Describe the change in soil quality.
• Describe the methods to control soil erosion.</td></tr>
<tr><td>Units</td><td colspan="17">• Definitions of soil and water quality
• Indicators of soil and water quality
• The soil and water management assessment framework
• Management of soil and water quality</td></tr>
<tr><td>Readings</td><td colspan="17">1) Blanco-Canqui H., Lal R. (2010). Erosion Control and Soil Quality. In: Principles of Soil Conservation and Management. Springer, Dordrecht
2) FAO. 2019. Soil erosion: the greatest challenge to sustainable soil management. Rome. 100 pp. Licence: CC BY-NC-SA 3.0 IGO.
3) Doran, J. W., & Parkin, T. B. (1994). Defining and assessing soil quality. Defining soil quality for a sustainable environment, (definingsoilqua), 1-21.</td></tr>
<tr><td>Activity</td><td colspan="17">Assignment 3.1: Student presentation for a selected Journal article:

Students have to present a Journal article related to soil quality. The presentation should not exceed 5 minutes and an extra 10 minutes for discussion. Students should use PowerPoint and submit a short summary for the article (one paragraph). The due date is the week 3.</td></tr>
<tr><td>SD Pillars</td><td colspan="4">Environment</td><td colspan="4">Economy</td><td colspan="4">Social</td><td colspan="5">Culture</td></tr>
<tr><td></td><td colspan="4">✓</td><td colspan="4">✓</td><td colspan="4">✓</td><td colspan="5">✓</td></tr>
<tr><td>21st ESD</td><td colspan="3">Learning to know</td><td colspan="3">Learning to be</td><td colspan="3">Learning to do</td><td colspan="3">Learning to live together</td><td colspan="3">Learning to transform oneself and society</td><td colspan="2">Learning to give and share</td></tr>
<tr><td></td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="2">✓</td></tr>
<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td></td><td></td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Module 4</td><td colspan="17">Integrated Water Resources Management</td></tr>
<tr><td>Keys</td><td colspan="17">Water resources management</td></tr>
<tr><td>Overview</td><td colspan="17">The Global Water Partnership's definition of Integrated Water Resources Management (IWRM) is “a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”. The concept is</td></tr>
</table>

	based on three principles: social equity, economic efficiency and environmental sustainability. So the IWRM is a comprehensive tool for managing water resources to balance social and economic needs and to ensure the protection of ecosystems. Water is used for many purposes including agriculture, ecosystem, and people. Therefore, the IWRM is a flexible way to manage water use between sectors.
Aim	The aim of this module is to: • Provide students with the knowledge and skills related to integrated water resources management. • Gain practical experience in using water management modelling tools.
Learning Outcomes	At the end of this module students will be able to: • Explain the concept and principles of IWRM. • Understand the water management system components. • Describe the methodologies and tools for practicing IWRM· • Pursue an interdisciplinary approach in managing the water resources. • Make appropriate use of water management modelling and integrated water management principles.
Units	• Groundwater resources and protection. • Catchment protection. • Modelling environmental processes. • Catchment hydrology and assessment. • Integrated systems for sustainable surface water management. • Forecasting and extreme event response.
Readings	1) Rahaman, M. M., & Varis, O. (2005). Integrated water resources management: evolution, prospects and future challenges. Sustainability: science, practice and policy, 1(1), 15-21. 2) Savenije, H. H., & Van der Zaag, P. (2008). Integrated water resources management: Concepts and issues. Physics and Chemistry of the Earth, Parts A/B/C, 33(5), 290-297.
Activity	**Assignment 4.1:** Student presentation for a selected Journal article: Students have to present a Journal article related to integrated water resources management. The presentation should not exceed 5 minutes and an extra 10 minutes for discussion. Students should use PowerPoint and submit a short summary for the article (one paragraph). The due date is week 4-10. **Assignment 4.2:** Applying a community-service learning methodology to a local farm: • Students are required to visit local farms and identify problems related water resources management. • Students need to design a survey to identify what kinds of water resources management are adopted by farmers.

<table>
<tr><td></td><td colspan="17">• Students are required to integrate the acquired knowledge that they have learned in this module to help farmers to use the water resources in an efficient way.</td></tr>
<tr><td>SD Pillars</td><td colspan="4">Environment</td><td colspan="4">Economy</td><td colspan="4">Social</td><td colspan="5">Culture</td></tr>
<tr><td></td><td colspan="4">✓</td><td colspan="4">✓</td><td colspan="4">✓</td><td colspan="5">✓</td></tr>
<tr><td>21st ESD</td><td colspan="3">Learning to know</td><td colspan="3">Learning to be</td><td colspan="3">Learning to do</td><td colspan="3">Learning to live together</td><td colspan="3">Learning to transform oneself and society</td><td colspan="3">Learning to give and share</td></tr>
<tr><td></td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td></tr>
<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td></td><td></td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Module 5</td><td colspan="17">Processes in the Soil Environment</td></tr>
<tr><td>Keys</td><td colspan="17">Soil environment</td></tr>
<tr><td>Overview</td><td colspan="17">This module addresses factors that affect on soil formation. There are several factors contribute to soil formation, stability, and sustainability. Climate factors such as temperature, moisture, and wind play a major role in soil formation and sustainability.</td></tr>
<tr><td>Aim</td><td colspan="17">The aim of this module is to highlight the processes in soil formation, environment, and sustainability.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="17">At the end of this module students will be able to:
• Identify factors involved in soil formation.
• Describe different types of parent material.
• Explain how topography affects soil formation.
• Explain how organisms affect soil development.
• Describe the effect of time and weathering on soil properties.
• Explain how climate affects the development of soil.</td></tr>
<tr><td>Units</td><td colspan="17">• Soil formation.
• The soil-forming factors.
• Parent material.
• Climate.
• Organisms.
• Relief.
• Time.</td></tr>
<tr><td>Readings</td><td colspan="17">1) Jenny, H. (1994). Factors of soil formation: a system of quantitative pedology. Courier Corporation.
2) Bockheim, J. G., Gennadiyev, A. N., Hartemink, A. E., & Brevik, E. C. (2014). Soil-forming factors and Soil Taxonomy. Geoderma, 226, 231-237.</td></tr>
</table>

<table>
<tr><td></td><td>3) Shepard, C., Pelletier, J. D., & Rasmussen, C. (2018). Soil evolution response to the quaternary climate system. Understanding Quaternary Soil Formation Using A Synthesis of Soil Chronosequences, 76.</td></tr>
<tr><td>Activity</td><td>Assignment 5.1: Reflecting upon soil processes environment:

Q.1) List factors affecting soil formation and sustainability?
Q.2) How do soil environment have an impact on soil processes?

Assignment 5.2: Students require to find videos about soil formation and sustainability from an authentic scientific source and share them with the rest of the students. Videos should be 5 minutes in length to highlight soil formation and sustainability. For longer-videos, students are required to shorten these videos by using an online-free video processing software.</td></tr>
<tr><td>SD Pillars</td><td><table><tr><td>Environment</td><td>Economy</td><td>Social</td><td>Culture</td></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
<tr><td>21st ESD</td><td><table><tr><td>Learning to know</td><td>Learning to be</td><td>Learning to do</td><td>Learning to live together</td><td>Learning to transform oneself and society</td><td>Learning to give and share</td></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
<tr><td>SDGs</td><td><table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr><tr><td></td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td></td></tr></table></td></tr>
<tr><td>Module 6</td><td>Soil Quality and Sustainable Land Management</td></tr>
<tr><td>Keys</td><td>Soil quality and land management</td></tr>
<tr><td>Overview</td><td>Soil quality concepts were highlighted in module 3, indication the ability of soil to perform a specified function. Human activities degrade natural resources including soil. Therefore, international agencies have responded by promoting ecologically sustainable development (ESD). There is a need for more sustainable land management (SLM) to assess soil (land) resources.</td></tr>
<tr><td>Aim</td><td>The aim of this module is to demonstrate to students how to integrate all sustainable practices into an integrated sustainable management system (SLM).</td></tr>
</table>

Learning Outcomes	At the end of this module students will be able to: • Understand basic definitions and principles of land management, degradation and restoration. • Describe important land degradation processes. • Explain how various factors lead to unsustainable land management practice. • Identify solutions to tackle land degradation problems. • Provide successful strategies for sustainable land management in different regions and farming systems.																
Units	• What is soil quality? • Concepts of sustainability. • Sustainable land management. • Summary																
Readings	5) Magdoff, F., & Van Es, H. (2000). *Building soils for better crops* (pp. 80-82). Beltsville: Sustainable Agriculture Network. 6) Robert E. White. Principles and Practice of Soil Science: The Soil as a Natural Resource, Fourth Edition, Blackwell.																
Activity	**Assignment 6.1**: Visit a local farm and use the checklist to check the issues and principles for all aspects of sustainability that growers encounter on their farms.																
SD Pillars	**Environment**			**Economy**			**Social**			**Culture**							
	✓			✓			✓			✓							
21st ESD	**Learning to know**			**Learning to be**			**Learning to do**			**Learning to live together**			**Learning to transform oneself and society**			**Learning to give and share**	
	✓			✓			✓			✓			✓			✓	
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
		✓													✓		✓

Table 1. A 10 ECTS workload allocation for the course "Sustainable Soil and Water Management".

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**						**Workload**
				1	**2**	**3**	**4**	**5**	**6**	
Lectures (face-to-face)	26	1.6	**42**	4	6	10	13	5.5	4.5	**43**
Online	5	2	**10**	-	1	2	4	1.5	1.5	**10**
Lab work										

Reading articles (3 pages per hour)	200	0.3	**58**	9	8	10	11	11	9	**58**
Reading book chapters (5 per/h)	135	0.2	**28**	4	5	6	4	5	4	**28**
Preparing course activities	6	9.7	**58**	3	5	10	20	10	10	**58**
Project work	6	8.3	**50**	6	3	9	20	5	7	**50**
Preparation for exam	2	23	**45**					20	25	**45**
Writing the exam	2	1.5	**3**						3	**3**
Total				**26**	**26**	**47**	**72**	**58**	**64**	**295**

Table 2. Connection of the 17 SDGs with the 3 key domains of the CCSAFS MSc.

No.	**SDGs**	**Climate Change**	**Sustainable Agriculture**	**Food Security**	**Course Module**
1	End poverty in all its forms everywhere				
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		✓		1, 2, 3, 4, 5, 6
3	Ensure healthy lives and promote well-being for all at all ages	✓		✓	4
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	✓	✓		1
5	Achieve gender equality and empower all women and girls		✓	✓	2
6	Ensure availability and sustainable management of water and sanitation for all		✓		1, 4
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all				
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				

10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns				
13	Take urgent action to combat climate change and its impacts				
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss		✓		1, 2, 3, 5, 6
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development		✓		6

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CCSAFS COURSE SYLLABUS

Jerash University

Course Number (0604716)

Course Title
Economics of Climate Change, Sustainable Agriculture and Food Security

Instructor Information

Instructor: **Dr.Mohamed AlTarawneh**
Office Location: **Faculty of Agriculture Building**
Telephone: 0096226350521
Office Hours (Times & Days).
E-mail: m.tarawneh@jpu.edu.jo

Website: http://www.jpu.edu.jo/jpu/profile.php?id=50Course Identification

Course Number:0604716

Course Name: **Economics of Climate Change, Sustainable Agriculture and Food Security**
Course Location: **Faculty of Agriculture**
Class Times: Not Now
Prerequisites: **Food Security (603374) Policies and Agricultural Economic Development (603353)**
Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Description/Overview

Climate change can be viewed as a fundamentally economic problem; however, climate change has a unique set of attributes that makes standard economic analysis hard to apply. It is a global problem which requires unprecedented international cooperation. It is pervaded by uncertainty in every step of the process of translating global emissions into local damages. The costs and benefits of its mitigation are highly mismatched geographically as well as temporally, and its damages are largely irreversible. This course examines basic problems of food production, socio-cultural and psycho-social factors on food security and policy. It considers critical factors influencing food security and historic situation of nutrition around the world. The course covers concepts of agricultural economics and policy from the perspective of food security, problems of hunger and malnutrition in the world, food policy in developing and developed countries, provision of world population, ecological problems of food resources production, resources and quality of plant and animal food. Students are encouraged to discuss solutions to the food security problem.

Course Learning Objectives

The course aims at:

1. Discussing environmental impacts of any development process.

2. Discussing the opportunity of mitigation against negative environmental impacts and enhancing positive environmental impacts

3. Using Cost Benefit Analysis as an integral part of project selection.

4. Understanding economic assessment of the environmental impacts of the project.

5. Understanding the inter-relationship between climate change, environment, food security and sustainability at global and regional level.

6. Understanding the concept of food security and its related issues.

7. Understanding the ways of adaptation for climate change, and how to manage the environment keeping and food security sustainability.

8. Promoting of critical thinking and problem-solving skills.

Course Content Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Discuss the environmental impacts of any agriculture activity

2. Use economic analysis as policy tools

3. Understand the use of public policies and support programs in influencing environmental actions by developers, manufactures, farmers and consumers.

4. Identify the interrelationships between environment and economics

5. Implement analytical skills to quantify the environmental impacts and interpret of quantified results.

6. Understand the production of food resources, their ecological problems, factors of nutritive policy, food safety and nutritive policy.

7. Apply the ways of adaptation for climate change.

Course Resources

1. Beddington J., Asaduzzaman M., Cndez A., Guillou M., Jahn M., Erda L., Mamo T., Van Bo N., Nobre C.A., Scholes R., Sharma R. andWakhungu J. (2012). Achieving Food Security in the Face of Climate Change: Final Report from the Commission on Sustainable Agriculture and Climate Change. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark, Available online at: www.ccafs.cgiar.org/commission.
2. National Research Council (2012). A Sustainability Challenge: Food Security for All, Report of Two Workshops. Washington, DC: The National Academies Press. http://www.nap.edu/catalog.php?record_id=13378#toc.
3. Food Insecurity Atlas of Rural India (2001) MS Swaminathan Research Foundation and World Food Programme.
http://home.wfp.org/stellent/groups/public/documents/ena/wfp076968.pdf
4. National Research Council (2012). *Sustainability Challenge: Food Security for All*, Report of Two Workshops. Washington, DC: The National Academies Press. http://www.nap.edu/catalog.php?record_id=13378#toc

5. Lichtfouse, E., Navarrete, M., Debaeke, P., Véronique, S., Alberola, C. 2009, Sustainable Agriculture.

6. UNDP, 2012. Chapter 5: Sustainable Agriculture, https://www.cbd.int/financial/finplanning/g-plantools5-undp.pdf.

7.OSU Extension Small Farms, An Introduction Sustainable Farming. http://extension.oregonstate.edu/sorec/sites/default/files/Sustainable_Farming.pdf

8. Archer, "The Perturbed Carbon Cycle.",
http://forecast.uchicago.edu/archer.ch10.perturbed_carbon.pdf.
9. Stephen H. Schneider, "What Is 'Dangerous' Climate Change?", Energy Research at Stanford 2005-2006,
https://gcep.stanford.edu/pdfs/SI3U6jOMPAIgwkaiBD_77Q/schneider_ers06.pdf
10. Piers Forster, "Changes in Atmospheric Constituents and in Radiative Forcing.", http://www.cgd.ucar.edu/events/20130729/files/Forster-Ramaswamy-etal-2007.pdf
11. Elizabeth Kolbert, "The Curse of Akkad.",
https://faculty.washington.edu/lynnhank/The_Curse_of_Akkad.html.
12. Surowiecki, "Better and Better: The Myth of Inevitable Progress.", https://www.foreignaffairs.com/reviews/review-essay/2007-07-01/better-and-better-myth-inevitable-progress.

13. Pew, "The Causes of Global Climate Change.",
https://www.pewresearch.org/science/2016/10/04/public-views-on-climate-change-and-climate-scientists/.

14. Jules Pretty,2007. Agricultural sustainability: concepts, principles and evidence, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2610163/.

15. Fritz J. Häni, László Pintér and Hans R. Herren,2006, Sustainable Agriculture: From Common Principles to Common Practice, International Forum on Assessing Sustainability in Agriculture (INFASA), https://www.iisd.org/pdf/2007/infasa_common_principles.pdf.

Course Website(s):

- **http://www.economicsplace.com**
- https://www.elgaronline.com/view/9780857937551.xml

Required Course Texts and Materials

PowerPoint presentations prepared by the instructor for the participants.

Optional Course Texts and Materials

1. Clayton Campanhola and Shivaji Pandey, 2018, Sustainable Food and Agriculture, 1st Edition, Academic Press.
2. Sarah Ellis,2018,The Changing Climate for Food and Agriculture: A Literature Review, Institute for Agriculture and Trade Policy Minneapolis, Minnesota.
3. Christopher Kipkoech Saina, Daniel Kipkosgei Murgor and Florence A.C Murgor,2013, Climate Change and Food Security.
4. Halvorsen, Robert & David F. Layton (2105). Handbook on the Economics of Natural Resources. Edward Elgar Publishing Limited. Library of Congress control Number: 2014952135.
5. Tietenberg, Tom & Lynne Lewis (2016). Environmental & Natural Resources Economics: 9th Edition. Pearson. ISBN-13: 978-0-13-139257-1 (alk. paper) ISBN-10: 0-13-139257-3 (alk. paper).

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least passing grade)

Grading Policy

Component	Grade
Assignments	80%
Class Attendance/ Participation	20%
Total Points	100%

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and / or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Dissability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Course Schedule

Week	SUBJECT
01	Syllabus / Introduction to the course
02	Scarcity, opportunity cost, and economic rationality
03	Pareto efficiency and the Kaldor/Hicks criteria Positive and normative economics
04	Economics and Sustainability
05	Theory of consumer choice and the demand curve
06	Profit maximization and the supply curve
07	The economics of market allocation
08	Positive and Negative Externalities
09	Public Goods and Sustainability

10	Human transformation of the Earth: drivers of change: *Demographic drivers (population size, age and gender structure, and spatial distribution) *Economic drivers (national and per capita income, macroeconomic policies, international trade) *Socio-political (democratization, roles of women and local communities, role of private sector) *Scientific and technological (research and development, adoption of new technologies) *Cultural and religious (choices individuals make about what and how to consume and what they value).
11	Climate change and the Kyoto Protocol
12	The Sustainable Development Goals of the United Nations
13	Decision-making: Individual vs. collective action The Rational Actor Paradigm Self-interest vs. social goals
14	Non-Market Valuation
15	Benefit Cost Analysis
16	Students' presentations

Course	**Economics of Climate Change, Sustainable Agriculture and Food Security**
Module 1	**Climate change economics and sustainability policy**
Key Concepts	climate change economics, sustainability policy
Overview	Anthropogenic climate change represents the most challenging global problem confronting policymakers. This course begins with a module that explains anthropogenic greenhouse gas emissions as a function of a number of economic variables.
Aim	The aim of this module is for students to learn to discourse on climate change economics and sustainability policy.
Learning Outcomes	At the end of this module learners will be able to: 1. Understand economic rationality and the concept of climate change 2. understand the complex factors influencing changes in carbon dioxide emissions

Units	Unit 1. Fundamental economic Concepts Unit 2. The relationship between environment and economics Unit 3. Ecosystems and their services
Readings	Assigned readings from various websites (see in the activity section below and choose relevant readings to agriculture and food security)
Activity	Ask students to browse the sites below: • World Meteorological Organization (WMO) • United Nations Environment Programme (UNEP) • United Nations Framework Convention on Climate Change (UNFCCC) • Global Environment Facility (GEF) • Linkages by International Institute for Sustainable Development (IISD) • IPCC Data Distribution Centre • United Nations Convention to Combat Desertification

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals	X	X	X			X	X	X				X	X		X	X	X

21st ESD	Learning to know	Learning to be	Learning to do	Learning to live together	Learning to transform oneself and society	Learning to give and share
	✓	✓	✓	✓	✓	✓

SD pillars	environment	economy	social	culture

ECTS WORK LOAD	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	10	**3**	**1**	**15**	**6**	**-**	**3**	**-**	**38**

Vision 2030	Ensure all human beings can enjoy prosperous and fulfilling lives and that economic, social and technological progress occurs in harmony with nature.
Module 2	**Sustainability and Climate Change**
Key Concepts	Pillars of sustainability, climate change, mitigation, adaptation, The Sustainable Development Goals
Overview	In this module, we examine the nature and scope of sustainability in relation to climate change. We begin with a definition of sustainability and a discussion of its relationship to other fields, including agriculture and food security. We emphasize strategies to ensure sustainability of both natural ecosystems and human well-being by integrating economic, environmental, social and cultural aspirations. The Sustainable Development Goals and the Millennium Ecosystem Assessment reports will be used to illustrate the integration of information from

<table>
<tr><td></td><td colspan="17">natural and social sciences and to harmonize the use of ecosystem services with human needs (food security and sustainable agriculture)</td></tr>
<tr><td>Aim</td><td colspan="17">The aims of this module are to:
1) distinguish between the different dimensions of sustainability,
2) introduce the Sustainable Development Goals,
3) explore decision-making options that can harmonize the use of ecosystem goods and service with human needs (such a food provision and other ecosystem services)</td></tr>
<tr><td>Learning Outcomes</td><td colspan="17">At the end of this module, learners will be able to:
• Distinguish between sustainability dimensions
• Assess the status of the Sustainable Development Goals in Egypt and in the region
• Examine decision-making to mitigate and adapt to climate change</td></tr>
<tr><td>Units</td><td colspan="17">Unit 1. Sustainability
Unit 2. The relationship between sustainability and economics
Unit 3. the Sustainable Development Goals
Unit 4. The Millennium Ecosystem Assessment
Unit 5. Making policy decisions to mitigate and adapt to climate change</td></tr>
<tr><td>Readings</td><td colspan="17">Millennium Ecosystem Assessment for the Arab region

http://gis.cedare.int/arabma/docs/MA_final%20full%20Report_Low.pdf</td></tr>
<tr><td>Activity</td><td colspan="17">Discussion related to the application of economic principles to environmental issu such as climate change and sustainable agriculture</td></tr>
<tr><td>SD pillars</td><td colspan="4">environment</td><td colspan="4">economy</td><td colspan="5">social</td><td colspan="4">culture</td></tr>
<tr><td>21st ESD</td><td colspan="3">Learning to know
✓</td><td colspan="3">Learning to be
✓</td><td colspan="3">Learning to do
✓</td><td colspan="3">Learning to live together
✓</td><td colspan="3">Learning to transform oneself and society
✓</td><td colspan="3">Learning to give and share
✓</td></tr>
<tr><td rowspan="2">SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td></td><td>×</td><td></td><td></td><td></td><td>X</td><td>×</td><td>×</td><td></td><td></td><td>×</td><td>×</td><td>X</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>ECTS workload</td><td>Lecture</td><td colspan="2">Online</td><td colspan="2">Lab</td><td colspan="2">Reading</td><td colspan="2">Course activity</td><td colspan="2">Project</td><td colspan="2">Prepare exam</td><td colspan="2">Writing exam</td><td>Total</td></tr>
</table>

	10	**3**	**1**	**13**	**6**	**-**	**3**	**-**	**35**
Vision 2030	lead to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources.								
Module 3	**Human transformation of the Earth: drivers of change**								
Key Concepts	Drivers of change: Demographic, economic, socio-political, scientific and technological, cultural and religious. Benefits and Costs of Climate Change Mitigation, Threats caused by climate change, Policy Initiatives.								
Overview	In this module, we discuss- in a holistic view-the different drivers of change for the transformation of the earth (including climate change) * Demographic drivers (population size, age and gender structure, and spatial distribution) * Economic drivers (national and per capita income, macroeconomic policies, international trade) * Sociopolitical (democratization, roles of women and local communities, role of private sector) * Scientific and technological (research and development, adoption of new technologies) *Cultural and religious (choices individuals make about what and how to consume and what they value).								
Aim	The aims are: 5) to discuss the drivers of climate change; 6) to understand the threats caused by climate change on humans and other living things through impacts on ecosystems, agriculture and food security; 7) to analyze economically estimates of mitigation benefits and costs in the case of various market distortions; 8) to discuss making policy choices under uncertainty in climate change models								
Learning Outcomes	At the end of this module, learners will be able to: 5. Identify drivers of change; 6. Understand the threats caused by global climate change through impacts on agriculture and food security; 7. Analyze economically estimates of mitigation benefits, improved understanding of costs in the presence of various market distortions, 8. Design tools for making policy choices under uncertainty								
Units	Unit 1: Drivers of change Unit 2: Assessing the Benefits and Costs of Climate Change Mitigation Unit 3: Dealing with Uncertainty of climate policy								

	Unit 4: International Policy Coordination
Readings	• Millennium Ecosystem Assessment Reports http://maweb.org • Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity (www.eia.doe.gov/oiaf/kyoto/kyotorpt.html): Comprehensive economic analysis of the costs of complying with the Kyoto Protocol, sponsored by the U.S. Energy Information Administration
Activity	Write a five-page essay in which you summarize what is known about global climate change. Discuss how the complexity, the long-term nature of the problem, the uncertainty regarding climate change effects, and the challenging policy problems related to sustainable agriculture and food security.

SD pillars	**environment**	**Economy**	**social**	**culture**

21st ESD	Learning to know	Learning to be	Learning to do	Learning to live together	Learning to transform oneself and society	Learning to give and share
	✓	✓	✓	✓	✓	✓

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	×	×						×			×	×					×

ECTS workload	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	10	**2**	**1**	**15**	**6**	**-**	**2**	**-**	**36**

Vision 2030	**Ensuring that everyone at all ages that enjoys a healthy lifestyle**

Module 4	**Climate Change: Science, Policy, and Economics**
Key Concepts	Greenhouse Gas Emissions and Global Climate Change, trends in greenhouse gas emissions, climate change predictions, international action on Climate Change: The Earth Summit , The Kyoto Protocol
Overview	According to the Intergovernmental Panel on Climate Change (IPCC), the present carbon dioxide concentration has not been exceeded during the past 650,000 years, and likely not during the past 20 million years. The current rate of increase is unprecedented during at least the past 20,000 years. Climate models are extremely complex, and so as our understanding of the world's climate improves, so too will our ability to model climate change caused by greenhouse gas emissions.

Aim	The aims of this module are to: 1) understand that deterioration of ecosystems due to climate change could have negative consequences for the world's economy, 2) introduce climate change models and predictions, 3) Discuss international action on climate change.
Learning Outcomes	At the end of this module, learners will be able to: • Understand that major alterations to ecosystems due to climate change could possibly have negative consequences for the world's economy • Explore assumptions of climate change scenarios • Discuss the Earth Summit and The Kyoto Protocol that includes three incentive-based economic instruments.
Units	Unit 1: The scientific aspect of climate change Unit 2: Assessing the Benefits and Costs of Climate Change Unit 3: Policy Initiatives
Readings	Hackett, S. C. (2006) Environmental and Natural Resource Economics: Theory, Policy, and the Sustainable Society. M.E. Sharpe, Armonk, NY (3rd ed.) - chapter 11
Activity	An Inconvenient Truth (movie)

SD pillars	**environment**	**Economy**	**social**	**Culture**

21st ESD	Learning to know	Learning to be	Learning to do	Learning to live together	Learning to transform oneself and society	Learning to give and share
	✓	✓	✓	✓	✓	✓

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	×	×	×		×	×	×			×	×		×				×

ECTS workload	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	10	3	1	12	6	-	2	-	34

Vision 2030	This will lead to a spirit of strengthened global solidarity, focused in particular on the needs of the poorest and most vulnerable and with the participation of all countries, all stakeholders and all people

Module 5	**Climate Change and Economic Development**
Key Concepts	Gas emissions and impacts of climate change on developing nations

<table>
<tr><td>Overview</td><td>This module examines climate change impacts on developing nations, particularly on poor people, and identifies the most vulnerable zones across the world. The cost of these direct and indirect climate change impacts are primarily borne by the poor as they directly depend on environmental resources for their livelihood. Strategies to slow down the progress of climate change and policy adaptations to help the “poor” are discussed.</td></tr>
<tr><td>Aim</td><td>The overriding aims of this module are:

1) to examine the topic of climate change and its impact on developing nations, particularly the poor; and

2) to discuss the strategies that need to be pursued to impede the pace of climate change.</td></tr>
<tr><td>Learning Outcomes</td><td>At the end of this module, learners will be able to:

• Analyze the development challenges caused by climate change
• Examine strategies to slow down climate change and adapt policies to help the poor, mostly affected by this problem</td></tr>
<tr><td>Units</td><td>Unit 1: Estimating the human and environmental impacts of global environmental problems, such as climate change

Unit 2: The impacts of climate change on developing nations, particularly the poor

Unit 3: Policies to impede the progress of climate change</td></tr>
<tr><td>Readings</td><td>• http://www.ipcc.ch/
• http://climatechange.worldbank.org/
• Adaptation to a changing climate in the Arab countries: a case for adaptation governance and leadership in building climate resilience http://www.preventionweb.net/english/professional/publications/v.php?id=29948</td></tr>
<tr><td>Activity</td><td>Write a report to discuss the responsibilities of developing and developed countries with respect to climate change and its impacts on the economy and the lives of people.</td></tr>
<tr><td>SD pillars</td><td>environment</td><td>Economy</td><td>social</td><td>Culture</td></tr>
<tr><td>21st ESD</td><td>Learning to know
✓</td><td>Learning to be
✓</td><td>Learning to do
✓</td><td>Learning to live together
✓</td><td>Learning to transform oneself and society
✓</td><td>Learning to give and share
✓</td></tr>
<tr><td>SDGs</td><td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
× × × × × × ×</td></tr>
<tr><td>ECTS workload</td><td>Lecture</td><td>Online</td><td>Lab</td><td>Reading</td><td>Course activity</td><td>Project</td><td>Prepare exam</td><td>Writing exam</td><td>Total</td></tr>
</table>

	10	**2**	**-**	**15**	**6**	**-**	**2**	**-**	**35**
Vision 2030	**Ensuring that everyone at all ages that enjoys a healthy lifestyle**								
Module 6	**Decision-making: Individual vs. collective action**								
Key Concepts	The Rational Actor Paradigm, Self-interest vs. social goals								
Overview	This module provides an overview on how individuals make decisions in collective action situation								
Aim	The aim of this module is to explain individual behavior in the case of a collective action								
Learning Outcomes	At the end of this module learners will be able to: 1. Understand the social dimension of environmental problems 2. Analyze decision-making from an economic perspective (RAP) 3. Understand cooperation in collective action situations								
Units	Unit 1. Environmental problems and their social dimensions Unit 2. The Rational Actor Paradigm Unit 3. Collective action cooperation								
Readings	Ostrom, E. (1990). Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, New York Ostrom, E. (2000). Collective Action and the Evolution of Social Norms. Journal of Economic Perspectives 13 (4): 137-158. Titenberg, T. (2002). The tradable Permits Approach to Protecting the Commons: What Have We Learned? Pages 197-232 in E. Ostrom, T. Dietz, and N. Dolsak, eds. The Drama of the Commons. National Academy Press, Washington, DC. http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml								
Activity	Discuss the climate change problem in terms of individual vs. collective decisions to reduce its impact on the economy and the lives of people								
SD pillars	**environment**		**Economy**		**social**		**Culture**		

21st ESD	Learning to know ✓		Learning to be ✓		Learning to do ✓		Learning to live together ✓		Learning to know ✓		Learning to be ✓						
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	×	×				×							×				×
ECTS workload	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**								
	10	**3**	**-**	**13**	**6**	**-**	**2**	**-**	**34**								
Vision 2030	Develop the corroborative thinking to give a solution for environmental problem.																

Module 7	**Economic Valuation Methods**
Key Concepts	Present value, future value, social discount rate, cost benefit analysis, willingness to pay, contingent valuation method (CVM), ecosystem assessment
Overview	This module overviews basic microeconomics as it applies to climate change economics. Also, it presents the methodologies available for quantifying benefits and costs. • Tradeoffs between current and future consumption. • Using an appropriate social discount rate. • How to correctly value the environment as a resource whose depletion represents a cost to future generations. • How to internalize negative externalities and correct for market failures.
Aim	The overall aims of this module are: 1) to run a cost-benefit analysis, 2) to define types of economic values and total willingness to pay, 3) to understand the various nonmarket valuation methods , 4) to provide an overview of cost estimation methods, 5) to illustrate complexities including benefits transfers, the monetization of intangibles, the treatment of risk and the choice of the discount rate.
Learning Outcomes	At the end of this module, learners will be able to: • Outline the complexities of cost-benefit analysis • Define types of values: use value, option value, existence value and willingness to pay • Classify the available non-market valuation methods

<table>
<tr><td></td><td>• Examine the potential complexities associated with the contingent valuation method and other cost estimation methods</td></tr>
<tr><td>Units</td><td>Unit 1: Current conditions of ecosystems and the effect of climate change agriculture and food security

Unit 2: Essential tools of environmental analysis and economic valuation, including the assessment of trade-offs, benefits, costs, cost-effectiveness, contingent valuation.

Unit 3: Ecological and social systems interactions, trade-offs involved in decisions concerning climate change

Unit 4: Economic policy to better achieve human development</td></tr>
<tr><td>Readings</td><td>• The Millennium Ecosystem Assessment (http://www.maweb.org/en/index.aspx)
• Environmental valuation http://cmsdata.iucn.org/downloads/09_compendium_of_case_studies_introduction.pdf
• Environmental Valuation: Challenges and Practices http://www.rff.org/Documents/08_Tropics_Conference/Tropics_Conference_Papers/Tropics_Conference_Dixon_Environmenal_Valuation.pdf
• The Economic Valuation of Environmental Amenities and Disamenities: Methods and Applications: http://environment.yale.edu/files/biblio/YaleFES-00000201.pdf</td></tr>
<tr><td>Activity</td><td>• An in-class example or problem set related to discounting will let the students learn with a hands-on example and will likely ease their minds about the difficulty of the concept of environmental valuation. Example: A spreadsheet problem is a hypothetical example of two proposed uses for an area (development project vs. agricultural area). A set of costs and benefits is given for a 5-year period. The problem is set up so that the net present value changes from positive to negative with a change in the discount rate. This is a nice illustration of the effect of the discount rate. The example is also set up so that a different project would be pursued at a different rate.
• Case study (in the field). Explain</td></tr>
<tr><td>SD pillars</td><td>environment | Economy | social | culture</td></tr>
<tr><td>21st ESD</td><td>Learning to know ✓ | Learning to be ✓ | Learning to do ✓ | Learning to live together ✓ | Learning to transform oneself and society ✓ | Learning to give and share ✓</td></tr>
<tr><td>SDGs</td><td>1 ×, 2 ×, 3, 4, 5, 6, 7, 8 ×, 9 ×, 10, 11, 12 ×, 13 ×, 14, 15, 16, 17</td></tr>
</table>

ECTS workload	Lecture	Online	Lab	Reading	Course activity	Project	Prepare exam	Writing exam	Total
	9	**2**	**2**	**12**	**6**	**-**	**2**	**-**	**33**
Vision 2030	**An educational system that produces a nicely structured thinking generation**								

SUMMRY OF ECTS WORKLOAD

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**							**Workload**
				1	**2**	**3**	4	5	6	7	
Lectures (face-to-face)	23	3	69	10	10	10	10	10	10	9	69
Online	6	3	18	3	3	2	3	2	3	2	18
Lab work	4	2	8	1	1	1	1	-	-	2	6
Reading articles (3 pages per hour)	120	0.5	60	10	8	10	7	10	8	7	60
Reading book chapters (5 per/h)	140	0.2	28	5	5	5	5	5	5	5	28
Preparing course activities	9	5	45	6	6	6	6	6	6	6	45
Project work	1	30	30	-	-	-	-	-	-	-	30
Preparation for exam	1	15	15	3	2	2	2	2	2	2	15
Writing the exam	2	3	6	-	-	-	-	-	-	-	8
Total			**279**	38	35	36	34	35	34	33	279

SDGs		**CC**	**SA**	**FS**	**COURSE MODULE**
1	End poverty in all its forms everywhere	X			1,3,4,5,6
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	X			1,2,3,4,5,6

3	Ensure healthy lives and promote well-being for all at all ages	X			3,4,5
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all				
5	Achieve gender equality and empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all	X	X	X	1, 2,4,6
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	X			1,2,4,5
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all	X			1,2,3,
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				
10	Reduce inequality within and among countries	X			4
11	Make cities and human settlements inclusive, safe, resilient, and sustainable	X			2,3,4,5
12	Ensure sustainable consumption and production patterns	X			1,2,3,5
13	Take urgent action to combat climate change and its impacts	X			1,2,4,5,6
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development	X			2
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss	X	X	X	1,
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions on all levels	X			1,5
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	X			1,3,4,5,6


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS


Constructing knowledge
Critical thinking and problem solving
Communi-cation
Collabo-ration
Creativity and innovation
Connectivity and networking
Critical conscious-ness
Critical reflection
Cross/inter-cultural competence
Co-responsibility
ICTs as enabling tools for the 10Cs

Back to Top

Program For M.Sc. Engineering and Sciences
Colleges CCSAFS COURSE SYLLABUS

Jerash University

Course Syllabus

Course Number ( )

Course Title

The syllabus of Research Methodology

Semester ( )

Instructor Information

Instructor: **Prof Omer Maaitah**
Office Location: **Faculty of Agriculture Building** Telephone: 009626629922 Office Hours (Times & Days).
E-mail: Maaitah_noor@hotmail.com
Website: http://www.jpu.edu.jo/jpu/profile.php?id=50

Course Identification

Course Number:

Course Name: Research Methodology Course Location: Faculty of **Agriculture**
Class Times: Not Now
Prerequisites:
Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Overview

This course aims to provide a solid foundation in conducting quality research at post-graduate level (especially at Master level) in the fields of Agriculture, science and engineering. Scientific research methods and their implications at different stages of the research process will be studied. Emphasis will also be placed on how to locate and make the best use of relevant sources, the development of a positive attitude toward research, the appreciation of scientific values (integrity, ethics, originality and academic freedom) and developing skills in the use of appropriate academic genres (research proposals, different types of report, journal papers, thesis) employing an appropriate

format, style and language. The use of information technologies at all stages of research (online literature search, data processing written communication and presentations) and other contemporary methods will also be considered together with a range of practical applications.

Course Learning Objectives:

The following main objectives of the course are: -

- be acquainted with the main features of science and technology.
- be aw are of the fundamental characteristics of scientists
- learn scientific methods of research
- have sufficient background and practice in all types of literature search with specific emphasis online methods
- learn to develop a positive attitude towards research
- be equipped w with the basic elements of scientific and ethical values, such as integrity, originality, and academic freedom whilst also being aware of different types of research misconduct, and their likely consequences
- develop communication skills in sharing scientific know ledge by emphasizing conventions in the format, style and language of both written (informal memos and letters, formal reports, thesis and journal papers) and oral (presentations, scientific discussions) communication
- be equipped with the awareness that information technology tools are likely to dominate all phases of research in foreseeable future;
- be aware of research funding and learn how to w rite a research proposals

Course Content Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Discuss / explain the research activities.
2. Use economic analysis as policy tools and instruments.

1. generate research topics
2. develop good summaries of the current know ledge
3. design research studies
4. conduct research efficiently

5. interact professionally with others involved in research
6. present oral and written research reports
7. be w ell acquainted with the use of information technology
8. understand the basic elements of '' being a responsible scientist

Course Resources.

1. Research Methodology, methods and techniques, by C.R. Kothari.
2. Research Methodology, an Introduction, by Wayne Goddard and Stuart Melville.
3. American Journal of Climate Change http://www.scirp.org/journal/ajcc
4. Identifying research priorities to advance climate services Catherine Vaughan a,d,⇑ , Lawrence Buja b , Andrew Kruczkiewicz c , Lisa Goddard cClimate Services 4 (2016) 65–74
5. Journal of Sustainable Agriculture
6. https://www.tandfonline.com/toc/wjsa20/current
7. Journal of Environment & Sustainable Agriculture
8. http://www.todayscience.org/JESA/jesa.html
9. **International Journal of Sustainable Agricultural Management and Informatics**
10. http://www.inderscience.com/jhome.php?jcode=IJSAMI
11. **Journal of Sustainable Agricultural Sciences (JSAS)**
12. http://jsas.journals.ekb.eg/
13. Sustainable Agriculture, Food and Wildlife
14. http://www.mdpi.com/journal/sustainability/sections/agriculture_food_and_wild life
15. Agricultural Sciences http://www.scirp.org/journal/as
16. **Journal of Agriculture and Sustainability** http://infinitypress.info/index.php/jas
17. Food Security https://link.springer.com/journal/12571
18. Journal of Food Security http://www.sciepub.com/journal/JFS
19. Agriculture & Food Security
20. https://agricultureandfoodsecurity.biomedcentral.com/
21. Global Food Security
22. https://www.journals.elsevier.com/global-food-security
23. Rao Sabir Sattar, et. Al. (2017). Qualitative and quantitative approaches to study adoption of sustainable agricultural practices: A research-note on mixed method approach. International Journal of Agricultural Extension and Rural Development ISSN 3254-5428 Vol. 5 (2), pp. 539-544.
24. Makrakis, V. & Kostoulas-Makrakis, N. (2016). Bridging the qualitative– quantitative divide: Experiences from conducting a mixed methods evaluation in the RUCAS programme. Evaluation and Program Planning 54, 144-51.

25. Hand, Ashley M. (2014). A mixed-methods approach to understanding farmer and rancher interest in supplying woody biomass in the U.S. Northern Great Plains. *Graduate Theses and Dissertations*. 14145. https://lib.dr.iastate.edu/etd/14145

26. Oltmans, Shelley Jayne (2013). A case study on the food retail environment of Accra, Ghana. *Graduate Theses and Dissertations*. 13634.https://lib.dr.iastate.edu/etd/13634

27. Barrett, Stephen R. (2013). Investigating The Local Food System: A Mixed Methods Study Of Sustainability in Southwest Atlanta." Thesis, Georgia State University, http://scholarworks.gsu.edu/geosciences_theses/65

28. Makrakis, V. (1995). Paradigms in Educational Research: Complementarity or Unity? In C. Wulf (Ed.), Education in Europe: An Intercultural Task. European Studies in Education. Waxmann Verlag Munster, pp.43-47
29. Sustainable Agriculture Theses
30. IOWA STATE UNIVERSITY DIGITAL REPOSITORY
31. https://lib.dr.iastate.edu/gpsa_etd/index.2.html

32. More information about research design see http://tll.mit.edu/help/developresearch-design
33. Sustainable Agriculture Theses
34. IOWA STATE UNIVERSITY DIGITAL REPOSITORY
35. https://lib.dr.iastate.edu/gpsa_etd/index.2.html

36. Grading Rubric for Research Proposal Assignment available at file:///D:/Downloads/Rubric%20(1).pdf

37. Common Rubric for Evaluating Undergraduate Research Proposals Student Study and Research Committee file:///D:/Downloads/DRI-Student-ResearchProposal-Rubric_151112%20(2).pdf

38. https://www.ship.edu/globalassets/student-research/scoring-rubric-1.pdf

Course Website(s)

Required Course Texts and Materials

Optional Course Texts and Materials

Assignments and Grading Scheme

Grading System and Grading Policy

0 to 10 (where 5 is the least pass mark)

Component	Grade
Assignments	80%
Exams	
Class Attendance/ Participation	20%
Total Points	100%

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and / or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Dissability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Course Schedule

Week	SUBJECT	Date
1	Unit 1.1 CSAFS research trends, needs and priorities Unit 1.2: CCSAFS Research Areas and Themes	
2	Unit 1.3: Exemplary Cases of CCSAFS Research Unit 2.1: The quantitative/qualitative debate	

3	Unit 2.2: Basic beliefs of quantitative/qualitative paradigms Unit 2.3: Criticism on qualitative/quantitative dichotomy	
4	Unit2.4: Differences in data, research setting and quality criteria Unit2.5: Mixing rivalry research paradigms	
5	Unit 3.1: The research problem and its constituencies Unit 3.2: Criteria for judging the quality of the research problem	
6	Unit 5.1: Data codification and preparation for quantitative analysis	
7	Unit 5.2: Using software for statistical analysis (PSPP)	
8	Using lab and homework on (PSPP)	
9	Unit 5.3: Descriptive statistical analysis	
10	Unit 5.4: From correlation analysis to multiple regression analysis	
11	Unit 6.1: Handling open-ended answers to semistructured questionnaires	
12	Unit 6.2: Extracting themes, patterns, etc. from qualitative data Unit 6.3: Integrating qualitative with quantitative results	
13	Unit 7.1: Substantiating research findings through previous research Unit 7.2: Results presentation, interpretation and conclusion	
14	Unit 8.1: Preparation of a thesis proposal Unit 8.2: Structure, order and substance	
15	Unit 8.3: Presentation, style and language	
16	Exam	

CCSAFS COURSE MODULE

Course	**Research Methodology & Advanced Statistical Analysis** **Developed by Prof.Dr. Vassilios Makrakis, University of Crete**
Module 1	The CCSAFS Research Context: Trends, Needs & Priorities
Key Concepts	Climate change, sustainable agriculture, food security
Overview	Climate projections for the Middle East and North African (MENA) region indicate warmer and drier conditions with increased frequency of natural disasters. Food insecurity and climate change are the two major challenges in the region. Agriculture is one of the most vulnerable economic sectors to climate change, mainly due to the limited availability of water and land resources in the two target MENA countries (Egypt and Jordan). Together with increasing urbanization (Egypt will be doubled by 2030) and forced migration in Jordan, puts additional challenges, not only for supporting the livelihood of rural populations, but also to maintain a tolerable level of food security. Given the rapidly changing marketplace that confronts agri-food industries, there is an urgent need to integrating agro-food entrepreneurship and trnasversal skills in teaching, learning and outrech activities. In light of these challenges, what are the research trends, needs and priorities to tackle them both globally and locally?
Aim	The overriding aim of this module is to: 1) explore the trends, needs and priorities of CCSAFS research; 2) identify research areas, topics and themes of CCSAFS research and 3) relate these to the local and regional contexts.
Learning Outcomes	At the end of this module students will be able to: • Identify and discuss various CCSAFS research areas • Discuss how these research areas can be related to local circumstances • Develop an inventory of potential CCSAFS research topics
Units	Unit 1.1 CCSAFS research trends, needs and priorities Unit 1.2: CCSAFS Research Areas and Themes Unit 1.3: Exemplary Cases of CCSAFS Research
Readings	American Journal of Climate Change http://www.scirp.org/journal/ajcc

	Identifying research priorities to advance climate services Catherine Vaughan a,d,⇑ , Lawrence Buja b , Andrew Kruczkiewicz c , Lisa Goddard cClimate Services 4 (2016) 65–74 Journal of Sustainable Agriculture https://www.tandfonline.com/toc/wjsa20/current Journal of Environment & Sustainable Agriculture http://www.todayscience.org/JESA/jesa.html **International Journal of Sustainable Agricultural Management and Informatics** http://www.inderscience.com/jhome.php?jcode=IJSAMI **Journal of Sustainable Agricultural Sciences (JSAS)** http://jsas.journals.ekb.eg/ Sustainable Agriculture, Food and Wildlife http://www.mdpi.com/journal/sustainability/sections/agriculture_food_and_wildlife Agricultural Sciences http://www.scirp.org/journal/as **Journal of Agriculture and Sustainability** http://infinitypress.info/index.php/jas Food Security https://link.springer.com/journal/12571 Journal of Food Security http://www.sciepub.com/journal/JFS Agriculture & Food Security https://agricultureandfoodsecurity.biomedcentral.com/ Global Food Security https://www.journals.elsevier.com/global-food-security
Activity	**Overview**
	Assignment 1a In light of the global trends, needs and priorities of CCSAFS research that can be identified through the links listed in the readings: 1) develop a catalogue of trends, needs and priorities; 2) assess the extent to which they are related to your country/region; 3) what other research needs and priorities can be considered in your local/national area**;** 4) develop an inventory of CCSAFS research topics in line with the local/national circumstances. **Assignment 1b** Use the class discussion forum available in the Blended Learning Environment and share your topic list with your instructor and classmates. Select one or two topics from the list that you would like to learn more about and return to your instructor or supervisor to discuss further.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**

10Cs/6 LEARNIN GGOALS	√	√	√	√	√	√	√	√	√	√		√	√		√	√	
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Module 2	The Quantitative vs the Qualitative Research Debate in the Context of CCSAFS
Key Concepts	Quantitative/qualitative research, paradigm, positivism, interpretive, pragmatism
Overview	There is a long history of discourse of quantitative versus qualitative research traditions. This controversy has created a lot of discussions raising the argument of a mixed methodological approach that combines the strengths and minimizing the weaknesses of quantitative (positivist) and qualitative (interpretive/constructivist) paradigms.
Aim	The overriding aim of this module is to present and discuss the quantitative vs qualitative research arguments and controversies in light of mixed methods designs.
Learning Outcomes	At the end of this module students will be able to: • Discuss the epistemological underpinnings and controversies of the quantitative/qualitative research. • Demonstrate knowledge of various research methods conducive to quantitative and qualitative research • Identify different types of mixed methods design. • Discuss issues of quality and rigor in quantitative/qualitative and mixed methods research • Know the ways rivalry research paradigms can be complementary
Units	Unit 2.1: The quantitative/qualitative debate Unit 2.2: Basic beliefs of quantitative/qualitative paradigms Unit 2.3: Criticism on qualitative/quantitative dichotomy Unit2.4: Differences in data, research setting and quality criteria Unit2.5: Mixing rivalry research paradigms
Readings	Rao Sabir Sattar, et. Al. (2017). Qualitative and quantitative approaches to study adoption of sustainable agricultural practices: A research-note on mixed method approach. International Journal of Agricultural Extension and Rural Development ISSN 3254-5428 Vol. 5 (2), pp. 539-544. Makrakis, V. & Kostoulas-Makrakis, N. (2016). Bridging the qualitative–quantitative divide: Experiences from conducting a mixed methods evaluation in the RUCAS programme. Evaluation and Program Planning 54, 144-51. Hand, Ashley M. (2014). A mixed-methods approach to understanding farmer and rancher interest in supplying woody biomass in the U.S. Northern Great Plains. *Graduate Theses and Dissertations*. 14145. https://lib.dr.iastate.edu/etd/14145

<table>
<tr><td></td><td>Oltmans, Shelley Jayne (2013). A case study on the food retail environment of Accra, Ghana. Graduate Theses and Dissertations. 13634.https://lib.dr.iastate.edu/etd/13634

Barrett, Stephen R. (2013). Investigating The Local Food System: A Mixed Methods Study Of Sustainability in Southwest Atlanta." Thesis, Georgia State University, http://scholarworks.gsu.edu/geosciences_theses/65

Makrakis, V. (1995). Paradigms in Educational Research: Complementarity or Unity? In C. Wulf (Ed.), Education in Europe: An Intercultural Task. European Studies in Education. Waxmann Verlag Munster, pp.43-47</td></tr>
<tr><td rowspan="2">Activity</td><td>Overview</td></tr>
<tr><td>Assignment 2a:
How would: 1) quantitative; 2) qualitative; and 3) mixed-methods advocates respond to the ontological, epistemological, methodological and axiological questions in connection to the three research paradigms?
Assignment 2b:
What are the advantages and disadvantages of qualitatizing quantitative data or quantifying qualitative data? Discuss using examples from the field of CCSAFS research.
Assignment 2c
Following-up the 1b activity in module 1, set date/time in the discussion forum and discuss why you found your short list of topics interesting, and learn which topics your classmate selected and why.</td></tr>
<tr><td rowspan="2">10Cs/6 LEARNING GOALS</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
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<tr><td rowspan="2">SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>5</td><td>16</td><td>17</td></tr>
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<tr><td>Module 3</td><td colspan="16">Defining a Researchable Issue and the Research Problem</td></tr>
<tr><td>Key Concepts</td><td colspan="16">Research problem, researchable issue, deductive reasoning, inductive reasoning</td></tr>
<tr><td>Overview</td><td colspan="16">Defining a researchable problem is crucial in assuring the quality of the research design, including the theoretical constructs and the suitable research method. A researchable problem is the one that can be handled and make sense. The terms research question and research problem are used interchangeably to reference the problem or issue you intend to investigate and/or solve. A quantitative research problem uses deductive reasoning to arrive in a testable hypothesis, while the qualitative one uses inductive reasoning. Defining your research problem implies that you are justifying the need to study a researchable issue or problem by asking a number of questions. Before doing that, it is important that you pay consideration of the following:</td></tr>
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	The rationale of the research problem The aims and objectives The context of the research problem The basic principles that underlie any kind of research include a systematic process of identifying a question or problem, setting forth a plan of action to answer the question or resolve the problem and rigorously collecting and analyzing data. In conducting any research, it is critical to choose the right method and design for a specific researchable problem. In module 1, you have learned to identify and document the trends and priorities in CCSAFS research and in module 2, you have learned the arguments concerning the quantitative and qualitative research. Now, it is time to understand the basic principles in formulating a research statement by identifying, justifying and documenting a researchable problem that can be applicable to both research paradigms.
Aim	The overriding aim of this module is to explore the rationale for choosing a researchable issue or problem and define the constituencies of the research problem in the context of CCSAFS research.
Learning Outcomes	At the end of this module learners will be able to: • Identifying and justifying a research problem • Recognising and discussing the constituencies of the research problem • Setting the research problem in its context
Units	Unit 3.1: The research problem and its constituencies Unit 3.2: Criteria for judging the quality of the research problem
Readings	Identifying and Defining a Research Problem ppt Presentation (file:///D:/Downloads/identifyinganddefiningaresearchproblem-111106143750phpapp02.pdf) What are the techniques involved in defining a Research Problem? Research Methodology Tutorial https://www.wisdomjobs.com/e-university/researchmethodology-tutorial-355/technique-involved-in-defining-a-problem11458.html
Activity	**Overview** **Assignment 3: Define your research problem through reflecting on: What? So what? Now what?** In order to facilitate you visit https://lib.dr.iastate.edu/gpsa_etd/index.2.html and choose from the Sustainable Agriculture Theses examples of research problems to find out what they include and how they are formulated. **What?**

Based on the short-list of research topics selected, choose one and write a problem statement. Post it to your group's Blended Learning Environment discussion group by [set date and time]. You are answering the following four questions in your problem statement:

- What issue of CCSAFS are you considering for your research?
- What are some of the pressing needs/issues in the community?
- How does this issue address the local needs and priorities?
- What is the main research questions and the sub-questions?

So What?

In defining your problem, look into the examples of the dissertations listed in the readings. In answering the "so what?" question, you are answering the following 7 questions:

- Why this problem and research questions are important and challenging to you, to others and locally?
- Are your research questions leading to a researchable problem?
- Do the research questions require data that can be accessible?
- Can the research questions explain variability, different outcomes under different conditions?
- Are the units of analysis clearly identified?
- Are the questions posed in a way that more than one result is possible?
- Does the research lead to better understanding of the CCSAFS issue under
- Does it fill in gaps in our present knowledge about the CCSAFS issue?
- Can the investigation of these questions generate solutions?

Now What?

- What seem to be the root causes of the CCSAFS research issue chosen?
- What other work is currently happening to address the issue?
- Did you learn anything by answering the above questions?
- If yes, what and how such a learning can be applied?
- What would you like to learn more about this research issue?
- What steps are needed to address any challenges or difficulties?
- What information can you share and how with your peers?

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	5	16	17
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Module 4	Developing the Research Design
Key Concepts	Research design, problem statement, quantitative research design, qualitative research design, mixed-methods research design, philosophical assumptions
Overview	A research design or methodology refers to the overall strategy that you choose to address the research problem and constitutes the blueprint for the collection, measurement, and analysis of data. Since your research problem determines the type of design you should use, before you create a research design, you first need to formulate a problem statement that you have done in the previous module. Now, it is time to think first the theoretical basis of your research problem and second to critically think about what information is required to address the research problem you have defined in the previous assignment. You should describe where and when you will conduct your research, who is going to participate, and what approach and methods you will employ. There are different types of research designs depending on the research methodology adopted. Some of them can be: 1) quantitative research design (cause and effect, empirical-analytic, experimental); 2) qualitative research design (action research, case study) and 3) mixed-method research design (combining quantitative and qualitative methodologies). For each of them, despite some similarities, there are also differences as you can see in the examples of the dissertations listed in the readings. Thus, in developing your research design, it is crucial that you examine your philosophical assumptions and those underpinning the research problem and questions, before answering where, when, who and what. Philosophical assumptions relate to ontology, or the nature of reality, the epistemology, the nature of knowledge and axiology, the values guiding your research decisions. Alignment of the researcher's worldview (e.g. ontology, epistemology and axiology) with methodology (research approach/design). Summing-up, the research design (or methodological approach) refers to: • The rationale and theoretical source for your choice of research approach • The rationale behind the selection of participants, methods of data collection and analysis, and the steps to be taken to ensure that ethical practices are followed • The limits, restrictions or boundaries of the research • An action plan which explains each of the tasks to be carried out and the anticipated times for completion
Aim	The overriding aim of this module is to help you become familiar with the characteristics, language and logic of qualitative/quantitative and mixedmethods research designs.

Learning Outcomes	At the end of this module students will be able to: • Classify and evaluate the strengths and weaknesses of the different research design of CCSAFS research

	• Discuss and use key concepts in research ethics as they apply to research design • Choose appropriately, and describe in detail, a research design for a specific CCSAFS research project • Identify the research problem clearly and justify its selection, particularly in relation to any valid alternative designs that could have been used • Review and synthesize previously published literature associated with the research problem • Clearly and explicitly specify hypotheses [i.e., research questions] central to the problem • Recognise the principles for constructing a research instrument • Explain how such data will be obtained • Describe the methods of analysis to be applied to the data in determining whether or not the hypotheses are true or false
Units	Unit 4.1: An overview of research designs Unit 4.2: Choosing and justifying a research design Unit 4.3: Quality standards for designing research methodology
Readings	Sustainable Agriculture Theses IOWA STATE UNIVERSITY DIGITAL REPOSITORY https://lib.dr.iastate.edu/gpsa_etd/index.2.html More information about research design see http://tll.mit.edu/help/developresearch-design
Activity	**Overview**

	Assignment 4: The purpose of this assignment is for you to explore quantitative, qualitative and mixed-methods research designs. Visit https://lib.dr.iastate.edu/gpsa_etd/index.2.html and choose from the Sustainable Agriculture Theses one example from each of the three research approaches. Read the sections referring to the research methodology. Having these as examples, as continue from the problem statement you formulated in the previous assignment and complete the following: • Background of the research problem • Aims and objectives • Design of a conceptual framework that shows how the intervention is expected to achieve the objectives • Description of the intervention intended to achieve the objectives • Describe who will be involved in the study, what means will be used to collect the data and what methods will be used to analyse them Upload the assignment and arrange peer-review with another student of your own choice using the Blended Learning Environment.

	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
10Cs/6 LEARNING GOALS	√	√	√	√	√	√	√	√	√			√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
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Module 5	**Moving from the Quantitative Research Design to the Data Analysis**
Key Concepts	Hypothesis testing, population, sample, variable, value, subject/case, data analysis software (SPSS or PSPP), descriptive statistics, correlation, Cronbach reliability, t-tests, ANOVA, multiple regression analysis

Overview	In quantitative data analysis, you are expected to operationalize the conceptual level (e.g. theory-hypothesis formulation) and apply the data analysis methods that your data support. All these entails turning raw numbers reflecting independent and dependent variables into meaningful data through certain methodological decisions. Quantitative data analysis may include the calculation of frequencies of variables and differences between variables. A quantitative approach is usually associated with finding evidence to either support or reject hypotheses formulated at the earlier stages of your research process (research design). For the analysis of quantitative data, a variety of statistical tests are available, ranging from descriptive statistics (e.g. frequencies, cross-tabs) to correlations, t-tests, comparing means and to the more complex such as the use of ANOVA, regression and factor analysis to develop scales. When analyzing data (whether from questionnaires, interviews, focus groups, or whatever), always start from review of your research goals, i.e., the reason you undertook the research in the first place. This will help you organize your data and focus your analysis. Research methods necessitate in depth knowledge of those statistics needed to answer the research questions posed. The most common statistical package is SPSS, but PSPP a free program for statistical analysis that resembles much SPSS can do many of the statistics SPSS does.
Aim	The overriding aim of this module is to get knowledge and skills in statistical techniques and a statistical program such as PSPP
Learning Outcomes	At the end of this module learners will be able to: 1. Codify and prepare a quantitative data set 2. Chunking data into large conceptual categories (composite variables) 3. Test the reliability of composite variables 4. Describe the data needed for testing hypotheses 5. Describe and justify the methods of analysis to be applied to the data 6. Use a statistical tool for data analysis 7. Apply descriptive and inferential statistical techniques needed
Units	Unit 5.1: Data codification and preparation for quantitative analysis Unit 5.2: Using software for statistical analysis (PSPP) Unit 5.3: Descriptive statistical analysis Unit 5.4: From correlation analysis to multiple regression analysis

Readings	**PSPP Manual accessible from** **http://www.gnu.org/software/pspp/manual/pspp.pdf**
Activity	**Overview**

	Assignment 5a Look into the methodology sections of the dissertations listed in the readings you have chosen in Module 4. Discuss the methodology used for these studies. Explain whether you think that the methodology used is an appropriate one. Identify possible problems with the methods used. Discuss the operationalisation of the statistical models used and the sources of data for the study. Organise a group discussion using the Blended Learning Environment to exchange your reflections on these issues. **Assignment 5b** Start learning the PSPP package, using an example of research data provided by your instructor.

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
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SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
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Module 6	**Integrating Qualitative Data into Quantitative Research**
Key Concepts	Qualitative data, open-ended questions, text analysis, Grounded theory
Overview	Many research methods derive from the empirical-analytic research paradigm, which seeks to discover facts and causes through the statistical testing of hypotheses. Contrary to that, as you have seen in Module 2, the qualitative or interpretive research paradigm seeks to discover how people see and experience their world, and how they apply meaning to it. Quantitative data is useful when you want to answer what-type questions, while qualitative data is about why people behave the way they do. Unlike quantitative data, qualitative research questions are open than closed generating mostly unstructured information, often in the form of text or narratives. In general, the qualitative type of research relies on close observation, direct or indirect, in-depth interviews, and extensive description of natural settings rather than the quantitative manipulation of variables to verify or reject theoretical constructs (hypotheses), using a deductive approach. Usually, open-ended questions are included in quantitative research instruments. In such cases, the information derived from such qualitative data serves to illuminate the analysis and interpretation of the quantitative results. Sometimes, qualitative data can be used to construct more robust quantitative

	research designs and vice versa. Summing up, qualitative data analysis has the following characteristics: • Often based on grounded theory practices • Answers the 'why?' questions • Looks further than numerical evidence • Does not concern about generalizability • Pays greater attention to personal cases
Aim	The goal of this module is (1) to get you started in understanding the importance of integrating qualitative data into quantitative studies and vice versa and (2) to get knowledge on the processes and practices of qualitative data analysis and theory generation using Grounded Theory.
Learning Outcomes	At the end of this module learners will be able to: 1. Understand the tenets of qualitative research 2. Discuss the ways qualitative data can be integrated into quantitative studies 3. Recognize the processes for extracting meaning from qualitative data
Units	Unit 6.1: Handling open-ended answers to semi-structured questionnaires Unit 6.2: Extracting themes, patterns, etc. from qualitative data Unit 6.2: Integrating qualitative with quantitative results
Readings	Makrakis, V. & Kostoulas-Makrakis, N. (2018). A Semi-structured Interview Toolkit Part 1 and 2 (From Data Collection to Data Analysis, Interpretation and Reporting) Harvard Business Review- Strategies for Effective Interviews accessible at https://hbr.org/1964/01/strategies-of-effective-interviewing See also https://sites.ewu.edu/hr/files/2017/06/Interviewing-Techniques.pdf
Activity	**Overview**
	Assignment 6 This assignment is to get you to practice qualitative data analysis and theory generation using Grounded Theory. You will complete this assignment in **three** parts. In the **first part**, you will carry out 2-3 interviews with key experts in the CCSAFS research topic you have chosen, following-up the instructions provided in the Toolkit Part 1, listed in the readings. Then, you are going to use inductive coding to analyze the collected data from the interviews and develop a narrative that answers your research question, following-up the instructions provided in the Toolkit Part 2. More specifically, using the inductive analysis method to code and analyze your data: A) Read through the entire transcript of the data set derived from your interviews a few times. B) Carry out your initial coding, generating 20-30 categories. C) Go through your codes and data again, reducing overlap and redundancy, combining related codes, etc. until you have generated 10-15 codes. D) Continue the iterating process on the data until you have roughly 5-8 high-level and meaningful “themes”.

	In the **second part**, find a partner from your student group and ask him/her to do the same process as you independently. You also do the same for his/her own data set. Then, compare your codes/themes with your partner's codes/themes. They will mostly likely be different. In the **third part**, organize an online discussion to discuss the differences and work together to reach a consensus between the two sets of codes/themes. Discuss which are the most meaningful to keep and which can be dropped, changed, or consolidated. You may need to rework your codes/themes based on each other's findings. Finally, develop a narrative that explains your data.

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
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SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
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Module 7	**Strategies for the Presentation of Results, Discussion and Conclusion**
Key Concepts	Research results, research discussion, research conclusion, interpretation
Overview	The presentation and discussion of research results are the most important parts of a research process. It is the part of a research paper or thesis where you report the findings of your study based upon the methodology [or methodologies] you applied. The results section should state the findings of the research arranged in a logical sequence. Just as the literature review is arranged under conceptual categories reflecting the key concepts of your research problem. In the results section, you just present the results without connecting them with previous results (interpretation), unless the results section includes the discussion section. In the discussion section, the strategy is different. Here, there is an opportunity to explore further or interpret the results, making connections between the results of your analysis and existing theory and research. This means that in the discussion there is need to explain what messages the results obtained convey. Usually, there is confusion of what the discussion is and what it should contain. Sometimes, researchers wrongly interpret the results in the results section or summarize their results without interpretation. The interpretations in the quantitative studies are organized in line with the research questions or hypotheses while for qualitative studies, the interpretations are organized in line with the themes derived. For each question or theme, there is need to go back to the literature and look at the major findings of previous studies as well as to provide possible explanations as to why the findings corroborated or contradicted the findings of previous studies. Additionally, other key issues to be included in the discussion of the findings

	are the implications, both in theory and methodology as well as recommendations for policy and further research. Finally, a conclusion is not merely a summary of the main topics covered or a re-statement of the research problem, but a synthesis of key points raised in the research results.
Aim	The overriding aim of the module is making explicit and understandable the meaning and function for the presentation of the research findings, the discussion of the findings and their conclusion.
Learning Outcomes	At the end of this module students will be able to: 1. Understand the principles for presenting, discussing and concluding research results 2. Recognise and discuss what should be avoided in writing the research results and their interpretation 3. Know how to synthesise research results and explore their possible implications in theory and practice
Units	Unit 7.1: Substantiating research findings through previous research Unit 7.2: Results presentation, interpretation and conclusion
Readings	Sustainable Agriculture Theses IOWA STATE UNIVERSITY DIGITAL REPOSITORY https://lib.dr.iastate.edu/gpsa_etd/index.2.html
Activity	**Overview** **Assignment 7**: Look into the **results section** of the quantitative, qualitative and mixed-methods dissertations you have selected in Module 4. Examine if the content of the results section fulfills the following: • Evidence that helps to understand the context of the results by restating the research problem underpinning the study**.** • Inclusion of non-textual elements, such as, tables, figures, charts, etc. that further illustrate key findings, if needed**.** • Highlighting the most meaningful results**.** • A balance of the length of the results section in relation to its importance and the amount and types of data**.** • A short paragraph that summarises the key findings of the study**.** Examine if in the presentation of the results, the authors avoid doing the following: • Discussing or interpreting their results. • Attempting to explain findings in relation to previous research, unless the results section includes also the discussion of the results. • Ignoring possible negative results**.** Look at the **discussion section** and examine if the content includes the following:

	1. Substantiates the findings with previous studies and indicate where findings align or do not align. 2. Provides possible explanations of not alignment with previous research findings. 3. Organizes the discussion from the general to the specific, linking the findings to the literature, then to theory, then to practice. 4. States how the findings from the study fill in and/or reveal new gaps in the research area. 5. Includes the implications of the research findings and provides recommendations for policy and further research. 6. Explores possible improvements in theory, the methodology and future research. Look at the **conclusion section** and examine if the content includes the following: 1. Summarizes the key findings that make sense and convey the significance of your study. 2. States possible new avenues about the research problem in its context and beyond that.

10Cs/6 LEARNING GOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
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SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
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Module 8	**Writing a CCSAFS-related Research/Thesis Proposal**
Key Concepts	Research proposal, structuring a research proposal
Overview	As pointed in Modules 1-3, designing and planning a whole research project involves choosing a researchable, significant topic and preparing a welldeveloped research proposal. A research proposal should be seen as more than the outcome of a technical procedure. It shows, in particular, your ability as a researcher to conceptualise clearly your research problem and to plan and organise carefully and thoroughly it. While a proposal format is standard for quantitative studies, for qualitative studies, it can vary. In both cases, however, there are certain basic principles that can be used for writing a very good research proposal. The way, the previous modules have been structured and the assignments asked for will highly help to understand and carry out a very good research proposal. For example, in the previous modules, you have dealt with questions in defining an area and topic of a CCSAFS study, you were asked to explain clearly – **what** research is intended, **why** it is being researched and **how** to structure a research design. These are, in fact, the three key elements in writing a research proposal.

	A research proposal should be clearly and well organized in a logical sequence with clear headings and subheadings covering its major sections and subsections. The importance for writing a research proposal before starting the real research process serves two key functions: 1) it is a contract between you and your supervising committee and 2) it shows your knowledge in the area of research chosen and specifies what you will do, how you will do it, and how you will analyse and interpret the results.
Aim	The overriding aim of this module is to describe the process for writing a successful research proposal that will probably become your thesis. This module serves as a reference guide to highlight the process in preparing a research proposal and basic elements that should be included.
Learning Outcomes	At the end of this module you will be able to: • Organize and structure a research proposal • Demonstrate to your thesis committee that you have read enough to show that you are aware of the state-of-the art in your area of research • Recognize which issues or concepts you will focus on in your research and why • Show that you can exercise critical judgement in selecting which issues to focus on and which to ignore • Argue for the importance of your area of research in terms of its need to address a 'gap' • Establish the theoretical orientation you are planning to take • Specify the aims and specific objectives of the study, the sources of the data to be collected, the means to be used and the methods for data analysis • What the subjects, the ways they will be selected, the instruments to be used for data collection
Units	Unit 8.1: Preparation of a thesis proposal Unit 8.2: Structure, order and substance Unit 8.3: Presentation, style and language
Readings	Grading Rubric for Research Proposal Assignment available at file:///D:/Downloads/Rubric%20(1).pdf Common Rubric for Evaluating Undergraduate Research Proposals Student Study and Research Committee file:///D:/Downloads/DRI-Student-ResearchProposal-Rubric_151112%20(2).pdf https://www.ship.edu/globalassets/student-research/scoring-rubric-1.pdf
Activity	**Overview**
	Assignment 8 This assignment has three parts. In the **first part**, you work alone to put all the previous pieces of the assignments you have done and develop a research proposal. While developing your proposal consult the rubrics listed in the readings for self-assessment. In the **second part**, exchange your

	research proposal with another student and start to evaluate each one's research proposal following-up the rubrics. Write down an assessment report of 4-5 pages, justifying your evaluation, paying attention to the issues raised in the rubrics. In the **third part**, using the Blended Learning Environment, setup an online session to discuss your evaluations.																
10Cs/6 LEARNIN GGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
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Table 1. A 10 ECTS workload allocation for the course "Climate Change, Sustainable Agriculture, and Food Security".

Learning Components	**No**	**Time**	**Workload**	**Course Modules**								**Workload**
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Lectures (face-to-face)	26	1.5	39	3	3	6	9	6	3	3	6	39
Online	6	2	12	1	2	2	3	2		0	2	12
Lab work	1.8	0.1	18					18				18
Reading articles (3 pages per hour)	21	0.3	70	8	10	8	20	10	14			70
Reading book chapters (5 per/h)	8	0.2	16	2	2	2	2	2	2	2	2	16
Preparing course activities	50	0.5	100	10	12	14	10	14	10	15	15	100
Project work	2	0.5	10						10			10
Preparation for exam	5	0.2	25							10	15	25
Writing the exam	2	1.5	3								3	3

Total												**293**

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CCSAFS COURSE SYLLABUS

JerashUniversity

Course Number (604726)

Course Title
Sustainability Justice and Food Security

Fall Semester 2018/2019

Instructor Information

Instructor: **Dr. EbraheemAltahat**
Office Location: **Faculty of Agriculture Building**
Telephone: 0096226350521
Office Hours:.
E-mail: **tahat1972@gmail.com**
Website: http://www.jpu.edu.jo/jpu/profile.php?id=50

Course Number: 604726

Course Name: **Sustainability of Justice and Food Security**

Course Location: **Faculty of Agriculture**
Class Times: **Not Now**
Prerequisites: **Food Security (603374).**
Faculty Web Page:http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Description/Overview

This course engages students in a wide ranging exploration of the theories, practices, and opportunities for enhancing sustainability justice andfood security. The course will be a forum

for students to draw on their work experiences and educational experiences to more fully understand, articulate, and advocate for sustainability justice and food. The course utilizes an interdisciplinary approach to understand how fields such as psychology, sociology, public health, and urban studies conceive of issues related to sustainability of justice and food security (i.e., housing, built environment, and community spaces), social justice, and practical solutions that exist within policy and planning to achieve food security.

This seminar explores the concept of sustainability and the role of law in achieving it. Using sustainability challenges such as climate change, biodiversity conservation, forestry, ecological services, toxics and water, students will discuss the various dimensions of sustainability and the institutional tools for implementing sustainability policies. Students will explore the evolution of the concept of sustainable development in international law and policy, and its relationship to international principles such as the precautionary, polluter pays and intergenerational equity principles.

Students will explore sustainability-related issues such as social justice, poverty, equity, implications of multilateral trade and investment rules, corporate social responsibility, sustainable agriculture, economic instruments, the precautionary principle, sustainability assessment, the role of science and evidence, international wildlife trade, and governance, with an emphasis on the role of law and policy. The seminar will feature a number of guest lectures to provide a multiplicity of perspectives

COURSE DESCRIPTION

The course addressesthe development of sustainable solutions towards sustainable-just food security, using systems thinking approaches. The course explores the Community food security (CFS) as a relatively new movement that promotes food security strategies within a region or community's food system. Using case studies that examine a number of community-based sustainable farming, the course promotes sustainability justice and greater equality to reduce poverty and hunger, prepare families to assume responsibility for ethical eating and revive the cultural values of solidarity. The course will use case studies to convey ways to strengthen ties to the regional economy, support local businesses, offer new entrepreneurial opportunities, and engage residents as well as local/state governments in seeking solutions to food insecurity and healthy food choices.

COURSE LEARNING OBJECTIVES

1. To understand the need and importance of the concept of sustainability justice and its constituencies
2. To engage students to reflect on the ethical and political implications of food and agricultural practices in relation to sustainability justice, with special attention to climate change
3. To allow students to begin to visualize the complex nature and interrelations of Food

Security & Sustainability Justice.

4. To address the development of sustainable solutions towards sustainable-just food security, using systems thinking approaches
5. To apply systems thinking in dealing with sustainable farming, food security and climate change through the lenses of sustainability justice.
6. To understand the complexities that face local communities and countries in terms of highly complex and interrelated systems.
7. To illustrate innovative methods of production, efficient ways of food distribution, and methods of processing or waste recycling

Course Content Learning Outcomes:

- Identify the key concepts of sustainability justice in terms of social, cultural, environmental and economic aspects
- Understand the importance of sustainability justice in the context of a sustainability crisis.
- Recognize the constituencies of sustainability justice and their connection to the pillars of sustainable development.
- Identify critical issues related to sustainability justice and food security
- Describe key challenges for food justice from local and national governance perspectives
- Discuss sustainable farming and understand its connection with food security under climate change conditions through the lenses of sustainability justice
- Develop action plans to raise the awareness of farmers and other stakeholders to assure sustainable farming and food security locally.
- Understand the diversity of food production systems under climate change
- Understand the principles of system analysis and how it can be applied in sustainable farming and food production systems.
- Gain comparative and holistic knowledge of today's food systems (production, distribution, consumption, and waste).
- Analyze how the food choices we make as individuals collectively influence: 1) political, socio-economic and ecological changes taking place locally, regionally and globally and 2) both climate change and food security.
- Discuss how disadvantaged social groups are disproportionately affected by climate/food injustice policies and practices.
- Assess how sustainability justice contributes to transforming climate and food injustices.
- Identify and analyze the aims and actions of climate justice and food justice organizations and movements, locally, regionally and globally.

Course Resources.

Walker, Gordon (2012) **Environmental Justice: Concepts, Evidence and Politics.** ***London: Rouledge.***

Course Website(s)

Required Course Texts and Materials

Optional Course Texts and Materials

Assignments and Grading Scheme

Grading System

0 to 100 (where 70 is the least pass mark)

Grading Policy

Component	Grade
Assignments	40%
Class Attendance/ Participation	20%
Final Exam	40%
Total Points	100%

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and /or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Dissability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Week	SUBJECT
1	General Introduction
2	The social and environmental dimension of sustainability justice
3	The culture and economic dimension of sustainability justice
4	Clarifying the Concepts of Climate Justice and Food Justice
5	Climate/Food Justice Policy Considerations and Actions in the Egyptian/Jordanian context
6	Sustainable Farming and Food Justice/Security under Climate Change
7	Sustainable Farming and Food Security
8	Empowering Community Farmers
9	Sustainability Justice and Sustainable Climate/Food Justice
10	The Value of Systems Thinking
11	The Climate and Food System Concept
12	Climate Change and Food Security Systems in Action
13	Community-Based Sustainable Food System
14	Community Food Security in Action: Case Studies
15	Presentation
16	Final exam

Course	Sustainability Justice, Climate Change & Food Security Developed by Prof.Dr. VassiliosMakrakis, University of Crete
Module 1	The Constituencies of Sustainability Justice
Key Concepts	Sustainability justice; environmental sustainability, social sustainability; economic sustainability; cultural sustainability
Overview	While social justice is a frequently employed concept in the deconstruction and reconstruction of the school curriculum and discussion of instructional practice in schools, sustainability-justice that, in addition to social justice, integrates environmental, economic and cultural justice, has not been discussed. Most people usually have only a basic or cursory understanding of Sustainability and Sustainable Development (SD). The concept of Sustainability Justice (SJ) has been recently advanced by Prof. Dr. Makrakis. The concept of "sustainability justice" as it has been conceptualised by Makrakis reflects the four pillars of sustainable development: environment, society, economy and culture. It is thus a concept that when students could be asked about it, they will mostly talk in terms of environmental issues and ignore the other dimensions or constituencies of sustainability justice.
Aim	The overriding aim of this module is for students to be able to understand the need and importance of the concept of sustainability justice and its constituencies
Learning Outcomes	At the end of this module learners will be able to: • Identify the key concepts of sustainability justice in terms of social, cultural, environmental and economic aspects. • Realize the rationale and critical importance of sustainability justice in the context of sustainability crisis. • Recognize the constituencies of sustainability justice and their connection to sustainable development pillars.
Units	Unit 1.1: The environmental dimension of sustainability justice Unit 1.2: The social dimension of sustainability justice Unit 1.3: The economic dimension of sustainability justice Unit 1.4: The culture dimension of sustainability justice
Readings	Makrakis, V. (2017). Unlocking the potentiality and actuality of ICTs in developing sustainable–justice curricula and society. Knowledge Cultures, 5(2), 103-122. doi: 0.22381/KC5220177 http://petarjandric.com/images/pdf/Knowledge-Cultures522017.pdf Makrakis, V. (2017). Developing and validating a sustainability justice instrument to transform curriculum, learning and teaching. 9th International Conference in Open & Distance Learning – November 2017, Athens, Greece–PROCEEDINGShttps://eproceedings.epublishing.ekt.gr/index.php/openedu/article/viewFile/1368/1303

	Vouzaksakis, G. &Makrakis, V. (2017). Embedding sustainability justice in secondary education economic courses enabled by ICTs (with G.).9th International Conference in Open & Distance Learning - November 2017, Athens, Greece–PROCEEDINGSfile:///D:/Downloads/1371-3200-1-PB%20(1).pdf https://eproceedings.epublishing.ekt.gr/index.php/openedu/article/viewFile/1368/1303
Activity	**Assignment 1a:** The main activity for this module will mainly focus on engaging students on the different dimensions or pillars of sustainability justice. As such, students will be organized in groups of 4. Each student will represent one of the pillars of Sustainability Justice and will be required to prepare one page report which will be discussed during an online session among the group members. **Assignment 1b:** Each group of students will exchange their reports for peer reviewing. After peer reviewing, students will collaboratively develop a Wiki providing a comprehensive overview of the pillars of Sustainability Justice and their connection to corresponding sustainable development pillars. The wikis developed will be presented and discussed in class during the second week. **Assignment 1c (Community-based learning project):** In this activity, the students have to disseminate their Wikis through the social media, especially through the development of a Facebook page, aiming to give and share knowledge and information as well as raising awareness on issues of sustainability justice, in relation to climate and food injustices. The deadline for both assignments will be two weeks after the end of the module.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**

	6h	**2h**		**12h**	**10h**	**10h**			**40**
Module 2	Climate Change, Food Security and Sustainability Justice in Context								
Key Concepts	Climate justice, food justice, sustainability justice								
Overview	In recent years, due to climate change humanity has witnessed wild weather and unpredictable seasons that have affected what farmers can grow and the prices and quality of the food. Besides that, millions of people, including children face inhumane working conditions to produce the food we all eat, while they do not have enough to eat themselves. Recent evidence (https://www.weadapt.org/knowledge-base/vulnerability/food-in-an-uncertain-future) shows that the MENA region is the only region outside of Sub-Saharan Africa where the number of undernourished people has increased since the early 1990s, Although, climate change and food security are two critical issues threatening humanity, the way these two interact in relation to justice has started to receive attention in recent years. Indeed, there is considerable discussion of climate justice and food justice and their interrelationship with climate change. Both climate justice and food justice are two emerging movements that can be seen in the context of sustainability justice, a concept that bridges together the four pillars of sustainable development. Sustainability justice reveals the critical intersection of climate change and food security issues in relation to the environmental, social, economic and cultural injustices emanating from climate change and food insecurity.In this sense, climate justice is food justice and sustainability justice offers a framework for addressing food and nutritional insecurity at levels from local to international in light of climate change. It is particularly effective in highlighting the injustices caused by climate change impacts on food security and the effects they have for the poorest and most vulnerable.								
Aim	The overriding aim of this module is to bridge the gap between the academic discourse and the mainstream discourse by engaging students to reflect on the ethical and political implications of food and agricultural practices in relation to sustainability justice, with special attention to climate change.								
Learning Outcomes	At the end of this module students will be able to: • Discuss the concepts of climate change and food security through the lenses of sustainability justice. • Realize the complex relationships between climate change, food security and sustainability justice. • Discuss how food justice and climate justice intersect with sustainability justice, and with inequities involving race, class, gender and governance. • Analyze how the food choices we make as individuals collectively influence: 1) political, socio-economic and ecological changes taking place locally, regionally and globally and 2) both climate change and food security. • Discuss how disadvantaged social groups are disproportionately affected by climate/food injustice policies and practices.								

	• Assess how sustainability justice contributes to transforming climate and food injustices. • Identify and analyze the aims and actions of climate justice and food justice organizations and movements, locally, regionally and globally.
Units	Unit 2.1: Clarifying the Concepts of Climate Justice and Food Justice. Unit 2.2: Climate/Food Justice Policy Considerations and Actions in the Egyptian/Jordanian context.
Readings	Human rights: their role in achieving climate justice and food and nutrition security: A New Dialogue : Putting People at the Heart of Global Development https://www.mrfcj.org/media/pdf/Human-Rights-FNS-Climate-Justice.pdf Mares, T. M., &Peña, D. G. (2011). Environmental and food justice. Cultivating food justice: Race, class, and sustainability, 197-220. https://www.foodethicscouncil.org/uploads/publications/2010%20FoodJustice.pdf Schmidhuber, J., &Tubiello, F. N. (2007). Global food security under climate change. Proceedings of the National Academy of Sciences, 104(50), 19703-19708.file:///D:/Downloads/Global_Food_Security_under_Climate_Change.pdf Agriculture, Food Security and Climate change: Outlook for knowledge, tools and action. CCAFS Report No. 3 file:///D:/Downloads/ccafs_report_3-low-res_final.pdf Purifou, D. Food policy councils: Integrating food justice and environmental justice. https://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=1302&context=delpf Jobbins, G. & Henley, G. (2015). Food in an uncertain future: the impacts of climate change on food security and nutrition in the Middle East and North Africa. Overseas Development Institute, London / World Food Programme, Rome. Available at file:///D:/Downloads/wfp283866.pdf
Activity	

	Assignment 2 Visit the site http://www.icarda.cgiar.org/arab-food-security entitled "Enhancing Food Security in Arab Countries", led by ICARDA. Read carefully the cases of Egypt or Jordan and based on the list of readings, write a 10 pages (1.5 Times New Roman) essay, identifying critical aspects of food insecurity facing the country of choice in light of potential climate change effects. Each student will post his/her essay. Then, students will be required to engage in an online forum to identify and discuss the root causes of food insecurity in these specific circumstances. Students will be required to write a 5 page summary reflective report, including in an annex the forum post and replies. The **deadline** for this assignment is two weeks after the end of the module

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√			√		√		

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√											√				

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6h	**3h**		**10**	**12**				**31**

Module 3	**Sustainable Farming and Food Justice/Security under Climate Change**
Key Concepts	Sustainable agriculture, food security, climate change, food system
Overview	The current agriculture and food system practices and climate threatening seem to damage sustainable farming and food security. Increasing agricultural and food production through intensive and pesticide means, and over-grazed lands, heavily pollutes air, water, and farmworkers health. As a whole, the food system, especially meat production is responsible for a significant portion of greenhouse gas emissions. In this module, particular attention will be given to the assumption that if our food and farming methods are to be sustainable over time, we must shift from unsustainable to sustainable farming. In doing so, maintain the health and productivity of land and must conserve water, energy, and the other natural resources

	upon which agricultural productivity ultimately depends. Any system of food and farming that fails to meet the needs of a sustainable society will fail in the long term. Climate change raises complex issues of science, economics, and politics; it also raises difficult issues of sustainable farming and food justice.
Aim	The aim of this module is to allow students to begin to visualize the complex nature and interrelations of Food Security & Sustainability Justice.
Learning Outcomes	At the end of this module students will be able to: • Discuss food and agriculture systems and how these are changing to impact on sustainable farming • Identify and understand the connection of sustainable farming with food justice • Get information about sustainable farming, food security and justice under climate change effects using online searching machines • Work with other students to define sustainable farming practices under climate change conditions through the lenses of sustainability justice • Analyse the current situation of food security/justice and think over what can be done • Develop action plans to raise the awareness of farmers and other stakeholders to assure sustainable farming and food security locally.
Units	Unit 3.1: Climate Friendly Farming Unit 3.2: Sustainable Farming and Food Security Unit 3.3: Empowering Community Farmers Unit 3.4: Sustainability Justice and Sustainable Climate/Food Justice
Readings	Wreford, A.A., Ignaciuk, A. &Guere, G. (2017). Overcoming barriers to the adoption of climate-friendly practices in agriculture. Papers 101. Paris: OECD DOI:http://dx.doi.org/10.1787/97767de8-en https://read.oecd-ilibrary.org/agriculture-and-food/overcoming-barriers-to-the-adoption-of-climate-friendly-practices-in-agriculture_97767de8-en#page1 European Commission (2012). Sustainable agriculture for the future we want. https://ec.europa.eu/agriculture/sites/agriculture/files/events/2012/rio-side-event/brochure_en.pdf
Activity	
	Assignment 3a Each student should construct three digital concept maps, using any type of software (e.g. Cmap, Inspiration): one for sustainable farming, the other for climate justice and the last for

	food justice. Then, they will critically reflect on the association and links of the three concept maps to produce a new one that merges the three. Each student should post his/her merged concept map in the blended learning environment and invite another student to comment on the concept map, highlighting similarities and differences using the discussion forum. The idea of this reflective assignment is to examine the need of revising the concept maps. Write down a comprehensive 3 pages report on the conceptual changes in students' thinking for revising the initial concepts maps. **Assignment 3b** Explore further the subject of sustainable farming and food security/justice under climate change visiting the Sustainable Development Knowledge Platform at https://sustainabledevelopment.un.org/topics/foodagriculture and access the FAO (2014) report on the State of "Food Insecurity in the World". Read the lessons learned from the analysis of individual countries and try to find similarities and differences with lessons in your own country, making connections to SDG1; SDG2; SDG3; SDG13 & SDG16. Each student will develop a wiki about this assignment to be discussed in the second week of the class and post it in the blended learning environment. The **deadline** for both assignments is within the period of the module, that lasts for two weeks.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√	√										√			√	

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6h	**2h**		**10h**	**14h**				**32**

Module 4	**Sustainable Just Climate & Food Security: The Value of Systems Thinking**
Key Concepts	Systems thinking, climate change, food security, values
Overview	Systems thinking, in general, is the ability to think about a system as a whole, rather than in its parts. It also helps to see the world as a complex system and better understand its

	interconnectedness and interrelationships. In other words, systems thinking is a way of approaching complicated issues through connecting the dots and understanding them as inter-related parts of a greater whole that constitutes the system. Understanding and working with the complexity of sustainable food production systems requires the values of systems thinking. In this module, students will apply systems thinking in line with sustainability justice to tackle the sustainability of food production systems. In a way, this module synthesizes knowledge and skills from the previous modules, addressing the development of sustainable solutions towards sustainable-just food security, using systems thinking approaches. Thus, students will begin to understand how to apply systems thinking in dealing with sustainable farming, food security and climate change through the lenses of sustainability justice. Moreover, they will also begin to understand the complexities that face their local communities and countries in terms of highly complex and interrelated systems that this module deals with.
Aim	The overriding aim of this module is: 1) to provide students with an understanding of the "big ideas" regarding systems thinking, complexity, and resilience as well as with an understanding of some of the methods and tools of analysis in the context of sustainable farming, food security and climate change. 2) To allow students to apply the principles of a systems thinking approach for a sustainable-just climate and food security.
Learning Outcomes	At the end of this module students will be able to: • Understand the complexity and diversity of food production systems under climate change through the lenses of sustainability justice. • Understand the principles of system analysis and how it can be applied in sustainable farming and food production systems. • Evaluate strong and weak points of different food production in terms of sustainability justice. • Gain comparative and holistic knowledge of today's food systems (production, distribution, consumption, and waste). • Explore the idea of food justice and alternative food systems in the local context.
Units	Unit 4.1: Systems Thinking: What, Why, When, Where and How? Unit 4.2: The Climate and Food System Concept Unit 4.3: The Values of Systems Thinking Unit 4.4: Climate Change and Food Security Systems in Action
Readings	Arnold, R.D. & Wade, J.P. (2015). A Definition of Systems Thinking: A Systems Approach Procedia Computer Science 44 (2015) 669 – 678 Behla, D. &Ferreiraa, S. (2014). Systems Thinking: An Analysis of Key Factors and Relationships Procedia Computer Science 36 (2014) 104 – 109

<table>
<tr><td></td><td>Keegan, M. (n.d.).Systems thinking, rural Development and food security. Migration Institute of Australia. https://core.ac.uk/download/pdf/15125474.pdf

Kwamina E. Banson, K. et. al. A systems thinking approach to address the complexity of agribusiness for sustainable development in Africa.
http://journals.isss.org/index.php/proceedings57th/article/viewFile/2119/697

Mares, T. M., &Peña, D. G. (2011). Environmental and food justice. Cultivating food justice: Race, class, and sustainability, 197-220.
https://www.foodethicscouncil.org/uploads/publications/2010%20FoodJustice.pdf</td></tr>
<tr><td>Activity</td><td>Overview</td></tr>
<tr><td></td><td>Assignment 4

Students will write a 10-page paper that analyses a given aspect of food security in light of climate change and its impacts and effects on environment, society, economy and culture. It will examine this as a social-ecological system and incorporate the knowledge acquired so far from previous readings and assignments. The report may cover the perspective of specific groups of people, at the local, national or regional level.

An online discussion forum will be arranged to discuss the key points of the papers written. A power point presentation will be prepared by each student for class presentation and discussion during the third week of the module.

This deadline of this assignment will be carried out during the three weeks of the module.</td></tr>
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10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
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SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√											√				

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	9h	**2h**		**12**	**17**		**12**		**52**

Module 5	Community Food Security and Sustainability Justice								
Key Concepts	Community food security (CFS), hunger, sustainability justice, democratic decision-making								
Overview	Community food security (CFS) is a relatively a new movement that promotes food security strategies within a region or community's food system. In this sense, CFS is concerned with the full range of food chain events including agriculture, the availability of supermarkets and other affordable outlets for quality and accessible food. It is also concerned with the involvement of the wider citizenry and local/state governments in seeking solutions to food insecurity and healthy food choices. While officially a movement since only 1994, CFS is now practiced by hundreds of organizations and communities worldwide, engaging thousands of groups, volunteers, government and non-government representatives in projects and activities that have improved their communities' capacity to meet their own food needs. Looking into past experiences, one can see projects and activities that include farmers' markets, food assistance program outreach, community gardens, youth food and agriculture programs, farmland preservation and farm viability projects, food system planning and food policy councils, nutrition education and health promotion strategies, farm-to-school projects and a range of public education and awareness campaigns. In general, CFS encourages progressive planning that addresses the underlying causes of hunger and food insecurity facing the current global food system. Although such a system has witnessed highly efficient food production, it has created many undesirable environmental, social, economic and cultural impacts. Small farmers' mostly profit margins that have significantly led to the abandonment of their agricultural activities. In general, the economic viability of small and medium-sized farms has reduced the number of farm-related local business and made farming less attractive to younger generations. Many studies show that food production has been less community-based, diminishing farmers' collective knowledge and sustainable agrarian practices. At the same time, the unprecedented demand for local and regionally identified foods has created many opportunities for agricultural producers and communities. In this module, we will bring a number of community-based sustainable farming and food case studies aiming to the promotion of sustainability justice and greater equality. Such case studies show how to reduce poverty and hunger, prepare families to assume responsibility for ethical eating and revive the cultural values of solidarity among families and social responsibility. Some case studies illustrate innovative methods of production, others demonstrate more efficient ways to distribute food, and some are exemplary methods of processing or waste recycling. The majority of case studies convey ways to strengthen ties to the regional economy, support local businesses, offer new entrepreneurial opportunities, and engage residents.								
Aim	It is promoting greater compassion for the food insecure, expanding awareness of local food systems and the range of options available to build local food security, and engaging the talents, resources, and wisdom of more participants than ever before to end food insecurity and hunger .								

Learning Outcomes	At the end of this module students will be able to: • Identify critical issues and problems related to SJ and FS • Understand the problems & obstacles faced by minority and disadvantaged groups in achieving food justice • Discuss how low-income communities are disproportionately impacted by food injustice • Explore the idea of food justice and alternative food systems in the local context • Describe key challenges for food justice from local and national governance perspectives
Units	Unit 5.1: What is a Community-Based Sustainable Food System? Unit 5.2: Indicators of Community-Based Sustainable Food System Unit 5.3: Community Food Security in Action: Case Studies
Readings	Building a Community-Based Sustainable Food System. University of Michigan Urban & Regional Planning Capstone Project April 2009. http://closup.umich.edu/publications/misc/Community-Based-Sustainable-Food-Systems.pdf Bendfeldt, E. et.al. (2011), A Community-based food system: Building health, wealth, connection, and capacity. Virginia Tech. https://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/3306/3306-9029/3306-9029-PDF.pdf Mares, T. M., &Peña, D. G. (2011). Environmental and food justice. Cultivating food justice: Race, class, and sustainability, 197-220. https://www.foodethicscouncil.org/uploads/publications/2010%20FoodJustice.pdf Ismail, S. et.al. (2003). Community-based food and nutrition programmes: What makes them successful -A review and analysis of experience. FAO Food and Nutrition Division **4. BRAZIL CASE STUDY** **5. KENYA CASE STUDY** **6. BANGLADESH CASE STUDY** http://www.fao.org/docrep/006/y5030e/y5030e00.htm
Activity:	
Community-based learning	**Assignment 5a**

	Choose one out of the three case studies and 1) discover the strengths and weaknesses; 2) discuss how such a case study can be contextualized in your own community. Based on it, organise an online discussion forum to share best practices in community-based, sustainable food systems for application in your own local communities. Write-up an action plan to show how changes to the current local food system could enhance the presence of healthy, affordable food and serve as an economic development tool in your local community. **Assignment 5b**: **Community-based learning project "Sustainable-Just Dining"** Create a number of Sustainable-Just Food Working Groups, preferably 2-3 students in each group. Each group will focus on a community sector that has services for dining and/or selling food, such as university, supermarkets, hotels, etc. Each group will have to examine ways to increase sustainable food policies that can be turned into concrete actions. The aim will be to reduce landfill food waste and promote the idea of ethical eating and to ensure that unsold leftovers are suitable for donating to vulnerable groups in the community. Each group should write a reflective essay about their experience and develop a .ppt presentation to share them. For "Writing a Good Reflective Essay: from Introduction to Conclusion" visit the https://writemyessay4me.org/blog/reflective-essay Organise an off-line (in class) and an online conference session to present and discuss your results. The **deadline** of the last assignment will be at the end of the examination period.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	√

SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
	√	√											√				

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	12h	**4h**	**6h**	**14**	**20**	**24**	**12**	**3**	**95**

SUMMARY OF ECTS WORKLOAD

Learning Components	**No**	**Time**	**Workload**	**Course Modules**					**Workload**
				1	**2**	**3**	**4**	**5**	
Lectures (face-to-face)	13	3	39	6	6	6	9	12	39
Online	4	3	13	2	3	2	2	4	13
Lab work	3	2	6					6	6
Reading articles (3 pages per hour)	97	0.3	29	6	5	5	6	7	29
Reading book chapters (5 per/h)	145	0.2	29	6	5	5	6	7	29
Preparing course activities	4.6	15	69	6	12	14	17	20	69
Project work	1.7	20	34	10				24	34
Preparation for exam	0.48	50	24				12	12	24
Writing the exam	2	1.5	3					3	3
Total			**250**	40	31	32	52	95	250

SDGs		**CC**	**SA**	**FS**	**COURSE MODULE**
1	End poverty in all its forms everywhere	X	X	X	1,2,3,4,5
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	X	X	X	1,2,3,4,5

3	Ensure healthy lives and promote well-being for all at all ages	X	X	X	1,3
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	X	X	X	1
5	Achieve gender equality and empower all women and girls	X	X	X	1
6	Ensure availability and sustainable management of water and sanitation for all	X	X	X	1
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	X	X	X	1
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all	X	X	X	1
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation	X	X	X	1
10	Reduce inequality within and among countries	X	X	X	1
11	Make cities and human settlements inclusive, safe, resilient, and sustainable	X	X	X	1
12	Ensure sustainable consumption and production patterns	X	X	X	1
13	Take urgent action to combat climate change and its impacts	X	X	X	1,2,3,4,5
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development	X	X	X	1
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss	X	X	X	1
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions on all levels	X	X	X	1,3
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	X	X	X	1


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS


ICTs as enabling tools for the 10Cs
Constructing knowledge
Critical thinking and problem solving
Communi-cation
Collabo-ration
Creativity and innovation
Connectivity and networking
Critical conscious-ness
Critical reflection
Cross/inter-cultural competence
Co-responsibility

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CCSAFS COURSE SYLLABUS

Course Number:…….

Small Scale Farming, Indigenous Knowledge and Local Food Supply
Semester 1st

Instructor Information

Instructor: Dr. Kamel I. Sultan
Office Location: Office 407, Faculty of Agriculture
Telephone: 00962795009498
Office Hours: 12.00-14.00 Sun & Tus
E-mail: k_sultan54@yahoo.ca
kamel.isultan@jpu.edu.jo
Website: http://www.jpu.edu.jo/jpu

Course Identification

Course Number: ……..

Course Name: Small Scale Farming, Indigenous Knowledge and Local Food Supply
Course Location:
Class Times:
Prerequisites:
Faculty Web Page:

Course Description/Overview

This course will explain the small sustainable farming systems, and their effects in mitigating climate change impacts, with building the farmers capacities in their specialisation. The small farms can keep up-to-date knowledge in their fields. So students will learn how to keep these farms running in the expected bad effects of climate change.

This course aims to provide an understanding of the fundamentals that apply to starting and managing a small farm business. Students will examine the basics of traditional and organic farming systems and learn about resources and strategies to get started and manage a small farm business. The information gained in this course prepares students to explore indigenous knowledge and local food supply chains from a holistic perspective.

Course Learning Objectives

- To gain knowledge of the practical aspects of whole farm planning for a wide variety of enterprises.
- To gain an understanding of the various components of sustainable small-scale farming systems
- To gain skills in assessing the feasibility of developing a viable, sustainable, small-scale farming enterprise including how to evaluate personal and family goals, evaluate land and personal resources, and improve environmental outcomes.
- To learn about available resources and support networks for sustainable farming.
- To develop a whole farm plan that meets social, environmental, and financial goals.

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

1- Earn knowledge about the principle of small farming and its effect on the sustainability of food production and human welfare.

2- Know about the systems used in sustainable food production with small farming.

3- Make decisions about efficient allocation of scarce resources to meet growing food demand using sustainable and safe food production methods.

4- Understand how sustainable food production can be done using environmental safe systems of production.

5- Practice soil preservation systems to sustain food production.

6- Examine how marketing food channels can achieve food security.

Course Resources

Course Website(s)

Required Course Texts and Materials

Lynn Bycznski, 2013. Market Farming Success: The Business of Growing and Selling Local Food, 2nd Editon. Chelsea Green Publishing.

Elliot Coleman, 1995. The New Organic Growe : A Master's Manual of Tools and Techniques for the Home and Market Gardener, 2nd Edition. Chelsea Green Publishing.

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Additional resources and reading materials provided in class

Optional Course Texts and Materials

Marzin J., Bonnet P., Bessaoud O. and Ton-Nu C.,.,2016. Study on Small-Scale Family Farming in the Near east and North Africa Region. FaaAO. Rome, Italy.

http://www.fao.org/3/b-i6436e.pdf

Hughes M., Granger K, Hashley J.and Owens C., 2010.How to Begin your Small Farm Dream. Agriculture, Food and Environment Program, Boston, USA.

Agricultural Sustainability Institute. 2013. Farm to Institution. Davis, CA: University of California, Davis. asi.ucdavis.edu/sarep/sfs/ftoi

Alkon, Allison Hope, and Julian Agyeman. (2011). Introduction: The food movement as polyculture. In A. H. Alkon & J. Agyeman (Eds.), Cultivating Food

Justice: Race, Class, and Sustainability (pp. 1–20). Cambridge, MA: MIT Press.

Allen, Patricia. 2004. Together at the Table: Sustainability and Sustenance in the American Agrifood System. University Park: Pennsylvania State Press.

American Farmland Trust. 2013. American Farmland Trust. http://www.farmland.org/

Applied Research Center (2012) About Us. www.arc.org/content/blogsection/4/200/

Cochrane, Willard W. 1993. The Development of American Agriculture: A Historical Analysis. Minneapolis, MN: University of Minnesota Press.

Community Alliance with Family Farmers. 2013. Programs. http://caff.org/programs/

Community Food Security Coalition. 2013. What is Community Food Security? foodsecurity.org/what-iscommunity-food-security/

Danbom, David B. 1979. The Resisted Revolution: Urban American and the Industrialization of Agriculture, 1900-1930. Ames, IA: The Iowa State

University Press.

Web resources

http://agr.wa.gov/FoodAnimal/Organic/#CertificationServices

http://smallfarms.wsu.edu/
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
http://www.ams.usda.gov/AMSv1.0/ams.fetchTemplateData.do?template=TemplateO&navID=ViewU.S.TerminalMarketPriceReports&rightNav1=ViewU.S.TerminalMarketPriceReports&topNav&leftNav&page=FVMarketNewsTerminalMarketReportsMorehttp://agr.wa.gov/foodanimal/organic/
http://www.marketfarm.com/
http://www.charliesproduce.com/
"Fresh Produce Facts" at http://postharvest.ucdavis.edu/
post harvest Agriculture Handbook Number 66

https://pubs.wsu.edu/ http://www.tractorhouse.com/
WSU WSU Organic Ag

Assignments and Grading Scheme

Grading System

Grading Policy

Grades can be based on the following: (Example)

Assignments	40%
Exams	40%
Class attendance/participation	20%
Total Points	**100**

Course Policies

Students are expected to attend all classes. Students cannot pass the class under any circumstances if they miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If a student knows that he has to leave early, he should notify the instructor before class starts. All are expected to treat faculty and other students with respect. During class, students are asked not to disrupt the class. Students who violate these minimal expectations will be asked to leave. Students are expected to have read and completed the assigned material before coming to class. The instructor expects attendance and active class participation, which counts for 20% of the total grade.

Late Assignments

Late assignments will not be accepted unless the student presented an accepted excuse for the delay.

Classroom Protocol

Attendance is needed for all the lectures unless there is an urgent absence with an accepted excuse.

Disability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodation. Establishing reasonable accommodation should be considered on a case-by-case basis.

Important Dates to Remember

Course Schedule

Week	Date	Topics
1		Small farming and Sustainability Concepts
2 & 3		Developing the whole farm plan
4		Evaluation of Resources & Enterprise Assessment
5 & 6		Sustainable Crop Production
7		Basics of Ecological Soil Management
8 &9		Integrated Pest and Weed Management
10		Sustainable Livestock and Poultry & Grazing Management on Small Acreages
11		Equipment and Facilities
12		Marketing Strategies and enterprise budgets
13		Implementation of applied small farming
14		Presentations

Course modules	**Small Scale Farming, Indigenous Knowledge and Local Food Supply**
Module 1	**Science of Small Scale Farming**
Key Concepts	Small scale farm concept, Climate Change, Sustainability
Overview	This module provides a general overview of Small farming concept, highlighting the current state of knowledge and uncertainties about climate change and agricultural sustainability development.
Aim	The overriding aim of this module is to turn students able to understand the following: 4. The small farming concept. 5. The global trends of greenhouse gases and pollution. 6. Climate change mitigation methods using small farming concepts.
Learning Outcomes	At the end of this module students will be able to: • Gain a general understanding of the issues of Climate Change and Sustainable Development. • Understand and critically assess the concepts of climate change and sustainability.
Units	1- Impacts of climate change. 2- Climate change damages. 3- Economic approach to value climate change damages. 4- Aggregating climate change damages.

	5- Greenhouse Gas Cycles. 6- Sustainable Development.
Readings	1. Archer, 2017. "The Perturbed Carbon Cycle." In Global Warming: Understanding the Forecast 2nd Edition 2. Schneider, "What Is 'Dangerous' Climate Change?". 3. Forster et al., 2006. "Changes in Atmospheric Constituents and in Radiative Forcing." Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 4. Surowiecki, 2007. Better and Better: The Myth of Inevitable Progress. Foreign Affairs. NY, USA. 5. Funk C. and Brian Kennedy B., 2016. "The Causes of Global Climate Change." Pew Research Center, Science and Society, NY, USA.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. This paper will express students reaction towards the subjects needed for this course
10Cs/6 LEARNINGGOALS	Character Education, Communication
ECTS WORK LOAD	30
SDGs	1, 2, 3, 6, 8, 11, 12, 15, 16
Vision 2030	National Economy and Domestic Product Growth, Sustainable Development and Developing Qualified Human Resources
Module 2	**Developing the whole farm plan and Evaluation of Resources and Enterprise Assessment**
Key Concepts	The farm scale, optimum farm size and the feasibility study of the farm using available resources management. Planning the farm project.
Overview	This module will give the students an idea about the economics of farm size and the optimum farm size for the economic production of agricultural products
Aim	The main aim of this module is to make comparison according to the size of the farm and to choose the optimal scale for production and to compare it with the available small scale farms in the area.
Learning Outcomes	At the end of this module, students will be able to make comparisons among farms according to their scale and to choose the feasible optimum

	farm size and compare with the benefits of sustainability in food production.
Units	1) Farm size and relation to sustainability of agricultural production. 2) Feasibility study of farms. 3) Planning of farm in plant production. 4) Planning farms of Animal production.
Readings	Stott D., Lee E. and Nichols E., 2014. Feasibility Study of Small/Medium Farm Product Distribution System In the Lower Mainland. http://www.farmfolkcityfolk.ca/PDFs_&_Docs/Distribution/Report%206_Small_Medium%20Farm%20Product%20Distribution%20System%20Development.pdf Feasibility Study Rural Household Biogas & Conservation Tillage CDM Project Development. http://www.un-csam.org/publication/CDMFinalReport.pdf Saša Slijepčevid Amela Dosovid – Medid, 2011. Goat Farm Feasibility Study; Sustainable Business and Inclusive Markets. www.ba.undp.org/content/dam/bosnia.../BiH_Goat-Farm-Feasibility-Study.pdf Feasibility Study on Priority Projects and Programs. http://open_jicareport.jica.go.jp/pdf/11752524_02.pdf FAO, 2005. Guidelines for the Design of Agricultural IY Projects. http://www.fao.org/3/a-v4810e.pdf Jordan Investment Commission, 2017. Pre-Feasibility Study Establishing a Cut Flowers Farm Madaba. https://jic.gov.jo/esfwebadmin/upload/%D8%A7%D9%84%D8%AE%D8%A7%D8%B1%D8%B7%D8%A9%20%D8%A7%D9%84%D8%A7%D8%B3%D8%AA%D8%AB%D9%85%D8%A7%D8%B1%D9%8A%D8%A9%201/A%20Cut%20Flowers%20Farm-%20Madaba.pdf
Activity	Students will be asked to prepare the following: • Farm plan. • A feasibility study of a small farm. • Compare the feasibility and sustainability measures.
10Cs/6 LEARNINGGOALS	Character Education, Citizenship, Critical Thinking, Creativity
ECTS WORK LOAD	40
SDGs	1, 2, 32, 6, 8, 11, 16

Vision 2030	Service and Infrastructure, Sustainable development, Developing Qualified Human Resources
Module 3	**Sustainable Crop Production,** Sustainable Livestock and Poultry, and Grazing Management on Small Acreages
Key Concepts	Sustainable, agriculture, soils, agriculture approaches, sustainable animal production and grazing management.
Overview	This module will provide an overview of sustainable agriculture. It will focus on the sustainability of food production at multiple levels: farm resources, community, regional, national and global. Students will gain basic understanding of the environmental problems caused by conventional agriculture/horticulture and understand the challenges to alternative forms of sustainable agriculture.
Aim	Upon completion of this course, students should be able to: 1. Use critical reading skills to guide interpretation of articles. 2. Identify the key principles of sustainable agriculture and ecology; 3. Describe several different models of sustainable agriculture systems. 4. Identify potential career opportunities in sustainable agriculture. 5. Design an agriculture system that incorporates key ecological principles and sustainable management practices
Learning Outcomes	At the end of this module students will be able to: 1. Learn how issues at various levels--farm, community, regional, national and global-- influence agriculture sustainability and future food supply. 2. Learn to think critically about where their food comes from, and be able to analyse the environmental, economic, and social costs and benefits involved in delivering food from farm to market. 3. Gain knowledge about the pros and cons to global trade, and what forms of sustainable agriculture will best suit the needs of a growing global population.
Units	1. What is sustainability, What is agriculture? 2. Features of agriculture: sustainable and unsustainable. 3. Soils and Sustainability. 4. Water and Sustainability 5. Cropping systems, Livestock systems. 6. “Alternative” agriculture approaches. 7. Issues in sustainable agriculture.

	8. Economic Dimensions of Farm Sustainability.
Readings	1. Lichtfouse, E., Navarrete, M., Debaeke, P., Véronique, S., Alberola, C. 2009, Sustainable Agriculture. 2. UNDP, 2012. Chapter 5: Sustainable Agriculture, https://www.cbd.int/financial/finplanning/g-plantools5-undp.pdf. 3. OSU Extension Small Farms, An Introduction Sustainable Farming. http://extension.oregonstate.edu/sorec/sites/default/files/Sustainable_Farming.pdf. 4. Jules Pretty**, 2007.** Agricultural sustainability: concepts, principles and evidence, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2610163/. 5. Fritz J. Häni, László Pintér and Hans R. Herren,2006, Sustainable Agriculture: From Common Principles to Common Practice, International Forum on Assessing Sustainability in Agriculture (INFASA), https://www.iisd.org/pdf/2007/infasa_common_principles.pdf.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.
10Cs/6 LEARNINGGOALS	Character Education, Citizenship, Communication
ECTS WORK LOAD	40
SDGs	1, 2, 6, 8, 12, 16
Vision 2030	Constructive change and Building Support System, Surface and Infrastructure,
Module 4	**Equipment and Facilities**
Key Concepts	Ploughing equipment, Irrigation Equipment, Pumps, Green houses equipment, Aquatic production equipment

Overview	This module allows students to know about the environmentally friendly equipment used in modern agriculture to produce with more water usage efficiency and higher productivity efficiency.
Aim	At the end of this module students are aware of the following: 1. Know the suitable equipment used in sustainable vegetable production. 2. Know the animal production facilities for sustainable small farm production.
Learning Outcomes	At the end of this module students are able to do the following: 1. Design the suitable farming system will be used in small farming production. 2. Use this equipment in both crop and animal production at the small scale farming. 3. Adapt and incorporate the modern technologies in small farming.
Units	1. Environmentally safe ploughing equipment. 2. Modern vegetable production system used in small farms. 3. Modern systems and equipment used in small animal farms.
Readings	Small Farm Equipment for Developing Countries. http://books.irri.org/971104157X_content.pdf FFTC annual report, 2012. Small farm mechanization systems development, adoption and utilization. http://en.fftc.org.tw/htmlarea_file/library/20110726133001/ac2005c.pdf Sims B. and Kienzle J., 2006. Farm power and mechanization for small farms in sub-Saharan Africa. Agricultural and Food Engineering Technical Report, FAO. https://vtechworks.lib.vt.edu/bitstream/handle/10919/68476/4239_a0651e00.pdf?sequence=1. Matthewson M., Powell M., Andrews N., Ellen G., Tipping D., Franklin T., Elkovich S., 2010. Designing a Whole Farm System: Whole Farming Principles and Strategies. Oregon State University Extension Small Farms. http://extension.oregonstate.edu/sorec/sites/default/files/designing_a_whole_farm_system_manual.pdf
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. The students will also be asked to write summaries new published papers about the subjects on the lectures content. 3. At the end of this module students will submit an individual farm equipment design paper.
10Cs/6 LEARNINGGOALS	Character Building, Critical Thinking, Collaboration, Creativity

ECTS WORK LOAD	55
SDGs	1, 2, 4, 5, 6, 7, 8, 9, 10, 13, 16, 17
Vision 2030	Care, Compassion, Courage, Commitment
Module 5	**Food Security.**
Key Concepts	Production, Safety, Security, climate change.
Overview	This module will provide students for an overview of food security. The module looks at food production at multiple levels: farm resources, community, regional, national and global. Students will gain basic understanding of the environmental problems caused by conventional agriculture/horticulture and understand the challenges of alternative forms of sustainable agriculture.
Aim	Objectives Upon completion of this course, students should be able to: 1. Understand ways of adapting to climate change and managing the environment keeping in mind food security and sustainability. 2. Understand the concept of food security and issues related to small scale farming and indigenous knowledge to achieve it.
Learning Outcomes	At the end of this module students will be able to: 1. Understand the production of food resources, their ecological problems, factors of nutritive policy, food safety and nutritive policy. 2. Identify the inter-relationship between climate change, environment, food security and sustainability at global and regional level.
Units	1. Food production. 2. Accessibility of food resources. 3. Food distribution. 4. Food safety. 5. Policy, economic and social aspect of food.
Readings	1. Beddington J., Asaduzzaman M., Cndez A., Guillou M., Jahn M., Erda L., Mamo T., Van Bo N., Nobre C.A., Scholes R., Sharma R. andWakhungu J. (2012)Achieving Food Security in the Face of Climate Change: Final Report from the Commission on Sustainable Agriculture and Climate Change. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark, Available online at: www.ccafs.cgiar.org/commission. 2. National Research Council (2012). Sustainability Challenge: Food Security for All, Report of Two Workshops. Washington, DC: The National

	Academies Press. http://www.nap.edu/catalog.php?record_id=13378#toc. 3. Food Insecurity Atlas of Rural India (2001) MS Swaminathan Research Foundation and World Food Programme. http://home.wfp.org/stellent/groups/public/documents/ena/wfp076968.pdf 4. National Research Council (2012). Sustainability Challenge: Food Security for All, Report of Two Workshops. Washington, DC: The National Academies Press. http://www.nap.edu/catalog.php?record_id=13378#toc
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.
10Cs/6 LEARNINGGOALS	Citizenship, Communication, Critical Thinking, Creativity
ECTS WORK LOAD	50
SDGs	1, 2, 3, 8, 9, 10, 11, 12, 13, 16,
Vision 2030	Constructing Change and Building Support System, National Economy and domestic Product Growth, Health Society Welfare
Module 6	**Marketing Strategies and enterprise budgets**
Key Concepts	Marketing, marketing rings, marketing strategies, enterprise budgeting
Overview	This module will explain the possible marketing strategies of farm products to overcome the environmental worse conditions and how to use the suitable marketing chain to distribute safe food products.
Aim	Upon completion of this course, students should be able to: 1. Design the suitable strategy will be used in marketing small farm safe food products. 2. Think of the alternatives to be used in small farm food products marketing.
Learning Outcomes	Upon finishing this module students will have the following knowledge:

	1. The different strategies used in food chain marketing. 2. The designing of the suitable marketing procedure for the small farm food products
Units	1) Marketing rings of food products. 2) Marketing strategies of food products. 3) Firms and farms budgets. 4) Cost benefit analysis of farms.
Readings	Marketing Strategies for Farmers and Ranchers. Sustainable. Agriculture Network (SAN), Sustainable Agriculture Network. https://www.sare.org/content/.../Marketing_Strategies_for_Farmers_and_Ranchers.pdf Yeager I., 2013. Marketing Strategies for Small Scale Producers. Utah State University. https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1260&context=gradreports Kima M., Curtisıb K. and Yeager I., 2014. An Assessment of Market Strategies for Small-Scale Produce Growers. International Food and Agribusiness Management Review (17): 187-207. https://www.ifama.org/resources/Documents/v17i3/Kim-Curtis-Yeager.pdf
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write summaries on the lectures content. 4. The students will be asked to report a small farm in the area. 5. The students will submit an individual abstract of a paper about the explained subjects.
10Cs/6 LEARNINGGOALS	Character Education, Citizenship, Communication, Critical Thinking, Creativity
ECTS WORK LOAD	77
SDGs	2, 6, 7, 8, 9, 11, 12, 16, 17
Vision 2030	Constructing Change and Building Support System, National Economy and domestic Product Growth, Health Society Welfare

The workload of Risk Analysis in the Food Chain 10 ECTS Workload Allocation

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**						**Workload**
				1	**2**	**3**	**4**	**5**	**6**	

Lectures (face-to-face)	10	3	30	5	5	5	5	5	5	30
Online	3	3	9	1	-	2	2	2	2	9
Lab work	4	2	8	-	-	2	2	2	2	8
Reading articles (3 pages per hour)	150	0.3	45	6	7	6	6	10	10	45
Reading book chapters (5 per/h)	140	0.2	28	4	4	5	5	5	5	28
Preparing course activities	5	15	75	10	15	20	20	10	-	75
Project work	1	20	20				3	5	12	20
Preparation for exam	1	50	50				10	15	25	50
Writing the exam	2	1.5	3						3	3
Total			**268**	30	40	40	55	50	77	**268**

SDGs		**CC**	**SA**	**FS**	**COURSE MODULE**
1	End poverty in all its forms everywhere		X	X	1,2, 3, 4, 5
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		X	X	1,2, 3, 4, 5, 6
3	Ensure healthy lives and promote well-being for all at all ages	X	X	X	1, 2, 5
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		X	X	4
5	Achieve gender equality and empower all women and girls		X	X	4
6	Ensure availability and sustainable management of water and sanitation for all	X	X	X	1, 2, 3, 4, 6
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				4, 6

8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all		X	X	1, 2, 3, 4, 5, 6
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation		X	X	4, 5, 6
10	Reduce inequality within and among countries		X	X	4, 5
11	Make cities and human settlements inclusive, safe, resilient, and sustainable	X	X	X	1, 2, 5, 6
12	Ensure sustainable consumption and production patterns		X	X	1, 3, 5, 6
13	Take urgent action to combat climate change and its impacts				4, 5
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss	X	X	X	1, 2
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions on all levels		X	X	1,2, 3, 4, 5, 6
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				4, 6

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CCSAFS COURSE SYLLABUS

Jerash University

Course Syllabus

Course Number ( )

Course Title

Social Entrepreneurship in the Organic Food Industry

Semester ( )

Instructor Information

Instructor: **Prof Omer Maaitah**

Office Location: **Faculty of Agriculture Building**

Telephone:
0096796629922

Office Hours
(Times &
Days).

E-mail: Maaitah_noor@hotmail.com

Website: http://www.jpu.edu.jo/jpu/profile.php?id=50

Course Identification

Course Number:

Course Name: **Social Entrepreneurship in the Organic Food Industry**

Course Location: **Faculty of Agriculture**

Class Times: Not Now

Prerequisites:

Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Description/Overview

Social entrepreneurship, an effective tool for solving social problems, has proven to be a fast growing sector in Europe. It is a relatively new concept in the many developing country and not a very old one in developed country. Each year there are more and more social enterprises tackling multitude of social problems and challenges, offering a diverse range of solutions. Because of the interdisciplinary nature of this type of entrepreneurship and many other reasons, social enterprises very often face obstacles and challenges that conventional businesses and civil society organizations already have dealt with to a certain extent: the lack of legal frameworks, insufficient state and municipality support, complicated business models, enterprise identity issues, the lack of awareness and visibility among the general public, access to investment markets.

Course Learning Objectives:

1. The student should have idea to look at one of these possible solutions - social entrepreneurship labeling initiatives (SDG 2,3, 5, 11, 13 &17)
2. Explain all the knowledge about organic food, organic industry – and investigate if they can help alleviate some of the problems and challenges faced by social entrepreneurs. Even though social entrepreneurship (SDG 2,3, 5, 11, 13 &17)
3. Know about labeling as a tool has been used in several European countries, the success or failure of these attempts remains a mostly unexplored issue (SDG 2,3, 5, 11, 13 &17).

Course Content Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Discuss / explain Social Entrepreneurship in the Organic Food Industry (SDG 2, 3, 5, 11, 13 &17)
2. Use economic analysis as policy tools and instruments (SDG 1, 2, 3 &5).
3. Understand the use of public policies and support programs in influencing food industry, organic farmers and consumers (SDG 2,3 5 11 &13).
4. Identify the interrelationships between environment and economics (SDG 5 &17).
5. Implement analytical skills to quantify the impact of Social Entrepreneurship in the Organic Food Industry (SDG 2, 3, 5, 11, 13 &17)
6. Understands the production of food resources, their ecological problems, factors of nutritive policy, food safety and nutritive policy (SDG 2,3, 5, 11, 13 &17).
7. Understanding of the inter-relationship between climate change, environment, food security and sustainability at global and regional level (SDG 2, 3, 5, 11, 13 &17).

8. Apply the ways of adaptation for climate changes and managing environmental keeping and food security sustainability (SDG 2, 3, 5, 11, 13 &17).

Course Resources.

Kaluski Nitzan, Dorit (2009): Strengthening food safety and nutrition policies and services in South-eastern Europe, WHO Regional Office for Europe, Copenhagen Ø, Denmark

Kotler, P., Keller K. (2012): Marketing Management, 14-E, Prentice Hall, USA, ISBN10: 0132102927 • ISBN-13: 9780132102926

Lund, T.B., Laura Mørch Andersen, Katherine O'Doherty Jensen (2012) The emergence of diverse organic consumers: Who are they and how do they shape demand? FOI Working Paper 2012 / 5, Institute of Food and Resource Economics, Copenhagen, Denmark

Stolz, Hanna, Ingrid Jahrl, L. Baumgart, Flurina Schneider (2010); Sensory Experiences and Expectations of Organic Food, Research Institute of Organic Agriculture (FiBL), Switzerland

ValueLinks (2009) Assuring Quality through Product & Process Standards, Product & Process Standards Module 9, available at www.enterprise-development.org/download.ashx?id=1886 (accessed 20.12.2012)

Zorn, A., C. Lippert, S. Dabbert (2009): ECONOMIC CONCEPTS OF ORGANIC CERTIFICATION, CERTCOST Project, agreement no. 207727, with financial support from the European Community under the 7th Framework available at http://www.certcost.org

›http://www.qlif.org/research/sub1/QLIF_Review_Reanalysis_%200509.pdf

›http://orgapet.orgap.org/annexes/annex_C4-6.pdf

›https://www.fibl.org/en/shop-en/article/c/w/gen-economics/p/1362-consumer.html

›https://www.fibl.org/fileadmin/documents/shop/1636-organic-world-2014.pdf

Course Website(s)

Required Course Texts and Materials

Optional Course Texts and Materials

Assignments and Grading Scheme

Grading System
0 to 10 (where 5 is the least pass mark)

Grading Policy

Component	Grade
Assignments	80%
Exams	
Class Attendance/ Participation	20%
Total Points	100%

Course Policies

Late Assignments
It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol
This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and / or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Dissability
Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Course Syllabus

Week No. (lectures time plane)	Subject Title	
Week 1 2 lecture	Chapter 1:	Introduction to social enter partnership
Week 2 2 lecture	Chapter 2	Social movement
Week 3 4 lecture	Chapter 3:	Organic Agriculture
Week 4 2 lecture	Chapter 4:	Organic Food
Week 5 4 lecture	Chapter 5:	Organic Food Standard
Week 6 4 lecture	Chapter 6	Scopes of Marketing in organic food
Week 7 3 lecture	Chapter 7:	Entrepreneurship in the Natural Food and Beauty
Week 8 3 lecture	Chapter 8	Sustainability (Resilience of a Sustainability Entrepreneur)
Week 9 2 lecture	Chapter 9	Entrepreneurship in farming
Week 10 4 lecture	Chapter 10	Establishing a social entrepreneurship: labeling initiative ratification
Week 11 2 lecture	Chapter 11	An analytical report on existing social value
		labeling practices, and a way forward
Week 12 Case study (organic farm)		

Week 13 Case study (organic food industry)
Week 14 Field trip: organic farm and food industry
Week 15 Student Presentations
Week 16 Final exam

Social Entrepreneurship in the Organic Food Industry Course Modulus

Course	**Social Entrepreneurship in the Organic Food Industry**
Module 1	Introduction to social enter partnership
Key Concepts	Global Warming, Climate Change, social movement
Overview	This module provides a general overview of climate science and climate change impacts on social and social movement.
Aim	The overriding aim of this module is to turn students able to understand the following: 1. Introduce the students to climate science and climate change impacts on social and social movement 2. Provide a basic understanding of the global cycles partnership 3. Provide a basic understanding of the workings of the global climate system.
Learning Outcomes	At the end of this module students will be able to: 1. Gain a general understanding of the issues of Climate Change and Sustainable Development on social and social movement. 2. Understand and critically assess the concepts of climate change and sustainability on social and social movement. 3. Student must conduct field study on their society
Units	• Introduction to social enter partnership • Social movement
Readings	ValueLinks (2009) Assuring Quality through Product & Process Standards, Product & Process Standards Module 9, available at www.enterprise-development.org/download.ashx?id=1886 (accessed 20.12.2012) Zorn, A., C. Lippert, S. Dabbert (2009): ECONOMIC CONCEPTS OF ORGANIC CERTIFICATION, CERTCOST Project, agreement no. 207727, with financial support from the European Community under the 7th Framework available at http://www.certcost.org

Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course.

	3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.																
10Cs/6 iOA LEARNING LS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√			√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
		√	√		√						√		√				√
Module 2	**Organic Food**																
Key Conc epts	Organic Agriculture, Organic Food, Scopes of Marketing in organic food, Organic Food Standard, Marketing in organic food, Entrepreneurship in the Natural Food and Beauty																
Overview	This module will provide an overview of organic food. It will focus on the organic food industry, organic farm resources, community, regional, national and global. Students will gain basic understanding of the environmental problems caused by organic agriculture/horticulture and understand the challenges to alternative organic agriculture.																
Aim	Objectives Upon completion of this course, students should be able to: 1. Use critical reading skills to guide interpretation of articles in organic industry and organic food. 2. Identify the key principles of organic food labeling ; 3. Describe several different models of food standard. 4. Identify potential career opportunities in organic food industry and organic farms. 5. Understanding the organic food marketing																

Learning Outcomes	At the end of this module students will be able to: 1. Learn how issues at various levels—organic farm, community, regional, national and global-- influence organic food industry and future of organic food supply. 2. Learn to think critically about organic food farm to market.

	3. Gain knowledge about the pros and cons to organic food label trade, and what forms of sustainable agriculture will best suit the needs of a growing global population.
Units	1. Organic Agriculture 2. Organic Food 3. Scopes of Marketing in organic food 4. Organic Food Standard 5. Scopes of Marketing in organic food 6. Entrepreneurship in the Natural Food and Beauty
Readings	Kaluski Nitzan, Dorit (2009): Strengthening food safety and nutrition policies and services in South-eastern Europe, WHO Regional Office for Europe, Copenhagen Ø, Denmark Kotler, P., Keller K. (2012): Marketing Management, 14-E, Prentice Hall, USA, ISBN-10: 0132102927 • ISBN-13: 9780132102926 Lund, T.B., Laura Mørch Andersen, Katherine O'Doherty Jensen (2012) The emergence of diverse organic consumers: Who are they and how do they shape demand? FOI Working Paper 2012 / 5, Institute of Food and Resource Economics, Copenhagen, Denmark Stolz, Hanna, Ingrid Jahrl, L. Baumgart, Flurina Schneider (2010); Sensory Experiences and Expectations of Organic Food, Research Institute of Organic Agriculture (FiBL), Switzerland
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.

10Cs/6	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**

LEARNINGGOALS	√	√	√	√	√	√	√	√	√			√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
		√	√		√						√		√				√

Module 3	Establishing a social entrepreneurship: labeling initiative ratification
Key Concepts	Sustainability, Entrepreneurship in farming, Establishing a social entrepreneurship: labeling initiative ratification, An analytical report on existing social value labeling practices, and a way forward.
Overview	This module will provide students for an overview of food security. The module looks at food production at multiple levels: farm resources, community, regional, national and global. Students will gain basic understanding of the environmental problems caused by organic agriculture/horticulture and understand the challenges of alternative forms of sustainable agriculture.
Aim Objectives	Upon completion of this course, students should be able to: 1. Understand ways of adapting to climate change and managing the environment keeping in mind food security and sustainability. 2. To understand the concept of organic food and food security and issues in achieving it.
Learning Outcomes	At the end of this module students will be able to: 1.Understands the production of food resources, their ecological problems, factors of nutritive policy, food safety and nutritive policy. 2.Identify the inter-relationship between climate change, environment, food security and sustainability at global and regional level.
Units	1. Sustainability (Resilience of a Sustainability Entrepreneur) 2. Entrepreneurship in farming 3. Establishing a social entrepreneurship: labeling initiative ratification 4. An analytical report on existing social value labeling practices, and a way forward

Readings

›http://www.qlif.org/research/sub1/QLIF_Review_Reanalysis_%200509.pdf

›http://orgapet.orgap.org/annexes/annex_C4-6.pdf

	›https://www.fibl.org/en/shop-en/article/c/w/gen-economics/p/1362consumer.html ›https://www.fibl.org/fileadmin/documents/shop/1636-organic-world2014.pdf
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√			√	√		√	√	√
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5**	**16**	**17**
		√	√		√						√		√				√

Table 1. A 10 ECTS workload allocation for the course "Climate Change, Sustainable Agriculture, and Food Security".

Learning Components	**No**	**Time Factor**	**Workload**	**Workload**			
				1	**2**	**3**	
Lectures (face-toface)	24	1.5	**42**	12	12	12	**42**
Online	5	2.2	**11**	1	4	6	**11**
Lab work							
Reading articles (3 pages per hour)	227	0.3	**68**	22	21	20	**68**

Reading book chapters (5 per/h)	160	0.22	**35**	9	10	11	**35**
Preparing course activities	4	9.5	**38**	10	12	16	**38**
Project work	6	8.5	**51**	15	21	15	**51**
Preparation for exam	2	23	**46**	12	16	18	**46**
Writing the exam	2	1.5	**3**			3	**3**
Total				**87**	**102**	**105**	**294**

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CCSAFS COURSE SYLLABUS TEMPLATE

Course Number:…….

Risk Analysis in the Food Chain

Second Semester

Instructor Information

Instructor: Dr. Kamel I. Sultan
Office Location: Agriculture Faculty, Jerash
Telephone: 00962795009498
Office Hours: 12.00-14.00 daily
E-mail : k_sultan54@yahoo.ca
Website: www.jpu.edu.jo

Course Identification

Course Number:

Course Name: **Risk Analysis in the Food Chain**
Course Location:
Class Times:
Prerequisites:
Faculty Web Page:

Course Description/Overview

This course is intended to explain the food chain analysis, marketing and distribution of food all over the world, the concepts of risk analysis, risk, types, risks in engineered systems, environmental risks, security risks; methods of risk analysis, fault trees and event trees; probability theory and modelling, quantification of probabilities, use of data, models, and expert judgments; risks and decisions, interlinking risk analysis with risk management and

applications to homeland security decisions and to mitigate adverse climate conditions. There will be also some explanation about the adverse effects of climate change on food chains to prepare measures to confront uncertainty for sustainable food production and distribution.

Course Learning Objectives

The objectives of this course are:

- Understand the food chain analysis.
- Understand the basic concepts of risk analysis and the relationship between probability theory and modelling, risk analysis, and decision analysis in the food chain.
- Understand how to interpret probability and probabilistic modelling, in the evaluation of risk
- Learn how to understand and interpret the basic tools of risk analysis – fault trees, event trees, and simulation models
- Understand the issues surrounding the use of risk analysis in decision making

Course Content Learning Outcomes

Upon successful completion of this course, students will be able to:

1- Know risk types and how people interact towards risk.

2- Know the methods of risk analysis.

3- Assess the types of risk facing food production.

4- Know the methods of risk mitigation programmes and how farmers should interact towards risk and uncertainty problems in Food production.

5- Understand the effect of risk mitigation on food farming sustainability and security.

6- To prepare risk and uncertainty confrontation measures for sustainable food production.

Course Resources

Course Website(s)

Jerash University website.

Required Course Texts and Materials

Baron, D. 2000. "The Market and Nonmarket Environments" Chap.1 in Business and the Environment, Prentice-Hall.

Covaliu Z., 2001. Decision Analysis: Concepts, Tools and Promise. Fair Isaac White Paper, USA.

Kunreuther H., S. Gupta, V. Bosetti, R. Cooke, V. Dutt, M. Ha-Duong, H. Held, J. Llanes-Regueiro, A. Patt, E. Shittu, and E. Weber, 2014: Integrated Risk and Uncertainty Assessment of Climate Change Response Policies. In: Climate Change 2014: Mitigation of Climate Change.

Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Herron H., Bohn B., Roy S. and Evans W. 2016. Climate Change Data and Risk Assessment Methodologies for the Caribbean. Inter-American Development Bank Environmental Safeguards Unit by Tetra Tech, Inc., USA.

Kammen, D.H., and Hassenzahl, D,M. 1999. Should We Risk It? New Haven: Princeton University Press, Chapter 1. (Hereafter, KH.)

King D., Schrag D., Dadi Z., Ye Q. and Ghosh A., 2014. Climate Change a Risk Assessment. Centre for Science and Policy, UK.

Kunreuther H., 2002. "Risk Analysis and Risk Management in an Uncertain World." Risk Analysis, 22(4):655-664.

McNamee P. and John Celona J., 2008. Decision Analysis for the Professional. 4th ed., SmartOrg, Inc., USA.

Neven D., 2014. Developing sustainable food value chains: Guiding principles. FAO, Rome. Italy.

Parnell G., Bresnick T., Tani S., and Johnson E., 2013. Decision Analysis. John Wiley & Sons, Inc., Canada.

Robert T. Clemen and Terence Reilly, 2013. Making Hard Decisions with Decision Tools. 3rd Ed., South-Western, OH, USA.

Optional Course Texts and Materials

Abi-Nader, J. A., A., Harris, K., Herra, H. Eddings, D., Habib, D., Hanna, J., Paterson, C., Sutton, K., Villanuesva, L. 2009. Whole Measures for Community food Systems: Value-based Planning and Evaluation. In C. F. S. Coalition (Ed.). Portland, OR.

Broad, G. 2016. More than Just Food: Food Justice and Community Change. University of California Press, CA.

Fischer, R. A., Byerlee, D., and Edmeades, G.O. 2009. Can Technology Deliver on the Yield Challenge to 2050? Expert meeting on how to feed the world in 2050. Food and Agriculture Organization of the United Nations, Economic and Social Development Department. Food and Agriculture Organization. (2009). Rome Principles: World summit on food security. United Nations. Available at http://www.fao.org/fileadmin/templates/wsfs/Summit/Docs/Final_Declaration/WSFS09_Declaration.pdf

Grantmakers in Health. 2012. Too few choices, too much junk: Connecting food & health. Issue brief no. 39. Washington, DC. Available at http://www.gih.org

Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, JF., Pretty, J., Robinson, S., Thomas, S.M., & Toulmin, C. 2010. Food security: The challenge of feeding 9 billion people. Science, 327(5967), 812-818.

Gottlieb, R., & Joshi, A. 2016. Food justice. MIT Press, Cambridge, MA.

Hamm, M.W. 2009. Principles for framing a healthy food system. Journal of Hunger and Environmental Nutrition 4(3-4), 241-250.

Hamm, M. & Bellows, A.2003. Community food security and nutrition educators. Journal of Nutrition Education and Behavior, 35, (1), 37–43.

Holben, D. H.2002. An overview of food security and its measurement. Nutrition Today, 37(4), 156–162.

Holt-Giménez, E., Altieri, M.A. 2013. Agroecology, food sovereignty and the new green revolution. Journal of Sustainable Agriculture. 37(1), 90–102.

Holt-Giménez, E., Shattuck, A., Altieri, M., Herren, H., Gliessman, S. 2012. We already grow enough food for 10 billion people … and still can't end hunger. Journal of Sustainable Agriculture. 36(6), 595-598.

Niewolny, K. & D'Adamo-Damery, P. 2016. Learning through story as political praxis: The role of narratives in community food work. In Sumner, J. (Ed.), Learning, food, and sustainability: Sites for resistance and change. Palgrave/Macmillan: New York

Patel, R. 2009. What does food sovereignty look like? Journal of Peasant Studies, 36(3), 663-706.

Pothukchi, K. 2007. Building community food security: Lessons from community projects: 1999-2003. In K. Siedenburg (Ed.). Venice, CA: Community Food Security Coalition.

Slocum, R. 2007. Whiteness, space and alternative food practice. Geoforum, 38, 520-533.

Stevenson, G. W., Ruhf, K., Lezberg, S., & Clancy, K. 2007. Warrior, builder, and weaver work-Strategies for changing the food system. In C. Claire Hinrichs & T. A. Lyson (Eds.), Remaking the North American food system- Strategies for sustainability (pp. 33-62). Lincoln: University of Nebraska Press.

Assignments and Grading Scheme

Grading System

Grading Policy

Grades can be based on the following:

Assignments	40%
Exams	40%
Class attendance/participation	20%
Total Points	**100**

Course Policies

Late Assignments

Classroom Protocol

Students are expected to attend all classes. Students cannot pass the class under any circumstances if they miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If a student knows that he has to leave early, he should notify the instructor before class starts. All are expected to treat faculty and other students with respect. During class, students are asked not to disrupt the class. Students who violate these minimal expectations will be asked to leave. Students are expected to have read and completed the assigned material before coming to class. The instructor expects attendance and active class participation, which counts for 20% of the total grade.

Disability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodation. Establishing reasonable accommodation should be considered on a case-by-case basis.

Important Dates to Remember

Course Schedule

Week	Date	Topics
1		What is risk analysis?
2&3		Formulating decision problems
4		Statistics for Risk Analysis
5		Uncertainty and Limited Information
6		Applying decision analysis
7		Technological and climate change Risk Assessment
8		Health Risk Assessment
9		Risk Perception
10		Valuation of Risk
11		Risk Communication
		risk management
12		Terrorism Risk
13		Project Presentation
14		In-Class Final Exam

I suggest adding 2 modules: risk management And another on risk perceptions

Course	**Risk Analysis in the Food Chain**
Module 1	**Introduction**
Key Concepts	Food chain definition and systems and Risk definition and types.
Learning Outcomes	At the end of this module students will be able to: Know the food chain systems and their work and the best economic chain in food industry and farming. Understand risk; differentiate between risk types, especially, the relevant types to food production.
Units	• Food chains definition and types • Risk definition • Risk types

	• Types of people according to their behavior towards risk • Risk facing agriculture and food industry
Readings	Kahn B., Larson M., Norris C. and Young B., 2005.The Food Chain Instruction Plan. University of Maryland, USA. http://www.rcsnc.org/UserFiles/Servers/Server_4702937/File/lynne%20huskey/FoodChainGang.pdf ALL ABOUT FOOD CHAINS. http://mrnussbaum.com/pdfs/All%20About%20Food%20Chains.pdf Kunreuther H., 2002. "Risk Analysis and Risk Management in an Uncertain World." Risk Analysis, 22(4):655-664.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. An assignment about the possible risks present in the food chain in Jordan.
10Cs/6 LEARNINGGOALS	Creativity, character Education, Communication,
ECTS WORK LOAD	27
SDGs	2, 8, 9, 11, 12, 16, 17
Vision 2030	
Module 2	**Formulating decision problems**
Learning Outcomes	At the end of this module students will be able to: To understand the possible ways to formulate risk by mathematical functions.
Units	• The decision making process . • Types of decision making processes. • Tools used for decision making
Readings	Kunreuther H., 2002. "Risk Analysis and Risk Management in an Uncertain World." Risk Analysis, 22(4):655-664. 7 Steps to Effective Decision Making. UMASS . Dartmout . https://www.umassd.edu/media/umassdartmouth/fycm/decision_making_process.pdf

	Harvey J. and Technical Information Service, 2007. Effective decision making.The Chartered Institute of Management Accountants 26 Chapter Street London SW1P 4NP United Kingdom. http://www.cimaglobal.com/documents/importeddocuments/40_effective_decision_making.pdf
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5. Formulate decision on the best crop planted in Jordan as an assignment.
10Cs/6 LEARNINGGOALS	Character Education, Communication,. Critical Thinking
ECTS WORK LOAD	31
SDGs	3, 8, 9, 11, 12, 16, 17
Vision 2030	Constructive changes and Building Support Systems
Module 3	**Statistics for Risk Analysis**
Learning Outcomes	At the end of this module students will be able to: • To use the statistical tools to analyze different types of risks. • Prepare statistical models for inference testing.
Units	• Statistical analysis refreshment. • Statistical tools used in risk analysis. • Risk analysis practice.
Readings	Montgomery, V., 2009. New statistical methods in risk assessment by probability bounds. Department of Mathematical Sciences Durham University UK. http://maths.dur.ac.uk/stats/people/fc/thesis-VM.pdf Hult H. and Lindskog F., 2007. Mathematical Modeling and Statistical Methods for Risk Management. https://people.kth.se/~lindskog/papers/RMlecturenotes07B.pdf Embrechts P., Hofert M., 20014 Statistics and Quantitative Risk Management for Banking and Insurance. Swiss Federal Institute of Technology, Zurich, Switzerland. https://people.math.ethz.ch/~embrecht/ftp/qrm_stat_review.pdf Strand R. and Oughton D., 2009. Risk and Uncertainty – as a Research Ethics Challenge. National Committees for Research Ethics in Norway. https://www.etikkom.no/globalassets/documents/publikasjoner-som-pdf/risk-and-uncertainty-2009.pdf

Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual homework of risk staiscal analysis of an actual field of agriculture production. 5. Statistically solving of Risks in the food chain in Jordan.
10Cs/6 LEARNINGGOALS	Critical thinking, Critical Thinking. Collaboration
ECTS WORK LOAD	43
SDGs	2, 9, 12, 17
Vision 2030	Sustainable Development
Module 4	**Applying decision analysis**
Learning Outcomes	At the end of this module students will be able to: • To know the how analyze risk decision especially risk related to climate change and agricultural production in all types of farming (the plant and the animal production). • The decision analysis methods. • The application of decision analysis in food chain.
Units	• Decision makers types and attitude towards risk. • Tools for decision analysis and application. • Decision quantification. • Decision Process Capability Building.
Readings	McNamee P. and John Celona J., 2008. Decision Analysis for the Professional. 4th ed., SmartOrg, Inc., USA. Chap 5. Robert T. Clemen and Terence Reilly, 2013. Making Hard Decisions with DecisionTools. 3rd Ed., South-Western, OH, USA.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5. An assignment of decision making to avoid risk in the food chain in Jordan
10Cs/6 LEARNINGGOALS	Character Education, Critical Thinking, Collaboration, Creativity
ECTS WORK	43

LOAD	
SDGs	2 3, 4, 11,
Vision 2030	Sustainable Development, Research Development,
Module 5	**Technological and climate change Risk Assessment**
Learning Outcomes	At the end of this module students will be able to: • Assess the climate change risk • Assess technological risk
Units	• Technological Risk Assessment • Climate Change Risk Assessment.
Readings	Bertule M., Appelquist L., Jason Spensley J., Trærup S. and Naswa P.. 2018. Climate Change Adaptation Technologies for Water a Practitioner's Guide to Adaptation Technologies for Increased Water Sector Resilience. UNEnvironment DHI Centre on Water and Environment, Climate Technology Centre and Network (CTCN) and the UNEP DTU Partnership. UN. Smith J., O'Grady M., Surbaugh H., Ray A., Duckworth M. and Meernik T., 2014. Technologies to Support Climate Change Adaptation in Developing Asia. Asian Development Bank, Mandaluyong City, Philippines.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5. Assignment about the technological methods of assessing Climate change risk at the governmental centres.
10Cs/6 LEARNINGGOALS	Critical thinking, Citizenship, Collaboration, creativity
ECTS WORK LOAD	43
SDGs	2, 17
Vision 2030	Constructive Change and Building Support Systems, Health and Society Welfare
Module 6	**Food Pollution Risk Assessment**
Learning Outcomes	At the end of this module students will be able to: Assess risk in food health sector. Propose several programs to mitigate risk associated with climate change.
Units	Types of possible health risks associated with food produced under climate change

	Programmes prepared to mitigate the associated climate change health hazards
Readings	Davis G., Hickox W. and Denton J., 2012. A Guide to Health Risk Assessment. California Environmental Protection Agency Office of Environmental Health Hazard Assessment, Sacramento, CA, USA. WHO, 2012.Human Health Risk Assessment Strategic Research Action Plan 2012 – 2016. U.S. Office of Research and Development Human Health Risk Assessment Environmental Protection Agency. Priestly B. and Ong J., Environmental Health Risk Assessment. enHealth. Australia.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5 Community food health risk studies by students
10Cs/6 LEARNINGGOALS	Character Education, Citizenship, Critical Thinking, Collaboration, Creativity
ECTS WORK LOAD	69
SDGs	3
Vision 2030	Service and Infrastructure, National Economy and Domestic Product Growth, Health and Society Welfare.
Module 7	**Valuation of Risk in Food Chain**
Learning Outcomes	At the end of this module students will be able to: 1) Quantify risk assessment. 2) Use probability to make the decision to avoid risk. 3) Using risk quantification and valuation to mitigate risk associated with climate adverse conditions
Units	• Steps followed to value risk. • The possible process of risk evaluation. • Quantifying risk probability.
Readings	Cisneros-Molina M., 2006. Mathematical Methods for Valuation and Risk Assessment of Investment Projects and Real Options. PhD thesis, Oriel College, University of Oxford. https://core.ac.uk/download/pdf/97052.pdf
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course.

	3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5. Visit to Jordan Food and Drug Administration and writing a report about its role in reducing the risk in food chain
10Cs/6 LEARNINGGOALS	Critical Thinking, Communication, Collaboration, Creativity
ECTS WORK LOAD	18
SDGs	1, 2, 3
Vision 2030	Service and Infrastructure, Health and Society welfare, Sustainable Development

The workload of Risk Analysis in the Food Chain 10 ECTS Workload Allocation

Learning Components	**No**	**Time Factor**	**Workload**	**Course Modules**							**Workload**
				1	**2**	**3**	**4**	**5**	**6**	**7**	
Lectures (face-to-face)	10	3.4	34	6	5	5	6	4	4	4	34
Online	3	3.33	10	1	-	2	2	1	3	1	10
Lab work	4	2.5	10	-	-	3	3	2	-	2	10
Reading articles (3 pages per hour)	150	0.3	53	6	8	7	7	8	9	8	53
Reading book chapters (5 per/h)	140	0.22	31	4	3	6	5	5	5	3	31
Preparing course activities	5	15	75	10	15	20	20	10	-		75
Project work	1	20	20					5	15		20
Preparation for exam	1	50	50					20	30		50

Writing the exam	2	1.5	3						3		3
Total			**286**	**27**	**31**	**43**	**43**	**55**	**69**	**18**	**286**

SDGs	CLIMATE CHANGE	SUSTAINABLE AGRICULTURE	FOOD SECURITY	COURSE MODULE
1 End poverty in all its forms everywhere				
2 End hunger, achieve food security and improved nutrition, and promote sustainable agriculture			X	1, 3, 4, 5, 7
3 Ensure healthy lives and promote well-being for all at all ages	X	X	X	2, 4, 5, 6
4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		X	X	4, 7
5 Achieve gender equality and empower all women and girls				
6 Ensure availability and sustainable management of water and sanitation for all				
7 Ensure access to affordable, reliable, sustainable, and modern energy for all				
8 Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all		X	X	1, 2, 4
9 Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation		X	X	1, 2, 3
10 Reduce inequality within and among countries				
11 Make cities and human settlements inclusive, safe, resilient, and sustainable		X	X	1, 2,4
12 Ensure sustainable consumption and production patterns		X	X	1, 2, 3
13 Take urgent action to combat climate change and its impacts				
14 Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15 Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss				
16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels		X	X	1, 2
17 Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development		X	X	1, 2, 3, 5

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CCSAFS COURSE SYLLABUS

Jerash University

Course Number ( )

Precision Farming

Semester ( )

Instructor Information

Instructor: Prof. Jawad Al-Bakri

Office Location: Office 116, Faculty of Agriculture, The University of Jordan

Telephone: +962-6-5335000, ext. 22449

Office Hours: 9-10 Mon., Wed.

E-mail: jbakri@ju.edu.jo

Website: http://eacademic.ju.edu.jo/jbakri/default.aspx

Course Identification

Course Number:

Course Name: Precision Farming

Course Location: **School of Agriculture,**

Class Times: Will be identified for each semester

Prerequisites: **Geographic Information System (GIS)**

Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Description/Overview

Applying technology for agricultural production and monitoring has increased with time, particularly with developments in ICT and sensing technologies. The conventional methods of field surveys and census for forecasting agricultural production and monitoring agricultural lands are diminishing with time and became part of history. Alternatively, real time monitoring tools are used to provide agricultural institutions, researchers and decision makers with data and information pertaining to agricultural production and food security level. Therefore, this course will provide the students with precision agriculture background, covering both the applications and the different technologies including the use of geographic information systems (GIS), global positioning systems (GPS), multispectral and hyperspectral remote sensing systems for both large- and small-scale applications. The course will focus on application of precision farming for soil sampling, fertilizers need through sensing technologies, yield monitoring, pest monitoring with hyperspectral technology for management of agricultural lands through the use of multispectral instruments. Students will work on case studies where UAV and Drone technologies area used, VRT for fertilizers and pesticides is applied, ICT is utilized for management and marketing of crops. Emphasis shall be placed on how the systems work, data is acquired, processed and analysed.

Course Learning Objectives:

The course aims to provide and explain the knowledge and techniques implemented in precision farming to achieve sustainable agricultural systems that contribute to food security. The objectives of the course are to:

- Enable the students to collect and critically analyse appropriate data, to define the plant development/growth problem.
- Develop an appropriate balance between didactic and self-directed learning, while encouraging a teaching approach which fosters lifelong learning skills and promotes critical thinking in problem-solving approach.
- Develop a learning atmosphere that encourages enthusiasm and professional behavior that improves competency in agricultural technology.
- Apply current technologies to access and utilization of information for managing agricultural areas.

Course Content Learning Outcomes:

- Increase awareness in the fields of precision agriculture and ICT deployed in the modern farming systems.
- Develop knowledge and understanding of precision farming towards sustainable agriculture.
- Enhance and empower students in the field of sustainable agriculture.
- Utilize background in statistics and agronomy for the purpose of improved and sustainable agriculture.
- Improve abilities in the fields of monitoring and assessment of crop health and yield.
- Identify means needed for integrating the fields of ICT and agriculture towards the development of digital farming**.**
- Develop a learning atmosphere that encourages enthusiasm and professional behaviour that improves competency in agricultural technology.

Course Resources

NASA Earth Observatory (https://earthobservatory.nasa.gov/Features/PrecisionFarming/)

Miniature Motors for Robotics Applications (https://www.therobotreport.com/top-10-technologies-in-precision-agriculture/)

Course Website(s)

Will be announced

Required Course Texts and Materials

1- Ess D. R. and Morgan, M. T. (2010). The Precision-Farming Guide for Agriculturalists: An Agricultural Primer. Deere & Company: Moline, IL. 168 pp.

2- Tulsa, Kumar L.H., Singh, R. (2014). Precision Farming: a New Approach. Daya Publishing House, 452 pp.

Optional Course Texts and Materials

1- Zhang, Q., (2016). Precision Agriculture Technology for Crop Farming, CRC Press

2- Jensen J. R., (2007,) Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Ed., Upper Saddle River, NJ: Prentice Hall, 592 pages.

3- Burrough, P. A., McDonnell, R. A. and Lloyd, C. D. (2015). Principles of Geographical Information Systems, 3rd ed., Oxford University Press, 352 pp.

4- Bolstad, P., (2012). GIS Fundamentals: A first text on Geographic Information Systems (4th edition), Eider Press, White Bear Lake, Minnesota.

5- Krishna, K.R. (2013). Precision farming: Soil fertility and productivity aspects. Apple Academic Press, 160 pp.

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark).

Grading Policy

Assignments	20%
Exams	60%
Student project	20%
Total Points	**100**

Course Policies

Late Assignments and Plagiarism

It is essential that papers and other assignments be completed and submitted on time. Late assignments are not accepted and their grade will be set to zero. Students who either intentionally or unintentionally practice plagiarism will receive a grade of zero for that assignment.

Classroom Protocols

The course will be structured in lectures, students' assignments and reports. Class attendance contributes significantly to academic success and student's learning outcomes. Therefore, university laws are applied to presence and absence. If a student is absent for a class for any reason, the student is responsible for all missed work and for promptly contacting his/her instructor. Classroom conduct follows university regulations.

Disability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Course Schedule

Week	Subject
1	Precision farming: definition, importance and current areas of application
2	Precision farming and spatial variability of soil and water
3	Crop spatial variability: Yield Monitoring & Mapping
4	GIS and GP roles in precision farming
5	Spatial interpolation methods within GIS
6	GIS tools for guiding variable rate technology (VRT)
7	Automation and Telematics (Student assignment and presentations)
8	Midterm Exam
9	Space-based multispectral remote sensing technology
10	Spectral reflectance of vegetation, soil and water
11	Hyperspectral remote sensing

Week	Subject
12	Unmanned air vehicles (UAVs) and Drone
13	Precision farming at large scale: improved water and crop management
14	Precision Farming Economics and Adoption
15	Developing digital farming (Student assignments and presentations)
16	Final hour Exam

Course Modules

Course	***Precision Farming***
Module 1	**Precision farming applications, requirements and economy**
Key Concepts	Precision farming, GIS, GPS, yield, fertilizers, crop maps, marketing, ICT
Overview	The module introduces the precision farming as a modern branch of science that aids in managing agricultural areas while ensuring their sustainability. The functions of precision farming, the main tools used and the importance of precision farming for decision making are emphasized.
Aim	The module aims to explain the functions of precision farming and how does it operate. Upon completion of this unit, the student will: 1- know the meaning of Precision Farming, GPS, and GIS. 2- recognize GPS, GIS and VRT as tools for use in Precision Farming. 3- recognize the technological tools of precision farming. 4- define precision agriculture from the managerial technological and social perspectives.
Learning Outcomes	At the end of this module students will be able to: 1- define and understand precision farming 2- develop a diagrammatic relationship between GIS, GPS, remote sensing and precision farming. 3- identify the cases that require application of precision farming
Units	1- What is Precision Farming? 2- Precision farming methodology and Components 3- Geographic and Economic aspects of precision farming

<table>
<tr><td>Readings</td><td colspan="17">1- Krishna, K.R. (2013). Precision farming: Soil fertility and productivity aspects. Apple Academic Press, 160 pp.

2- Ess D. R. and Morgan, M. T. (2010). The Precision-Farming Guide for Agriculturalists: An Agricultural Primer. Deere & Company: Moline, IL. 168 pp.

3- Tulsa, Kumar L.H., Singh, R. (2014). Precision Farming: a New Approach. Daya Publishing House, 452 pp.

4- Different websites (student task)</td></tr>
<tr><td>Activity</td><td colspan="17">1- Interactive learning: instructor will introduce and discuss with students the benefits of precision farming its use in CCSAFS fields.

2- Student presentations: Students will apply what they learned about precision farming to develop a list of specific benefits of precision farming and their contribution to farmers and extension services and marketing of agricultural products. Students will be asked to prepare multimedia files on the use and benefits of precision farming with examples that can be adopted in the Jordan and in the region.</td></tr>
<tr><td>SD Pillars</td><td colspan="5">Environment</td><td colspan="4">Economy</td><td colspan="5">Social</td><td colspan="3">Culture</td></tr>
<tr><td></td><td colspan="5">✓</td><td colspan="4">✓</td><td colspan="5">✓</td><td colspan="3">✓</td></tr>
<tr><td>21st ESD</td><td colspan="3">Learning to know</td><td colspan="3">Learning to be</td><td colspan="3">Learning to do</td><td colspan="3">Learning to live together</td><td colspan="4">Learning to transform oneself and society</td><td colspan="3">Learning to give and share</td></tr>
<tr><td></td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="3">✓</td><td colspan="4">✓</td><td colspan="3">✓</td></tr>
<tr><td>SDGs</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr>
<tr><td></td><td>✓</td><td>✓</td><td></td><td></td><td></td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Vision 2030</td><td colspan="17">The module is directly related to sustainable agriculture and food security as it explains the applications of precision farming and the tools needed for precision farming. Adoption of the precision farming will enable agricultural communities to improve income (SDG1) and will ensure food and water security (SDG2,6) at country’s and regional level. Also, the technology of precision farming is becoming an important tool to combat climate change (SDG13) and to restore degraded ecosystems (SDG15).</td></tr>
<tr><td>ECTS WORK LOAD</td><td colspan="17">The ECTS work load is 1.0, which is equivalent to 15 working hours (See the table of ECTS workload).</td></tr>
<tr><td>Module 2</td><td colspan="17">Precision farming and spatial variability of soil and crop.</td></tr>
<tr><td>Key Concepts</td><td colspan="17">Spatial variability, semi-variogram, kriging, interpolation, yield map, VRT</td></tr>
</table>

Overview	The module introduces the concept of spatial variability and the advantages of its use over the classical statistics. Soil spatial variability and its impacts on crop yield are discussed. The maps of crop yield and their implications and usefulness are discussed with the students, who are required to create example maps to work on and to use for VRT of fertilization.
Aim	The module aims to enable the student to identify the soil and management factors that influence crop yield. The objectives are: 1. Understand the concept of spatial variability and soil sampling 2. Identify key issues affecting crop yield
Learning Outcomes	At the end of this module students will be able to: 1- Identify the various methods for sampling soils and mapping their spatial variability. 2- understand the yield maps and the potential benefits and limitations of these maps. 3- list objects or field data that can be mapped 4- describe benefits for farm management
Units	1. Soil Formation and Change Across Landscapes 2. Soil Mapping Technology 3. Sampling schemes and methods 4. Grid and Zone Soil Sampling 5. Crop Spatial Variability 6. Yield Monitor Technology
Readings	1- Ess D. R. and Morgan, M. T. (2010). The Precision-Farming Guide for Agriculturalists: An Agricultural Primer. Deere & Company: Moline, IL. 168 pp. 2- Krishna, K.R. (2013). Precision farming: Soil fertility and productivity aspects. Apple Academic Press, 160 pp. 3- Zhang, Q., (2016). Precision Agriculture Technology for Crop Farming, CRC Press 4- Burrough, P. A., McDonnell, R. A. and Lloyd, C. D. (2015) Principles of Geographical Information Systems, 3rd ed., Oxford University Press, 352 pp.

<table>
<tr><td>Activity</td><td>1- Student assignment and activities: each student or group will prepare a grid map and assumed points of sampling for soil and plants and a map for yield and will present it to the class showing advantages and limitations. Each group will complete a table and answer the question that follows.

<table><tr><th>Mapped Information or Type of Map</th><th>Benefits to Farm Management</th><th>Benefits to Record Keeping</th></tr><tr><td>Yield Map</td><td>Decide why some areas had low yield and adjust management</td><td>Know which varieties yielded the most</td></tr><tr><td>Soil fertility</td><td>Selective application of fertilizers</td><td>Establish cost per dunum</td></tr></table>
2- Presentations: each student or group will prepare a presentation on soil and plant yield maps and how these maps will serve the agricultural communities and farmers. Suggestions for Jordan farmers shall be emphasized and presented.</td></tr>
<tr><td>SD Pillars</td><td><table><tr><th>Environment</th><th>Economy</th><th>Social</th><th>Culture</th></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
<tr><td>21st ESD</td><td><table><tr><th>Learning to know</th><th>Learning to be</th><th>Learning to do</th><th>Learning to live together</th><th>Learning to transform oneself and society</th><th>Learning to give and share</th></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
<tr><td>SDGs</td><td><table><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th></tr><tr><td>✓</td><td>✓</td><td></td><td></td><td></td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td></td></tr></table></td></tr>
<tr><td>Vision 2030</td><td>The use of geospatial techniques in precision farming will save economic resources of farmers and maximize benefits which will in turn reduce poverty (SDG1) and will ensure food and water security (SDG2,6) at country’s and regional level. Also, effective mapping will contribute to efforts of restoration for degraded ecosystems (SDG15).</td></tr>
<tr><td>ECTS WORK LOAD</td><td>The ECTS work load is 0.8, which is equivalent to 20 working hours (See the table of ECTS workload).</td></tr>
<tr><td>Module 3</td><td>GIS and GPS roles in Precision Farming</td></tr>
<tr><td>Key Concepts</td><td>GIS, GPS, coordinates, interpolation, IDW, spatial statistics</td></tr>
<tr><td>Overview</td><td>Roles of GIS and GPS in precision farming will be explained, with emphasis on spatial interpolation. Students will utilize capabilities and functions of GIS to generate maps of soil and crop yield using spatial interpolation methods. The use of GPS to record coordinates for sampling points and to generate yield and soil map will be covered by this module.</td></tr>
</table>

Aim	To explain the roles of GIS and GPS as key corners in precision farming and to enable the students to use these tools produce crop and soil maps. Specific objectives are 1. Recognize and utilize the roles of GIS and GPS in precision farming and site-specific crop production. 2. Understand and implement the steps needed to generate maps of crops and soils by utilizing spatial interpolation techniques
Learning Outcomes	At the end of this module students will be able to: 1- use GPS units in recording point data needed for yield maps. 2- implement functions of spatial interpolation within GIS. 3- use GIS package to set grids and samples and transform these grids into maps.
Units	1- Spatial interpolation in GIS 2- GPS functions 3- Spatial statistics 4- Crop maps 5- Soil fertility maps 6- Variable Rate Technology (VRT)
Readings	1. Bolstad P., (2012). GIS Fundamentals: A first text on Geographic Information Systems (4th edition)-Chapters 3&4. 2. Chang K., (2013). Introduction to Geographic Information Systems, 7th edition-Chapter 10. 3. Burrough, P. A., McDonnell, R. A. and Lloyd, C. D. (2015) Principles of Geographical Information Systems, 3rd ed., Oxford University Press, 352 pp. 4. Ess D. R. and Morgan, M. T. (2010). The Precision-Farming Guide for Agriculturalists: An Agricultural Primer. Deere & Company: Moline, IL. 168 pp.
Activity	1- Practical sessions and student activities: each group of students is asked to prepare a project that is based on a real case for an agricultural area near Jarash. The crops yield shall be collected in the form of point data using GPS. The data shall include soil properties (analysed for main macro nutrients). Students are then required to enter the data in GIS and prepare maps for crop yields and soil properties using spatial analysis and interpolation techniques. 2- Student presentation: Each group shall present its results to the class, with recommendations for VRT of fertilizer. A similar project for pesticide is also possible and encouraged.

SD Pillars	**Environment**	**Economy**	**Social**	**Culture**
	✓	✓	✓	✓

21st ESD	Learning to know			Learning to be		Learning to do			Learning to live together		Learning to transform oneself and society				Learning to give and share		
	✓			✓		✓			✓		✓				✓		
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	✓	✓				✓							✓		✓		
Vision 2030	The module builds on GIS and GPS capabilities and applications to solve problems related to CCSAFS. This will contribute to efforts in reducing poverty and improving food security (SDGs 1&2). The effective use of resources based on geospatial data will improv sustainable use of water (SDG6) and serves the efforts of combating climate change (SDG13), as well as restoration of degraded ecosystems (SDG15).																
ECTS WORK LOAD	The ECTS work load is 0.8, which is equivalent to 20 working hours (See the table of ECTS workload).																
Module 4	**Multispectral and hyperspectral remote sensing for precision farming**																
Key Concepts	Multispectral sensors, spectral reflectance, image processing, Hyperspectral technology, drones and UAV, radiometers and ASD																
Overview	The module explains the technology of remote sensing and its applications in precision farming. Students will put hands on technology and will be familiar with services and products provided by the multispectral and hyperspectral technology. The progressive development in the field of digital image processing and the new earth observation systems (EOS) will be covered in this module, with possible application for the groups of sensors in precision farming at different scales. The module will include the advanced techniques of crop sensing with the use of hyperspectral technology on board drones and UAV and their use to detect crop diseases and pest and to assess plant health. The cost/benefit and the added values of these techniques are emphasized. The roles of geospatial techniques for decision making is also discussed.																
Aim	The overall aim is to explain the parameters and information that can be derived from multispectral remote sensing data and its implications to precision farming. Specific objectives are: 1- providing the scientific background on quantities and indices that can be derived from multispectral data. 2- explaining the roles of remote sensing and possible uses of the technology in precision farming. 3- to identify the components of operational hyperspectral technology needed for precision farming. 2- to provide case studies and hyperspectral models that can be adopted and applied in developing countries.																

Learning Outcomes	At the end of this module students will be able to: 1- Understand the structure of remote sensing data. 2- gain knowledge in the field of remote sensing and EOS. 3- identify the appropriate datasets and products of EOS and hyperspectral technology needed for precision farming. 4- integrate remote sensing technology and GIS towards future digital farming. 5- understand the physical quantities and parameters that can be mapped by the hyperspectral instruments.
Units	1- Earth observation systems 2- Remote sensing dataflow and structure. 3- Spectral reflectance of vegetation, soil and water 4- Image transformations 5- Hyperspectral scanners 6- UAV and Drones 7- Hyperspectral data handling and analysis.
Readings	1. Jensen J. R., (2007), Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Ed., Upper Saddle River, NJ: Prentice Hall, 592 pages. 2- Tulsa, Kumar L.H., Singh, R. (2014). Precision Farming: a New Approach. Daya Publishing House, 452 pp. 3- Bolstad, P., (2012). GIS Fundamentals: A first text on Geographic Information Systems (4th edition), Eider Press, White Bear Lake, Minnesota. 4- NASA Earth Observatory https://earthobservatory.nasa.gov/Features/PrecisionFarming/ 5- Weng Q. (2014) Remote Sensing of Natural Resources. CRC Press (Taylor & Francis Group). 6- Al-Metwali A. M. H. (2008). Remote Sensing as a Precision Farming Tool in the Nile Valley, Egypt. University of Striling. 7- Adão T. et al. (2017). Hyperspectral Imaging: A Review on UAV-Based Sensors, Data Processing and Applications for Agriculture and Forestry." Remote Sensing, 9 (2): 1110. (doi:10.3390/rs9111110)

<table>
<tr><td>Activity</td><td>1- Theoretical lectures given by the instructor, supported by handouts, uploaded videos and short manuals for carrying out digital image processing functions that area relevant to precision farming.

2- Student assignment and presentation on a case study where remote sensing is implemented for precision farming. Multimedia files and presentations are encouraged and prioritized. Student assignments and presentation on case studies where hyperspectral is used in precision farming. All presentation shall include multimedia files and demos. The presented cases shall include solutions to agricultural communities and farmers in Jordan Valley and in the highlands.</td></tr>
<tr><td>SD Pillars</td><td><table><tr><th>Environment</th><th>Economy</th><th>Social</th><th>Culture</th></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
<tr><td>21st ESD</td><td><table><tr><th>Learning to know</th><th>Learning to be</th><th>Learning to do</th><th>Learning to live together</th><th>Learning to transform oneself and society</th><th>Learning to give and share</th></tr><tr><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table></td></tr>
<tr><td>SDGs</td><td><table><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th></tr><tr><td></td><td>✓</td><td></td><td>✓</td><td></td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td><td>✓</td><td></td><td>✓</td><td></td><td></td></tr></table></td></tr>
<tr><td>Vision 2030</td><td>The module shall enable graduates from the CCSAFS program to utilize the gained knowledge and improved skills in providing all needed requirements for adoption of multispectral and hyperspectral data to improve food security (SDG2). Since these contemporary technologies are looking at large areas for improved decision making, this contribute to efforts oriented for remote areas, this will contribute to SDGs 4 and 8. Application of the multispectral and hyperspectral technology will include water, agricultural and environmental sectors, i.e. they will contribute to SDGs 6,7,13&15.</td></tr>
<tr><td>ECTS WORK LOAD</td><td>The ECTS work load is 1.2, which is equivalent to 30 working hours (See the table of ECTS workload).</td></tr>
<tr><td>Module 5</td><td>Automation, Telematics and Robotics in Precision Farming</td></tr>
<tr><td>Key Concepts</td><td>Telemetry, VRT, robotics, automated system, steering, ISOBUS, VRT</td></tr>
<tr><td>Overview</td><td>The use of different technology to manage crops at small and large scales is important and forms major component in precision farming.

Thus, the module will subject the students to the high-tech instruments and technology in precision farming, with field visits to institutions that use or provide these elements. Planned visits will be carried outs to institutions working with these systems. Visits to some farms and companies involved in the use and business of Automation and Robotics is also possible.</td></tr>
</table>

Aim	The model aims provide knowledge on the tools of technology used in precision farming. Specific objectives of the module are: 1- to identify the level of ICT use and contribution in precision farming. 2- gain knowledge on the telematics, robotics and automation technology in precision farming.
Learning Outcomes	At the end of this module students will be able to: 1- identify the types of technology tools used in precision faming. 2- build a comprehensive image on the components of precision farming at large and small scales. 3- select among options of technology for precision farming.
Units	1. Implement Steering and Coordination 2.VRT for planter and Pesticides 3. Automatic Boom Levelling 4. Telematics Technology 5. ISOBUS Concept and Technology
Readings	1- Ess D.R., Morgan M.T. 2010. The Precision-Farming Guide for Agriculturalists: An Agricultural Primer. Deere & Company: Moline, IL. 168 pp. 2- Tulsa, Kumar L.H., Singh, R. 2014. Precision Farming: a New Approach. Daya Publishing House, 452 pp. 3- Zhang, Q., 2016. Precision Agriculture Technology for Crop Farming, CRC Press. 4- Different web resources
Activity	1- Community-based activities and case studies: Students are asked to perform field visits to farmers, companies and institutions from the beginning of the semester to start collecting data and information on the level of implementation of precision farming. The students will work in groups and will identify the problems that can be solved by interventions pertinent to precision farming. Some of the groups shall collect data from the Ministry of Environment and the use of drones for monitoring areas known as hotspots for pollution. The use of telematics the Ministry of Water and Irrigation is another case that students can work on. At the end of the course the students shall present their findings on level of technology use and propose solutions to problems reported by the stakeholders from which data were collected. It is also possible to present the work to the stakeholders within activities or workshops during the semester or as arranged by the university. Cooperative learning is also targeted through the course and within this module. This will be achieved by selected projects by which students will communicate and interview key experts in local and regional markets and institutions working in the area of precision farming. Findings from these communications shall be

	presented as a term paper and a presentation that includes all details and conclusions reached.																
SD Pillars	**Environment**					**Economy**			**Social**				**Culture**				
	✓					✓			✓				✓				
21st ESD	**Learning to know**			**Learning to be**		**Learning to do**			**Learning to live together**			**Learning to transform oneself and society**				**Learning to give and share**	
	✓			✓		✓			✓			✓				✓	
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
		✓				✓							✓		✓		
Vision 2030	The module targets all techniques that maximize food production and minimize risks (SDGs 13&15) which means less poverty (SDG1) and more food and water security (SDGs 4&6) while ensuring sustainable use of water (SDG6) and production of food (SDG2).																
ECTS WORK LOAD	The ECTS work load is 1.2, which is equivalent to 30 working hours. (See the table of ECTS workload).																

ECTS Workload

The course consists of 5 ECTS, each equivalent to 25 hours of teaching and work. The total teaching hours are 30 for lectures and 10 labs under the supervision of the instructor. Following these labs, the student is given an assignment to carry out work that depends on the gained understanding during the lab practical. The assignment has critical questions to answer. These will show students gained knowledge during each course module. Each student is asked to prepare a project composed of five phases; each is related to the course module in sequence. The student will submit his project as a package of layout and analysed layers, in addition to a short report.

Learning Components	No	Time Factor	Workload	Course Modules					Workload
				1	2	3	4	5	
Lectures (face-to-face)	30	1.5	45	9	6	6	12	12	45
Activities- 1) Lab work and web-based tasks	10	2	20	4	4	4	4	4	20
Activities-	10	2	20	5	3	2	5	5	20

2) Assignment, Presentations									
Activities- 3) Project	5	5	25	5	5	5	5	5	25
Preparation for exam	2	6	12	2	2	2	3	3	12
Writing the exam	2	1.5	3			1	1	1	3
Total			**125**	**25**	**20**	**20**	**30**	**30**	**125**

SDGs RUBRIC

The course activities are connected with the SDGs and the three key domains of the CCSAFS Master program; i.e. climate change (CC), sustainable agriculture (SA), and food security (FS) as shown in the following table.

SDGs		**CC**	**SA**	**FS**	**Course Module**
1	End poverty in all its forms everywhere		✓	✓	1,2,3
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		✓	✓	1,2,3,5
3	Ensure healthy lives and promote well-being for all at all ages				
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all			✓	4
5	Achieve gender equality & empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all	✓	✓	✓	1,2,3,4,5
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	✓			4
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all	✓			4
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation	✓			4

10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns				
13	Take urgent action to combat climate change and its impacts	✓	✓	✓	1,3,4
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss	✓	✓	✓	1,2,3,4
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, & build effective, accountable, and inclusive institutions at all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development				

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CCSAFS COURSE SYLLABUS
Jerash University

Course Number (0604720)

Course Title
Consumer Behaviour, Food Security, and Marketing

Instructor Information

Instructor: **Dr. Mohamed AlTarawneh**
Office Location: **Faculty of Agriculture Building**
Telephone: 0096226350521
Office Hours (Times & Days).
E-mail: m.tarawneh@jpu.edu.jo
Website: http://www.jpu.edu.jo/jpu/profile.php?id=50

Course Identification

Course Number: 0604720

Course Name: **Consumer Behaviour and Food Security and Marketing**
Course Location: **Faculty of Agriculture**
Class Times: Not Now
Prerequisites: **Food Security (603374), Agri. Marketing (603361)**
Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

***Course Description**:*

This course focuses on the study of what it means to be a consumer in a global, information-oriented (technology-oriented, market-oriented) culture. We will examine concepts, processes and approaches that inform marketing strategy as to what, how, when, where and why people consume. The course emphasizes marketing strategy implications of the propositions that compose consumer decision-making processes. The course topics provide a managerial oriented understanding of consumption in post-modern life, where climate change becomes a major threat. In this sense, the course integrates the themes of sustainability in the context of consumer behaviour. It considers the impact that global and local social and economic issues have on marketing and food security. It is the aim of the course to equip students with current knowledge about sustainable development topics and the promotion of critical thinking skills and competences of how individual psychology (motivations, perceptions, attitudes), and socio-cultural factors (cultural and cross cultural influence, reference group) influence consumer behaviour in an ESD framework.

Course Learning Objectives

The goals of the course are to introduce students to main concepts in consumer behavior and to demonstrate their practical use. The course is designed to give students a clear understanding of the ways consumers process the marketing messages directed at them by sellers; how they're likely to respond to those messages; and the many ways they can use this information to formulate a comprehensive marketing strategy. At the end of this course, students should be able to:

1. Understand the role of the consumer in marketing from a variety of disciplinary approaches (e.g., cultural, sociological, psychological, postmodern consumption patterns)

2. Demonstrate how the study of consumer behavior can be used in marketing strategy formation using consumer behavior analysis (brand equity, customer satisfaction and loyalty, consumer impact on marketing strategy, database marketing, market segmentation, diffusion of innovation, qualitative field research: shopping behavior)

3. Develop an understanding of why people consume and the socio-cultural and psychological processes influencing consumption behavior decision-making, household influence, marketing cultural influences, personality and lifestyle, perceptions, learning, memory, motivation and values, consumer involvement, attitudes, communications, purchase situation, post-purchase evaluation, group influence and opinion leadership.

4. develop an appreciation of how the consumption of products, services, ideas and experiences contribute to the broader social world, including global marketing and international business

5. develop an understanding of the positive and negative aspects of consumption and marketing practices (ethical and public policy issues in relation to consumer behavior, particularly with respect to marketing related to food security in the context of sustainability)

6. Become familiar with world food problems, and their relationship to agricultural production, development, and policies.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Understand the concept of consumer behaviour, food security and the relationship between the two concepts.
2. Identify and evaluate the scale of the global challenges to food security and the drivers of change in the context of poverty alleviation and food security.
3. Demonstrate a critical understanding to the scope of components of food security agenda and communicate contemporary issues relating to international and local responses to food supply and nutrition.
4. Critically analyse the potentially conflicting requirements of environmental protection and food production.

Course Resources

There is no single text for this course. Readings will come from a variety of articles, books and reports including reports on Climate Change and sustainability issues. The following may be helpful.

1. Michael Solomon, et al , Consumer Behaviour: A European Perspective, (2006), Third edition, Pearson Education Limited.

http://www.books.mec.biz/tmp/books/nxhqrthbq2l87niu6yvn.pdf

2 . Leon Schiffman, Leslie Kanuk, and Mallika Das. (2006). Consumer Behaviour. Canadian (1st) edition. Pearson Education.

3. The Consumer Decision-Making, university of Pretoria, Process,https://repository.up.ac.za/bitstream/handle/2263/29162/03chapter3-1.pdf?sequence=4.

4. Gary L. Lilien, Philip Kotler, (1983). Marketing decision making: a model-building approach.

5. Beddington J., Asaduzzaman M., Cndez A., Guillou M., Jahn M., Erda L., Mamo T., Van Bo N., Nobre C.A., Scholes R., Sharma R. andWakhungu J. (2012). Achieving Food Security in the Face of Climate Change: Final Report from the Commission on Sustainable Agriculture and Climate Change. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark, Available online at: www.ccafs.cgiar.org/commission.
6. Giovannucci D., Scherr S., Nierenberg D., Hebebrand C., Shapiro J., Milder J. and Wheeler K. (2012). Food and Agriculture: The Future of Sustainability, A Strategic Input to the Sustainable Development in the 21st Century (SD21) Project, New York: United Nations Department of Economic and Social Affairs, Division for Sustainable Development. http://www.un.org/esa/dsd/dsd_sd21st/21_pdf/agriculture_and_food_the_future_of_sustainability_web.pdf .
7. National Research Council (2012). ASustainability Challenge: Food Security for All, Report of Two Workshops. Washington, DC: The National Academies Press. http://www.nap.edu/catalog.php?record_id=13378#toc

8. Marketing management, de essentie. Kotler, Robben & Geuens (2003). Pearson Education Benelux

9. Agro-food marketing. Padberg, Ritson & Albisu (1997). CAB International Verbeke, W. (2005). Consumer acceptance of functional foods: socio-demographic, cognitive and attitudinal determinants. Food Quality and Preference, 16 (1), 45-57.

10. W. D. Perreault, Jr., J.P Cannon, and E. J. McCarthy (2009), Basic Marketing: A Marketing Strategy and Planning Approach, 17th ed., Irwin/McGraw Hill

Course Website(s)

Required Course Texts and Materials

PowerPoint presentations prepared by the instructor for the participants.

Optional Course Texts and Materials

1. Bryan L. McDonald (2010), Food Security,1 edition ,Polity.

2. Philip, Kotler (1974), Marketing Decision Making: A Model-building Approach. Holt, R & W; New edition.

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading Policy

Component	Grade
Assignments	80%
Class Attendance/ Participation	20%
Total Points	100%

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and / or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Dissability
Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Course Schedule

Week	SUBJECT
1	Introduction, consumer definition, consumer rights, consumer behavior and its types, the emergence and evolution of consumer behavior theories.
2+3	The characteristics of consumer behavior, the importance of studying consumer behavior, the interpretation of consumer behavior, the determinants of consumer behavior.
4+5	Decision making, types and stages of procurement, theories explaining consumer behavior: utility theory
6	Explanatory theories of consumer behavior: utility theory or curves, mathematical equilibrium of the consumer
7	Food security: definition, components, dimensions, impediments, indicators (standards).
8	Food Security in Jordan: A Historical Perspective.
9	Food Security in Jordan: Its Policies.
10	Agricultural marketing: its definition, importance, characteristics, importance of study.
11	Agricultural marketing: its objectives, functions, channels.
12	Agricultural markets: their forms, overlaps of consumer behavior and food security.
13	Marketing Interactions in Consumer Behavior.
14	World Trade and Food Security
15	Student Presentations
16	Student Presentations

Course		**Consumer Behaviour, Food Security and Marketing**
Module 1		Consumer Behaviour as individuals and decision makers
Key Concepts		Consumer, behaviour, attitudes, decision makers

Overview		Students develop an appreciation for the influence of consumer behaviour on marketing activities. Students will apply a psychological, social and cultural concept for marketing decision making. These module topics will include the importance of consumer behaviour and research; internal influences such as motivation and involvement, personality, self-image, life-style, perception, learning, attitude formation and change, and communication; external influences such as culture, subculture, social class, reference groups and family, and the diffusion of innovations; and consumer decision making.
Aim		The overriding aim of this module is to turn students able to understand the following: 1. Consumer behaviour in an informed systematic way. 2. The processes used when individuals, group or organizations make consumption decisions. 3. What marketing can and can't do and the ethical restrictions on the marketing profession. 4. The interrelationship with other functional areas of business as part of the management process.
Learning Outcomes		At the end of this module students will be able to: 1. Gain a general understanding of the issues of consumer behaviour. 2. Identify and critically assess the concepts of consumer behaviour.
Units		1. Principles of consumer behaviour. 2. Marketing segmentation and positioning. 3. Consumer motivation and personality. 4. Consumer learning, memory and involvement. 5. Consumer attitudes. 6. Consumer decision-making process. 7. Organizational buying behaviour.
Readings		1. Leon Schiffman, Leslie Kanuk, and Mallika Das. Consumer Behaviour. (2006) Canadian (1st) edition. Pearson Education. 2. The Consumer Decision-Making, university of Pretoria, Process,https://repository.up.ac.za/bitstream/handle/2263/29162/03chapter3-1.pdf?sequence=4. 3. Bryan L. McDonald (2010), Food Security, 1st Edition. 4. Philip Kotler (1974). Marketing Decision Making: A Model-building Approach. 5. Gary L. Lilien, Philip Kotler(1983). Marketing decision making: a model-building approach.

Activity		1. Seminars / Lectures; a series of lectures and seminars will provide guidance in the understanding of the course topic. The lectures are held by the main instructor (course examiner) and invited lecturers. 2. Group exam task with presentations; with the acquired understanding achieved through the course, the students will be ready for a group task exam. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit, the students will submit an individual reflection paper of approximately 1000 words. 5. case study, 6.project-based learning tasks, 7. role-playing. **8.Roundtable on Consumer Decision Making.** Pick a consumer decision that your household just made. Analyze it in terms of the search, evaluation of alternatives, and purchase. Did you go through all the steps?? Why or why not? Why would a firm want to know what steps you went through? **9.Roundtable on Perceptions and Advertising:** How many ads did you perceive today? Did you remember everything about them? Give examples of ads that you tuned out. How can marketers encourage consumers to pay attention to their messages?

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals																	
	×	×	×					×				×					×

21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6	1	2	12	10	-	10	-	31

SD pillars	environment	economy	social	culture
VISION 2030	All people can make the suitable decision without any negative effect on environment or population.			

Module 2	**Food Security and Marketing**
Key Concepts	Food, marketing management, product, price, promotion, place, health, nutrition.

Overview		This modulE focuses on the relation between food security and marketing. It discusses the framework for consumer analysis, affect and cognition, conditioning and learning process. It also familiarizes the students with concepts such as: motivations, perceptions, attitudes, cultural and cross cultural influences, social class, reference group and family; market segmentation and product positioning, consumer behavior and new product adoption.
Aim		- To encourage students to gain knowledge and develop understanding that enables them to critically evaluate challenges and problems related to the future of food security - Proposed solutions to improve future food security. - Include knowledge/understanding of issues related to global changes in population, land use and climate and resource availability and use efficiency in food production.
Learning Outcomes		At the end of this module students will be able to: 1. Develop a basic understanding of food security. 2. Identify the strategic elements of food security. 3. Expand understanding of food security entrances. 4. Determine the role of international organizations and world trade in food security. 5. Knowing the principles and basic concepts with respect to marketing of food products, as well as principles and concepts with respect to consumer behaviour towards food. 6. Identify the language and principles of marketing and sales departments within a food and agribusiness context.
Units		1. Defining food security. 2. Culture and agricultural sustainability in the post-modern world. 3. The climate change and its relation to consumption patterns. 4. Trends and future of global food security. 5. Market analysis. 6. Building a Market Profile. 7. Why Market Analysis in a Food Security Context?. 8. Analyzing Domestic Food Supply and Demand. 9. Analyzing Data and Reporting.
Readings		1. Beddington J., Asaduzzaman M., Cndez A., Guillou M., Jahn M., Erda L., Mamo T., Van Bo N., Nobre C.A., Scholes R., Sharma R. andWakhungu J. (2012). Achieving Food Security in the Face of Climate Change: Final Report from the Commission on Sustainable Agriculture and Climate Change. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark, Available online at: www.ccafs.cgiar.org/commission.

		2. Giovannucci D., Scherr S., Nierenberg D., Hebebrand C., Shapiro J., Milder J. and Wheeler K. (2012). Food and Agriculture: The Future of Sustainability, A Strategic Input to the Sustainable Development in the 21st Century (SD21) Project, New York: United Nations Department of Economic and Social Affairs, Division for Sustainable Development. http://www.un.org/esa/dsd/dsd_sd21st/21_pdf/agriculture_and_food_the_future_of_sustainability_web.pdf . 3. National Research Council (2012)A Sustainability Challenge: Food Security for All, Report of Two Workshops. Washington, DC: The National Academies Press. http://www.nap.edu/catalog.php?record_id=13378#toc 4. Marketing management, de essentie. Kotler, Robben & Geuens (2003). Pearson. Education Benelux 5. Agro-food marketing. Padberg, Ritson & Albisu. (1997). CAB International Verbeke, W. (2005). Consumer acceptance of functional foods: socio-demographic,cognitive and attitudinal determinants. Food Quality and Preference, 16 (1), 45-57. 6. W. D. Perreault, Jr., J.P Cannon, and E. J. McCarthy (2009), Basic Marketing: A Marketing Strategy and Planning Approach, 17th ed., Irwin/McGraw Hill.
Activity		1. Seminars / Lectures; a series of lectures and seminars will provide guidance in the understanding of the course topic. The lectures are held by the main instructor (course examiner) and invited lecturers. 2. Group exam task with presentations; with the acquired understanding achieved through the course, the students will be ready for a group task exam. 3. case study, 4.project-based learning tasks, 5. role-playing

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals																	
	×	×	×					×				×					×

21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓

SD pillars	Environment	economy	social	culture

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6	2	2	15	15	-	10	-	40

VISION 2030	Include knowledge/understanding of issues related to global changes in population, land use and climate and resource availability and use efficiency in food production.to save the healthy life for all.
Module 3	**Food Security and Sustainability**
Key Concepts	Food, marketing management, product, price, promotion, place, health, nutrition.
Overview	The module emphasizes real life projects about access to food all over the world. It enhances understanding of food security in the context of marketing within a sustainability framework.. It highlights dilemmas at household, local, national and international levels and unravels the connections between levels and actors regarding access to food; namely food and nutrition policy makers, development practitioners and trainers at international, national, household and individual level.
Aim	• Understanding The basic principles of food access • Understanding actors' choices influencing food access • Discerning dilemmas at household, local, national and international levels • Unraveling the connections between levels and actors regarding access to food
Learning Outcomes	At the end of this module students will be able to: 1. Develop a basic understanding of food security. 2. Identify the strategic elements of agricultural development food security. 3. Expand understanding of food security entrances. 4. Determine the role of international organizations and world trade in food security. 5. Know the principles and basic concepts with respect to marketing of food products, as well as principles and concepts with respect to consumer behaviour towards food. 6. Identify the language and principles of marketing and sales departments within a food and agribusiness context.
Units	1. Introduction to food access as one of the pillars of global food security. 2. Households accessing and allocating food. 3. Introduction to distribution and trading food at the local level.
Readings	1. Christopher Barrett. (2010).“Measuring Food Security” , American Association for the Advancement of Science,327,825. 2. **M S Swaminathan, Science and Sustainable Food Security,**2009 **http://www.worldscientific.com/worldscibooks/10.1142/7414.** 3. David Barling (2017).Advances in Food Security and Sustainability, Volume 2,1st Edition. Publisher?

Activity		1. Seminars / Lectures; a series of lectures and seminars will provide guidance in the understanding of the course topic. The lectures are held by the main instructor (course examiner) and invited lecturers. 2. Group exam task with presentations; with the acquired understanding achieved through the course, the students will be ready for a group task exam. 3. case study, 4.project-based learning tasks, 5. role-playing *6. Dividing students to groups, and assign them to donate different sources of food with the cooperation of different farms and industries to a chosen poor community near the university as a community service task.* *7. Introduce the importance of sustainability and consumers rule in agricultural industries to farmers by performing seminars and lectures given by the students as a community service task.*

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals																	
	×	×	×	x				×		x		×					×

21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓
SD pillars	Environment	economy	social	culture		

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6	2	2	14	20	-	10	-	54

VISION 2030	Help all consumers to choose a healthy bath when they choose their food.	
Module 4		**Marketing strategy implications using consumer behavior analysis**
Key Concepts		Customer satisfaction, Customer loyalty, Consumer impact, Marketing strategy, Database marketing, Market segmentation.
Overview		This module focuses on studying the importance of marketing for consumers and implication of consumer behavior and its relation with marketing strategy. The module will show the perspective of a marketing manager who needs a sophisticated understanding of consumers in order to develop, evaluate, and implement effective marketing strategies Relevance of consumer behavior for non-profit organization, government agencies or consumer groups. Perform a working model of consumer behavior.

Aim		Objectives Upon completion of this course, students should be able to: • understand consumption-related behaviors • create programs to influence behaviors • evaluate the span and degree of influence on behavior
Learning Outcomes		At the end of this module students will be able to: 1. Develop a basic understanding of marketing strategies 2. Expand understanding of the impact of the consumer behaviour on marketing 3. Know the principles and basic concepts regarding to marketing of food products, as well as principles and concepts regarding consumer behaviour towards food
Units		1. Consumer And Market Analysis 2. Consumers' Product Knowledge and Involvement 3. Consumer Decision Making 4. Product Policy and Consumer Behavior
Readings		J. Paul Peter and Jerry C. Olson, Consumer Behavior: Marketing Strategy Perspectives, 6th edition, Homewood, IL: Richard D. Irwin. Maja Hostaa, Vesna Žabkarb, consumer sustainability and responsibility: beyond green and ethical consumption, Market-Tržište Vol. 28, No. 2,2016, pp. 143-157. J. Paul Peter; Jerry Corrie Olson, Consumer Behavior and Marketing Strategy-1, https://www.studocu.com/en/document/uppsala-universitet/principles-of-marketing/book-solutions/consumer-behavior-and-marketing-strategy-1/1232652/view.
Activity		1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5. Learning by group. 6. Learning by Project

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals																	
	×	×	×					×				×					×

21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓
SD pillars	environment	economy	Social	culture		

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6	2	2	16	20	10	10	-	76

VISION 2030	Evaluate the span and degree of influence on behavior to save the environment and make a balance between people to save them from poverty	

Module 5		**Sustainability in the context of consumer behavior**
Key Concepts		Social economic marketing, Food security, Products consumption, Global marketing, International business
Overview		This module will focus on theories and findings from consumer behavior, marketing and psychology, which help to understand sustainable behavior from a consumer and brand perspective. It also focus on understanding why consumers have difficulties to act sustainable, what consumer and corporate social responsibility means. And how brands can misuse sustainability issues in order to appear more sustainable.
Aim		Objectives Upon completion of this course, students should be able to: • Understand the consumption process from a sustainability perspective. • Understand why consumers have difficulty to act sustainable. • Explain how consumer behavior can be nudged by managers into a more sustainable direction • Understand what brand managers can do to make their brand look more sustainable
Learning Outcomes		At the end of this module students will be able to: 1. Develop a basic understanding of sustainability. 2. Expand understanding of the impact of the consumer behaviour on marketing sustainability
Units		2. Sustainability and Consumption. 3. Sustainability Strategies 4. Consumer behaviour and sustainable marketing 5. Global problems and global opportunities 6. Marketing channels and sustainable supply chain

Readings		Elena Kostadinova, Sustainable Consumer Behavior: Literature Overview, Economic Alternatives, Issue 2, 2016. William Young, Kumju Hwang, Seonaidh McDonald and Caroline J. Oates. Sustainable Consumption: Green Consumer Behaviour when Purchasing Products. Sustainable Development Sust. Dev. 18, 20–31 (2010). Fernando Dias Simões. Consumer Behavior and Sustainable Development in China: The Role of Behavioral Sciences in Environmental Policymaking. Sustainability 2016, 8, 897; doi:10.3390/su8090897 www.mdpi.com/journal/sustainability. Martin, D., & Schouten, J. (2012). Sustainable Marketing. Prentice Hall. ISBN# 978-0136117070.
Activity		1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words. 5. Learning by group. 6. Learning by Project.

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Sub goals																	
	×	×	×	X				×				×					×

21st ESD	Learning to know ✓	Learning to be ✓	Learning to do ✓	Learning to live together ✓	Learning to transform oneself and society ✓	Learning to give and share ✓

SD pillars	environment	economy	Social	culture

ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**
	6	2	2	10	17	10	10	-	67

VISION 2030	Ensure that 85% of sustainable development goals have been achieved

SUMMRY OF ECTS WORKLOAD

	No		**Workload**	**Course Modules**	**Workload**

Learning Components		**Time Factor**		**1**	**2**	**3**	**4**	**5**	
Lectures (face-to-face)	10	3	30	6	6	6	6	6	30
Online	3	3	9	1	2	2	2	2	9
Lab work	4	2	8	2	2	2	2	2	8
Reading articles (3 pages per hour)	150	0.3	45	8	9	9	9	10	45
Reading book chapters (5 per/h)	140	0.2	28	4	6	5	7	7	28
Preparing course activities	5	15	75	10	15	20	20	10	75
Project work	1	20	20	-	-	-	10	10	18
Preparation for exam	1	50	50	10	10	10	10	10	50
Writing the exam	2	1.5	3	-	-	-	-	-	3
Total			**268**	31	40	54	76	67	**268**

SDGs		**CC**	**SA**	**FS**	**COURSE MODULE**
1	End poverty in all its forms everywhere		X	X	1,2 ,3,4,5
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		X	X	1,2,3,4,5
3	Ensure healthy lives and promote well-being for all at all ages		X	X	1,2,3,4,5
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		X	X	3,5
5	Achieve gender equality and empower all women and girls				
6	Ensure availability and sustainable management of water and sanitation for all		X	X	5
7	Ensure access to affordable, reliable, sustainable, and modern energy for all				
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all		X	X	1,2,3,4,5

9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation				
10	Reduce inequality within and among countries				
11	Make cities and human settlements inclusive, safe, resilient, and sustainable				
12	Ensure sustainable consumption and production patterns		X	X	1,2,3,4,5
13	Take urgent action to combat climate change and its impacts				
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development				
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss		X	X	5
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions on all levels				
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development		X	X	1,2,3,4,5


Constructing knowledge
Critical thinking and problem solving
Communi-cation
Collabo-ration
Creativity and innovation
Connectivity and networking
Critical conscious-ness
Critical reflection
Cross/inter-cultural competence
Co-responsibility
ICTs as enabling tools for the 10Cs

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CCSAFS COURSE SYLLABUS

Jerash University
Course Syllabus

Course Number (????????)

Course Title
Sustainable and Ethical livestock Management

Semester ()

Instructor Information

Instructor: **Hani A. M. Talafha**
Office Location:**Faculty of Agriculture Building**
Telephone: 0096226350521
Office Hours ( ).
E-mail: hanit@just.edu.jo

Course Identification

Course Number:

Course Name: **Sustainable and ethical livestock management (Sustainable Livestock System)**

Course Location: **Faculty of Agriculture**
Class Times: Not Now
Prerequisites:
Faculty Web Page:

Course Description/Overview

Introducing sustainability in livestock production systems has been very important recently. Such production systems will emphasizes production resources conservation by regeneration and substitution of increasingly rare resources. In addition, sustainable production systems will insure functional integrity of production parameters such as animal welfare and animal ethics. Theses parameters are associated with the five freedoms inputs or factors of animal welfare such as animal survival, reproduction, health, mental status and naturalness.

The course aims to help students develop key competencies including knowledge of essential ecological, social, institutional, and economic dimensions as part of a an ethical sustainable farming system. Topics included are animal welfare and animal use ethics concept, animal welfare inputs, livestock production systems and resources, animal welfare to improve production and assessment of livestock production systems using welfare concept. Upon completion, students should demonstrate an understanding of the role of livestock production in a sustainable production system under the umbrella of welfare. Field trips are an essential part of this course; students are expected to pay attention to where class meetings will be held based on the syllabus.

Course Learning Objectives:

1) Define terminology and concepts related to sustainable farming practices.
2) Describe the ecological, economical, and social implications of agricultural practices.
3) Define the concept of welfare and ethical livestock production.
4) Apply best welfare practices in livestock management to maximize animal productivity.
5) Utilize a systems approach to analyze agriculture in your own backyard and/or community.
6) Identify resources for solving problems facing farmers, in order to reduce waste and energy consumption in agriculture.
7) Expand consumer awareness and support of ethical alternatives.
8) Describe strategies to increase profit and efficiency for sustainable producers.
9) Strengthen group work, communication, facilitation and reporting skills
10) Reflect on the wider management or conservation context of their research problem (or another issue of their choice)

Course Content Learning Outcomes:

Animal products requirement is increasing due to the enormous increase in global population. Such demand on animal product result in direct or indirect influence towered animal's quality of life and environment. This can either be utilizing production resources or livestock production plan and management. The overall aim with the course is to give the students the necessary basic information about sustainable livestock production and the effect of good practises of welfare on productivity. This should be set in overall view so the students are able to critically evaluate the factors which are important for a sustainable growth in the ethical livestock production systems.

Upon completion of this course, students should demonstrate competency in:

- Selection of appropriate livestock production system to insure sustainable and ethical plan.

- Selecting appropriate environment for livestock production to maintain best animal welfare.
- Evaluating animal welfare to maintain ethical livestock use and increase productivity.

Teaching and learning approach

The course is designed to foster multi-disciplinary and integrative problem-solving skills in ethical livestock production management. It starts off with structured lectures, homework, assignments and field visits, but progresses towards are more open-ended, student-driven and often group-based learning.

From you as a student, the course requires enthusiasm for grappling with complex and poorly defined ethical livestock production management issues ("messes"). From graduate students, it further requires initiative and a willingness and ability work in groups (you will receive a substantial share of your grade based on group work). Many students enjoy these challenges but some don't.

If you want to be told what to do at all times, are uncomfortable engaging with problems that don't have a right or wrong answer, or dislike group work then this course may not be for you. The course is taught in mixed mode for both on-campus and distance students. On-campus and distance students will interact directly through a variety of electronic means and work collaboratively throughout the course. In addition, as a student you should be able to evaluate, analyze and improve livestock production systems.

Course Resources:

6) Taylor, Robert E and Thomas G. Field. Scientific Farm Animal Production: An Induction to Animal Science. Prentice-Hall: Upper Saddle River, NJ. 2004.
7) *Understanding Animal Welfare: The Science in its Cultural Context*, by David Fraser, Wiley-Blackwell, Oxford, 2008
8) Appleby, M.C. and Hughes. B.O. Animal Welfare CAB International ISBN 0-85199-180-7 1997
9) Farm Animal Welfare Council (FAWC) Reports
10) *The Animal Ethics Reader*, edited by Susan J. Armstrong & Richard G. Botzler, 2nd edition (NY: Routledge, 2008).
11) *Animal Law: Welfare, Interests, and Rights*, 2nd edition, David Favre (Aspen Elective, 2011).
12) *Animal Rights: Current Debates and New Directions*, edited by Cass R. Sunstein and Martha C. Nussbaum (Oxford University Press, 2004).
13) Dawkins, M.S. From an animal's point of view: motivation, fitness and animal welfare. Behav. Brain Sci. 13:1-9 1990
14) Dawkins, M.S. Animal Suffering: the Science of Animal Welfare. London, Chapman and Hall 1992
15) Fraser, A.F. & Broom, D.M. Farm Animal Behaviour and Welfare. London, Boiler Tindall 3rd Ed. 1990
16) Grandin, T. (ed) Livestock handling and transport. CAB International 1993 (New edition due out in 2000)
17) Gregory, N.G. & Temple Grandin Animal Welfare and Meat Science. CAB International ISBN 0-851-9929-6 1999

Course Website(s)

Required Course Texts and Materials

Optional Course Texts and Materials

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading Policy

Component	Grade
Assignments	80%
Exams	
Class Attendance/ Participation	20%
Total Points	100%
Field trip	Up to 5% bonus

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and /or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Dissability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Important Dates to Remember

Course Schedule

Week	SUBJECT	Date
1	**General Introduction:** Introduction to the course. Introductions and discussion of student's interests and research Initial discussion on possible topics, interests, tasks, timeline	
2	Discussion I:Livestock products and human animals relationship history Understanding livestock productions systems	
3	Animal welfare and ethics the concept	
4	Qualitative interview studies Stakeholders as individuals: values, attitudes, assets and drivers of behavior	
5	Case study	
6	Minor exam	
7+8	Animal Welfare Assessment I: Livestock production systems Animal Welfare Assessment II: solving problems	
9	Communication strategies for working with stakeholders	
10	Field trip: Visit to livestock production plan	
11	Livestock plan management skills	
12	Sustainability certification of animal products managing small-scale livestock production systems in developing countries	
13	Student Presentations	
14	Final exam	

Course	**Sustainable and Ethical livestock Management**
Module 1	**Introduction**

Key Concepts	Animal welfare, ethics, sustainable domestication
Learning Outcomes	At the end of this module students will be able to: To understand the terminology of animal ethics and welfare
Units	• Introducing the Course Terminology • History of Animal Use • Human – Animal Bond • Animal Domestication • Animal Products
Readings	**Diamond, Jared (2012).** "1". In Gepts, Paul. Biodiversity in Agriculture: Domestication, Evolution, and Sustainability. Cambridge University Press. p. 13. **Driscoll, C. A.; MacDonald, D. W.; O'Brien, S. J. (2009).** "From wild animals to domestic pets, an evolutionary view of domestication". Proceedings of the National Academy of Sciences. 106: 99719978. doi:10.1073/pnas.0901586106. PMC 2702791 PMID 19528637 **Meyer, Rachel S.; Purugganan, Michael D. (2013).** "Evolution of crop species: Genetics of domestication and diversification". Nature Reviews Genetics. 14 (12): 840–52. doi:10.1038/nrg3605. PMID 24240513. **Price, Edward O. (2008).** Principles and Applications of Domestic Animal Behavior: An Introductory Text. Cambridge University Press. ISBN 9781780640556. Retrieved January 21, 2016. **Larson, G. (2014).** "The Evolution of Animal Domestication". Annual Review of Ecology, Evolution, and Systematics. 45: 115 –36. doi:10.1146/annurev-ecolsys-110512-135813.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.
Module 2	**Animal Production Systems**
Learning Outcomes	At the end of this module students will be able to: Understand Animal production systems plans and management

Units	Animal Production Practices Livestock Systems Produce for Purpose Farm Management Risk analysis Economic of Livestock Systems Market Supply and Demand Case Studies: Risk Analysis of a Dairy Farm Exercise: Designing an Economically Efficient and Environmentally sustainable Dairy Farm
Readings	**Banerjee, G. (2015).** A textbook of animal husbandry (8th edition). Oxford & IBH Publishing **Cheeke, Peter R. Contemporary Issues in Animal Agriculture (3rd Edition).** Pearson Prentice Hall.C. **Cottle, D. and Kahn, L. (2014).** Beef Cattle: Production and Trade. CSIRO Publishing, Collingwood **Gillespie, J. and Flanders, F. (2016).** Modern Livestock and Poultry Production, 9th edition. Cengage Learning, Boston. **Pingali, P. (2006).** Westernization of Asian diets and the transformation of food systems: Implications for research and policy. *Food Policy*, *32*, 281-298 **Plachter, H. and Hampicke, U. (2010).** Large-scale Livestock Grazing. Springer-Verlag, Berlin **Sejian, V., Naqvi, S., Ezeji, T., Lakritz, J and Lal, R. (2012).** Environmental Stress and Amelioration in Livestock Production. Springer-Verlag, Berlin **Webster, A. J. F. (2001).** Farm animal welfare: The Five Freedoms and the free market. *The Veterinary Journal*, *161*, 229-237. **World Bank (2006).** Creating business opportunity through improved animal welfare. Good Practice Note no. 6. Washington, DC: International Finance Corporation, World Bank Group. **One Health Initiative (2011).** One Health Initiative will unite human and veterinary medicine. Retrieved from www.onehealthinitiative.com/
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.
Module 3	**Ethics of Animal Use in Food Production**

Learning Outcomes	At the end of this module students will be able to: Understanding the integrity and ethics of using animals for food production
Units	Participatory Approach The New era of Animal Ethics Our duties to Animal Community Organization Advisory Committees Use of Traditional Knowledge Case Studies: Examples of Community Small Livestock Holding Management Exercise: Develop Plan for Winning Argument for Using Animal in Food Production.
Readings	**Anthony, R. (2003).** The ethical implications of the human–animal bond on the farm. *Animal Welfare, 12*, 505-512. **Cohen, C. (2003).** Reply to Tom Regan. In S. Armstrong & R. Botzler (Eds.), *The animal ethics reader* (pp. 25-29). London: Routledge. **Douglas-Hamilton, I., Bhalla, S., Wittemyer, G., & Vollrath, F. (2006).** Behavioural reactions of elephants towards a dying and deceased matriarch. *Applied Animal Behaviour, 100*, 87-102. **Heleski, C. R., & Anthony, R. (2012).** Science alone is not always enough: The importance of ethical assessment for a more comprehensive view of equine welfare. *Journal of Veterinary Behaviour, 7*, 169-178. **Langford, D., Crager, S., Shehzad, Z., Smith, S., Sotocinal, S., Levenstadt, J., Chanda, M. L., Letivin, D. J., & Mogil, J. S. (2006).** Social modulation of pain as evidence for empathy in mice. *Science, 312*, 1967-1970. **Regan, T. (1984).** *The case for animal rights*. London: Routledge. **Rollin, B. (2006).** *An introduction to veterinary medical ethics: Theory and cases* (2nd ed., pp. 1-41). Oxford: Blackwell. **Sandøe, P., & Christiansen, S. B. (2008).** *Ethics of animal use* (pp. 15-31). Chichester, UK: Wiley-Blackwell. **Schneider, B. (2001).** A study in animal ethics in New Brunswick. *Canadian Veterinary Journal, 42*, 540-547. **Taylor, A. (1999).** *Magpies, monkeys and morals. What philosophers say about animal liberation* (pp. 25-66). Peterborough, UK: Broadview.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.
Module 4	**Introduction to Animal Welfare and Assessment**

Learning Outcomes	At the end of this module students will be able to understand: Which animals we are concerned about and why • Sentience • Suffering • Anthropomorphism • Death and animal welfare Why animal welfare is complex • Different scientific definitions of animal welfare • Why animal welfare science involves more than veterinary medicine The roles of science, ethics and law The theory behind the Five Freedoms How they have influenced the development of modern assessment tools How to assess the animal's experience in terms of welfare (inputs) and actual welfare performance (outcomes)
Units	Animal welfare the concept Animal welfare approaches The importance of animal welfare The Five Freedoms Problems with the Five Freedoms Welfare inputs and outputs Welfare assessment Welfare validation how and why?
Readings	**Farm Animal Welfare Council. (2009).** *Farm animal welfare in Great Britain: Past, present and future* (p. 1). London: FAWC. **Farm Animal Welfare Council. (1992).** FAWC updates the Five Freedoms. *Veterinary Record 131*, 357. **Fraser, D. (2008).** *Understanding Animal Welfare. The science in its cultural context*. (pp. 262-266).Oxford: Wiley Blackwell **Jongman, E. C. (2007).** Adaptation of domestic cats to confinement. *Journal of Veterinary Behavior, 2*, 193-196. **Laven, R. A., & Holmes, C. W. (2008).** A review of the potential impact of increased use of housing on the health and welfare of dairy cattle in New Zealand. *New Zealand Veterinary Journal, 56*, 151-157. **Rollin, B. (1993).** Animal welfare, science and value. *Journal of Agricultural and Environmental Ethics* (Special Supplement 2), 8-14. **Scholtz, M. M., McManus, C., Okeyo, A. O., & Theunissen, A. (2011).** Opportunities for beef production in developing countries of the southern hemisphere. *Livestock Science, 142*, 195-202. **Taylor, A. (1999).** *Magpies, Monkeys and Morals. What philosophers say about animal liberation*. Broadview, Peterborough. p 24

	Templar, D. & Leith, B. (2010) *Human Planet*. BBC Books. London. p180-181 **Viñuela-Fernández, I., Jones. E., Welsh, E. M., & Fleetwood-Walker, S. M. (2007).** Pain mechanisms and their implication for the management of pain in farm and companion animals. *The Veterinary Journal, 174*, 227-239. **Webster, J. (2011).** Zoomorphism and anthropomorphism: fruitful fallacies? *Animal Welfare, 20*, 29-36 **Widowski, T. (2010).** Why are behavioural needs important? In T. Grandin (Ed.) *Improving animal welfare. A practical approach* (pp. 290-307). Wallingford, UK: CABI. **Yeates, J. W. & Main, D. C. J., (2008).** Assessment of positive welfare: A review. *The Veterinary Journal* 175: 293–300
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.
Module 5	**The Application of Animal Welfare Ethics**
Learning Outcomes	At the end of this module students will be able to: Understanding of the advantage of practicing animal welfare ethics
Units	Ethical Animal Breeding Farming and Animal Nutrition Animal Housing Animal Welfare Impact on Productivity and Economics Utilitarianism Introduction to Environmental Ethics Controlling infectious diseases The Concept of One Health
Readings	**Dawkins, M. S., & Layton, R. (2012).** Breeding for better welfare: genetic goals for broiler chickens and their parents. Animal Welfare , 21: 147-155. **D'Silva, J., & Webster, J. (eds) (2010).** The Meat Crisis. Developing more sustainable production and consumption. London: Earthscan. **Desjardins, J. R. (2012).** Environmental Ethics: An Introduction to Environmental Philosophy. 5th edition. Kentucky: Wadsworth Publishing. **Helelski, C. R., & Anthony, R. (2012).** Science alone is not always enough: The importance of ethical assessment for a more comprehensive view of equine welfare. Journal of Veterinary Behaviour, 7: 169-178. **Mepham, B. (1996).** Food Ethics. London: Routledge.

	Mullan, S., & Main, D. (2001). Principles of ethical decision-making in veterinary practice. In Practice, 23: 394-401. **Palmer, C. (2012).** Does breeding a bulldog harm it? Breeding, ethics and harm to animals. Animal Welfare, 21: 157-166. **Rollin, B. (2006).** An Introduction to Veterinary Medical Ethics. Theory and Cases. Second edition, pp.34-37. Oxford: Blackwell. **Sandøe, P., & Christiansen, S. B. (2008).** Ethics of Animal Use, pp.67-153. Chichester: Blackwell
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.
Module 6	**Sustainable Livestock Planning Management**
Learning Outcomes	At the end of this module students will be able to: Understanding of the steps to develop a sustainable Livestock plan
Units	Introduction to Sustainable Livestock Production Whole Farm Planning: with Livestock Pasture Systems Livestock Breeds and Rare Breeds Meat and Dairy Goats/forages Poultry Organic Farming Climate Change
Readings	**Beck, U. (1986).** Risk Society: Towards a New Modernity. London: Sage Publications Ltd. **Berkhout, Frans, Adrian Smith, and Andy Stirling (2004).** Socio-technical regimes and transition contexts. In B. Elzen, F. W. Geels and K. Green.(eds.) System Innovation and the Transition to Sustainability: Theory, Evidence and Policy. Cheltenham: Edward Elgar, pp.48-75. **Bos B., and John Grin J., (2008).** "Doing" Reflexive Modernization in Pig Husbandry: The Hard Work of Changing the Course of a River. Science, Technology, & Human Values 33(4): 480-507. **Bos B. ,(2009).** "Concepts and objects as boundary objects for sustainable animal husbandry: Anticipating regime transformations by design." Paper for 1st European Conference on Sustainability Transitions, Amsterdam, 4-6 June 2009

	Geels, F.W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Research Policy 31 (8/9): 1257–1274. **Geels, F.W. (2005).** Technological Transitions and System Innovations: A co-evolutionary and socio-technical analysis. Edward Elgar Publishing Ltd., Cheltenham. **Groot, Koerkamp, P.W.G, and A.P. Bos (2008).** Designing complex and sustainable Agricultural production systems: an integrated and reflexive approach for the case of table egg production in the Netherlands. Neth. J. agric. Sci., 55: 113-138. **Hirsch Hadorn, G., H. Hoffmann-Riem, S. Biber-Klemm, W. Gossenbacher-Mansuy, D. Joye, C. Pohl, U. Wiesmann, and E. Zemp (2008).** Handbook of transdisciplinary research. Springer Verlag. **Hoogma, R., R. Kemp, J. Schot and B. Truffer (2002).** Experimenting with Sustainable Transport: the approach of Strategic Niche Management. London: Spon Press. **Quist, J. (2007).** Backcasting for a sustainable future. The impact after 10 years. PhD thesis. Technical University Delft. **Rip, A., and R. Kemp (1998).** Technological Change. In S. Rayner and E.L. Malone (eds). Human Choice and Climate Change. Columbus, Ohio: Battelle Press. Volume 2: 327-399. **Roep D, Van der Ploeg J.D. and Wiskerke J.S.C.,(2003).** Managing technical-institutional design processes: some strategic lessons from environmental cooperatives in the Netherlands. Neth. J. agric. Sci. 51: 95-217. **Schot, J., and F.W. Geels (2008).** Strategic niche management and sustainable innovation journeys: theory, findings, research agenda and policy. Technology Analysis & Strategic Management. 20: 537-554. **Smith A., Stirling A. and Berkhout F., (2005).** The governance of sustainable sociotechnical transitions. Research Policy. 34: 1491–1510.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.

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CCSAFS COURSE SYLLABUS

Jerash University

Course Number (604721)

Course Title
Sustainable Fisheries and Food Security

Instructor Information

Instructor: **Dr. EbraheemAltahat**
Office Location: **Faculty of Agriculture Building**
Telephone: 0096226350521
Office Hours:.
E-mail: **tahat1972@gmail.com**
Website: http://www.jpu.edu.jo/jpu/profile.php?id=50

Course Identification

Course Number:604721

Course Name: **Sustainable Fisheries and Food Security**

Course Location: **Faculty of Agriculture**
Class Times:
Prerequisites:
Faculty Web Page:http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Description/Overview

The course provides a framework in which you will acquire insights and skills to bring stakeholders in the fisheries system and help them understand each other's perspectives, manage their conflicts and learn together. The program is highly interactive and will

allow you to practice a range of participatory methodologies in a real-life case. You will be challenged to apply the concepts learned to your own work situation.

Fisheries and aquaculture represent the largest source of dietary protein and are pivotal in current food security. The science of sustainable management of these precious resources is therefore critical in the global grand challenge of sustainable future food security. This course provides advanced level content in the biology and mathematics of fisheries and aquaculture, including fish reproductive biology and dispersal, mathematical modelling and stock assessment, fish nutrition, health and genetics in aquaculture and fisheries. Students will produce a cohesive, evidence-based scientific discourse on the potential placement of fish and fisheries, both capture and aquaculture, in future global food security and poverty alleviation. For this they will draw extensively on the relevant biological sciences and mathematics and show adaptability and application in a changing economic and ecological framework. Excellent students should be able to demonstrate substantial unexpected extension in their critical analysis and thinking and in how they apply their in-depth knowledge and communicate it to a broader scientifically literate audience.

Course Learning Objectives:

11) Appreciate the complex, multi-dimensional nature of fisheries management problems andthe benefits of integrative-interdisciplinary approaches to addressing them.
12) Understand key relevant concepts in the areas of fisheries ecology, stakeholdercharacteristics and behavior, governance systems, fisheries economics, and managementand planning processes
13) Gain practical skills in fisheries assessment, interview techniques, institutional analysis,economic analysis, and participatory planning.
14) Gain practical experience in analyzing fisheries management issues in a problem andoutcome-oriented, interdisciplinary manner.
15) Strengthen group work, communication, facilitation and reporting skills
16) End poverty in all its forms everywhere
17) End hunger, achieve , food, security and improved nutrition and promote sustainable agriculture.
18) Give the students the necessary basic information about fisheries and aquaculture
19) Ensure healthy lives and promote well-being for all at all ages
20) Achieve gender equality and empower all women and girls
21) Ensure availability and sustainable management of water and sanitation for all
22) Promotesustained,inclusiveand sustainableeconomicgrowth,fullandproductiveemploymentanddecentworkforall
23) Buildresilientinfrastructure,promoteinclusiveand 14)sustainable industrialization and foster innovation
24) Ensure Sustainable Consumption And Production Patterns Take Urgent Action To Combat Climate Change And Its Impacts
25) Conserveandsustainably usetheoceans, seasandmarineresourcesforsustainabledevelopment
26) Protect,restoreandpromotesustainableuseofterrestrial ecosystems, sustainably manage forests, combat desertification,andhaltand reverse land degradation and haltbiodiversityloss
27) Promotepeacefulandinclusivesocietiesforsustainable development, provide access to justiceforallandbuildeffective,accountableandinclusiveinstitution stall levels.

Course Content Learning Outcomes:

The requirement for fish and seafood in the word is increasing. This can either be harvest from the sea through traditional fisheries,or it can be produced trough aquaculture. These are complex systems and productions that may interfere with each other and the surrounding environment. The overall aim with the course is to give the students the necessary basic information about fisheries and aquaculture. This should be set in overall view so the students are able to critically evaluate the factors which are important for a sustainable growth in the industry.

Teaching and learning approach

The course is designed to foster multi-disciplinary and integrative problem-solving skills infisheries management. It starts off with structured lectures and labs/homework assignments, butprogresses towards more open-ended, student-driven and often group-based learning.

From you as a student, the course requires enthusiasm for grappling with complex and poorlydefined real-world fisheries management issues ("messes").it furtherrequires initiative and a willingness and ability work in groups (you will receive a substantialshare of your grade based on group work). If you want to be told what to do at all times, are uncomfortable engaging with problems thatdon't have a right or wrong answer, or dislike group work then this course may not be for you.The course is taught in mixed mode for both on-campus and distance students. On-campus anddistance students will interact directly through a variety of electronic means and workcollaboratively throughout the course.

Course Resources.

18) Acheson, J.M. (1975). Fisheries management and social context: the case of the Maine lobsterfishery. *Transactions of the American Fisheries Society* 104: 653-668.

19) Adkins, T.J. (2010). Fishing for masculinity: recreational fishermen's performances of gender.M.A. Thesis, Kent State University. 64pp.

20) Allison, E. H. & Ellis, F. (2001). The livelihoods approach and management of small-scaleFisheries. *Marine Policy* 25**:** 377-388.

21) Arlinghaus, R. &Mehner, T. (2006). Determinants of management preferences of recreational anglers in Germany: Habitat management versus fish stocking. *Limnologica*35: 2-17.

22) Garcia, S. & Rosenberg, A. (2010). Food security and marine capture fisheries: characteristics,trends, drivers and future perspectives. *Philosophical Transactions of the Royal Society B*365: 2881-2896.

23) NOAA (2007). Magnuson-Stevens Fishery Conservation and Management Act. Public Law 94-265.

Rice, J.C. (2005) Understanding fish habitat ecology to achieve conservation.*Journal of Fish Biology* 67(SB): 1-22Course Website(s)

Required Course Texts and Materials

Presentation and PowerPoint.

Optional Course Texts and Materials

HLPE, 2014.Sustainable fisheries and aquaculture for food security and nutrition.A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.

Assignments and Grading Scheme

Grading System

0 to 100 (where 70 is the least pass mark)

Grading Policy

Component	Grade
Assignments	40%
Class Attendance/ Participation	20%
Final Exam	40%
Total Points	100%

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged not disrupt class by making noise and /or leaving and re-entering during class. Students who violate these minimal

expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Dissability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Course Schedule

Week	SUBJECT
1	Introduction and Concepts of sustainable fisheries
2	Importance of fisheries, status and management challenges. Understanding fisheries systems
3	Impact of seasonal variations on sustainable fisheries and Challenges to food security
4	Sustainable Fisheries and Food Security Challenges
5	High Value Fish Production
6	Important of fish for food security
7	Habitat Fisheries management
8+9	Sustainable Fisheries Management Planning
9+10	**Economic Perspective**
11	Field trip: Visit to agricultural research institutes
12+13	Marine Reserves and Zonal Management
14	Student Presentations
16	Final exam

Course	Sustainable Fisheries and Food Security
Module 1	**Introduction**
Key Concepts	Fish Populations, fisheries Ecology
Learning Outcomes	At the end of this module students will be able to: To understand the factors that affect fish population size and fish catch; understand why fish stocks are particularly vulnerable to overfishing; use of severity ranking of collateral impacts
Units	• The Biology of Fish Populations • Growth and Mortality of Stocks • Tropical Fish Ecology: Species and Habitats Affect each Other • Fishing Status and Decline • Fish Catch and Fishing Effort: Do More Boats Catch More Fish? • Use of Destructive Fishing Methods and Gear • Ecology of Multispecies Fisheries • External Issues Causing Fisheries Decline • Case Studies: ETPS Site Presentations on Status of Fisheries (diversity of fisheries, levelof effort, status and trends
Readings	FAO. 2018. The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals. Rome. Licence: CC BY-NC-SA 3.0 IGO. **GAA (Global Aquaculture Alliance).** 2011. *Antibiotic residues* (www.gaalliance.org/newsroom/whitepapers-detail.php?Antibiotic-Residues-10). **Garaway, C.** 2005. Fish, fishing and the rural poor. A case study of the household importance of small-scale fisheries in the Lao PDR. *Aquatic Resources, Culture and Development*, 1(2): 131–144. **Williams, M.J., Porter, M., Choo, P.S., Kusakabe, K., Vuki, V., Gopal, N. &Bondad-Reantaso, M.** 2012a. Guest editorial: gender in aquaculture and fisheries - moving the agenda forward. *Asian Fisheries Science*, Special Issue 25S: 1–13.
Activity	Get information on how individual communities use scientific ideas to protect and collect Earth's resources and environment.

10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
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SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

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ECTS WORK LOAD	**Lecture**		**Online**		**Lab**	**Reading**		**Course activity**		**Project**		**Prepare exam**		**Writing exam**		**Total**	
	4h		**2h**			**10h**		**12h**								**26**	
Module 2	**Fisheries From an Economic Perspective**																
Learning Outcomes	At the end of this module students will be able to: **To understand the economic drivers behind overfishing; to understand the pros and cons of alternative livelihoods (including tourism)**																
Units	Economic Efficiencies and Rents Economic Causes of Overfishing Economics of Open Access Fishery Industry Costs, Revenues, and Fishing Effort Market Supply and Demand The Sole Owner Fishery Profit Margins Tax on Fish Landings Declining Fisher Incomes Changes to Fishing Communities Alternative Livelihoods and Credit Schemes Case Studies: Economic Drivers Behind Different Fisheries Exercise: Designing an Economically Efficient and Environmentally Sound fishery.																
Readings	**Beveridge, M., Phillips, M., Dugan, P. &Brummett, R.** 2010. Barriers to aquaculture development as a pathway to poverty alleviation and food security: policy coherence and the roles and responsibilities of development agencies, in *Advancing the aquaculture agenda*, Proceedings of a workshop, Paris, 15–16 April. Paris, OECD. **Bharucha, Z. and Pretty, J.** 2010. The roles and values of wild foods in agricultural systems. *Phil. Trans. R. Soc. B* 27 September 2010 vol. 365 no. 1554 2913-2926 **Cheng, M.H.** 2010. Asia-pacific faces diabetes challenge. *The Lancet*, 375: 2207–2210.																

<table>
<tr><td></td><td colspan="16">Chokesanguan, B., Ananpongsuk, S. &Wanchana, W. 2009. Impact of fisheries management in improving safety at sea measures: a case study in Thailand. Fish for the People, 7(2): 29-35.</td></tr>
<tr><td>Activity</td><td colspan="16">Discussion related to the application of economic principles to environmental issue such as food security and sustainable agriculture</td></tr>
<tr><td rowspan="2">10Cs/6 LEARNINGGOALS</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
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<tr><td colspan="2">3h</td><td colspan="2">2h</td><td colspan="2"></td><td colspan="2">13h</td><td colspan="2">15h</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td>32</td></tr>
<tr><td>Module 3</td><td colspan="16">Community Involvement</td></tr>
<tr><td>Learning Outcomes</td><td colspan="16">At the end of this module students will be able to:
Understand the local community and how to incorporate them in the management planning process</td></tr>
<tr><td>Units</td><td colspan="16">Participatory Approach
Understanding the Community
Winning the Support of the Community
Community Organization
Fostering Partnerships
Advisory Committees
Use of Traditional Knowledge
Contribution to Conservation
Case Studies: Examples of Community-based Fisheries Management
Case Studies: Examples of Use of Traditional Knowledge
Exercise: Develop Plan for Winning Support of Community</td></tr>
<tr><td>Readings</td><td colspan="16">Bush, S.R., Belton, B., Hall, D., Vandergeest, P., Murray, F.J., Ponte, S., Oosterveer, P., Islam, M.S., Mol, A.P., Hatanaka, M., Kruijssen, F., Ha, T.T.,</td></tr>
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<tr><td></td><td colspan="16">Little, D.C. &Kusumawati, R. 2013. Certify Sustainable Aquaculture? Science 341(6150): 1067–1068.

Cabello, F.C. 2006. Heavy use of prophylactic antibiotics in aquaculture: a growing problem for human and animal health and for the environment. Environmental Microbiology, 8(7): 1137–1144.

Cabello, F.C., Godfrey, H.P., Tomova, A., Ivanova, L., Dolz, H., Millanao, A. &Buschmann, A.H. 2013. Antimicrobial use in aquaculture re-examined: its relevance to antimicrobial resistance and to animal and human health. Environmental Microbiology, 15(7): 1917–1142.

Chamnan C., Thislted, S.H., Roitana, B., Sopha, L., Gerpacio, R.V. &Roos, N. 2009 The role of fisheries resources in rural Cambodia: combating micronutrient deficiencies in women and children. Phnom Penh, Department of Fisheries Post-harvest Technologies and Quality Control, Fisheries Administration, Ministry of Agriculture, Forestry and Fisheries. 106 p.</td></tr>
<tr><td>Activity</td><td colspan="16">Students will do filed visits for local fisheries. They will be asked for collecting data from fisheries, highlighting problem, and recommending solutions.</td></tr>
<tr><td rowspan="2">10Cs/6 LEARNINGG OALS</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
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<tr><td colspan="2">5h</td><td colspan="2">3h</td><td colspan="2"></td><td colspan="2">8h</td><td colspan="2">13h</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td>27</td></tr>
<tr><td>Module 4</td><td colspan="16">Fundamentals of Fisheries Management</td></tr>
<tr><td>Learning Outcomes</td><td colspan="16">At the end of this module students will be able toUnderstand how to incorporate up-front management principles that link to site-specific goals and objectives</td></tr>
<tr><td>Units</td><td colspan="16">Goals of Fisheries Management

Fisheries Management Principles

Ecosystem Principles, Goals and Policies

Precautionary Principle

Adaptive Management

Reversing Downward Trends</td></tr>
</table>

	Optimal Sustainable Yield vs Maximum Sustainable Yield Local Government Involvement in Fisheries Management Local Government Partnerships with National Agencies
Readings	**EC (European Commission).** 1999. Shrimp culture. Impact of tropical shrimp aquaculture on the environment in Asia and the Pacific/Mangroves, shrimp and the development of coastal areas in Central America. *EC* *Fisheries Cooperation Bulletin*, 12(4). **EFSA.** 2010. Scientific opinion on dietary reference values for fats, including saturated fatty acids, polyunsaturated fatty acids, trans fatty acids and cholesterol. *EFSA Journal*, 8(3): 1461. **EJF (Environmental Justice Foundation).** 2003. Risky business: Vietnamese shrimp aquaculture - impacts and improvements. London. 34 p. **Eknath, A.E.** 1995. Managing aquatic genetic resources. Management example 4: the Nile tilapia, *In* J.E. Thorpe, G. Gall, J.E. Lannan& C. E. Nash, eds. *Conservation of fish and shellfish resources: managing diversity*, pp. 176-194. London, Academic Press, Harcourt Brace Company, Publishers. **Eknath, A.E. & Doyle, R.W.** 1990. Effective population size and rate of inbreeding in aquaculture of Indian major carps. *Aquaculture*, 85: 293–305.
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.

10Cs/6 LEARNINGGOALS	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
		√	√		√	√	√		√			√	√		√	√	
SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
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ECTS WORK LOAD	**Lecture**	**Online**	**Lab**	**Reading**	**Course activity**	**Project**	**Prepare exam**	**Writing exam**	**Total**

	4h	**2h**		**10h**	**11h**				**27**
Module 5	**Fisheries Management Tools**								
Learning Outcomes	At the end of this module students will be able tounderstand the pros and cons of different fisheries management tools								
Units	Issue Identification and Baseline Assessment Assessing Bycatch and Habitat Damage Fisher, Vessel, Company Licensing Limiting Entry into the Fishery Total Allowable Catch Seasonal Restrictions Technology and Gear Restrictions Gear Restrictions Gear Modifications Rotational Closures								
Readings	**Aswani, S. &Furusawa, T.** 2007. Do marine protected areas affect human nutrition and health? A comparison between villages in Roviana, Solomon Islands. *Coastal Management,* 35(5): 545–565. **Badayos-Jover, M.B.P.** 2013. *Gendered concerns in coastal disasters: an analysis of women's political subordination and prospects for empowerment*. Presented at 4th Global Symposium on Gender in Aquaculture and Fisheries, Yeosu, Korea. May 2013 (http://genderaquafish.files.wordpress.com/2013/04/ppt_2.pdf). **Bush, S.R., Belton, B., Hall, D., Vandergeest, P., Murray, F.J., Ponte, S., Oosterveer, P., Islam, M.S., Mol, A.P., Hatanaka, M., Kruijssen, F., Ha, T.T., Little, D.C. &Kusumawati, R.** 2013. Certify Sustainable Aquaculture? *Science* 341(6150): 1067–1068. **Cabello, F.C.** 2006. Heavy use of prophylactic antibiotics in aquaculture: a growing problem for human and animal health and for the environment. *Environmental Microbiology*, 8(7): 1137–1144. **Globefish Research Programme.** 2013. *By-products of tuna processing*, by E.G. Gamarro, W. Orawattanamateekul, J. Sentina&T.KSrinivasaGopal. Rome, FAO. **Gomna, A. &Rana, K.** 2007. Inter-household and intra-household patterns of fish and meat consumption in fishing communities in two states in Nigeria. *British Journal of Nutrition*, 97(1): 145–152.								
Activity	1. Group exam task with presentations; with the acquired understanding achieved through the course, the students will be ready for a group task exam.								

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<tr><td></td><td colspan="16">2.Case study.</td></tr>
<tr><td rowspan="2">10Cs/6 LEARNINGGOALS</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
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<tr><td colspan="2">3h</td><td colspan="2">2h</td><td colspan="2"></td><td colspan="2">11h</td><td colspan="2">13h</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td>29</td></tr>
<tr><td>Module 6</td><td colspan="16">Marine Reserves and Zonal Management</td></tr>
<tr><td>Learning Outcomes</td><td colspan="16">At the end of this module students will be able to understand the appropriate use and process for developing MPA zones</td></tr>
<tr><td>Units</td><td colspan="16">Fisheries Refugio, Size, Location and Design
Spill-Over Effects, Replenishment Effects
Zonal Management Schemes to Address User Conflicts
Single Species Management vs Ecosystem Management
Adaptive Management
Case Studies: Different Processes for Implementing Marine Reserves
Case Studies: Examples of the Role of the Community in Implementing Marine Reserves
Case Studies: The Science, Politics and Economics of Reserve Design
Exercise: Design a Zonal Plan for Sustainable Fisheries that Complements Your
Sustainable Tourism Plan</td></tr>
<tr><td>Readings</td><td colspan="16">Allison, E.H. & Ellis, F. 2001. The livelihoods approach and management of small-scale fisheries. Marine Policy, 25(5): 377–388.
Allison, E.H. & Seeley, J.A. 2004. HIV and AIDS among fisherfolk: a threat to 'responsible fisheries'? Fish and Fisheries, 5(3): 215–234
Eknath, A.E. 1995. Managing aquatic genetic resources. Management example 4: the Nile tilapia, In J.E.</td></tr>
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<tr><td></td><td colspan="15">Thorpe, G. Gall, J.E. Lannan& C. E. Nash, eds. Conservation of fish and shellfish resources: managing diversity, pp. 176-194. London, Academic Press, Harcourt Brace Company, Publishers.

Eknath, A.E. & Doyle, R.W. 1990. Effective population size and rate of inbreeding in aquaculture of Indian major carps. Aquaculture, 85: 293–305.

Henson, S. J. &Mitullah, W. 2004. Kenyan exports of Nile Perch: impact of food safety standards on an export-oriented supply chain. World Bank Policy Research Working Paper No. 3349, Washington, DC, World Bank.

Henson, S. J., Brouder, A.M. &Mitullah, W. 2000. Food safety requirements and food exports from deeloping countries: the case of fish exports from Kenya to the European Union. American Journal of Agricultural Economics, 82(5): 1159–1169.</td></tr>
<tr><td>Activity</td><td colspan="15">Write a five-page essay Marine Reserves and Zonal Management in your

country and Discuss with students</td></tr>
<tr><td rowspan="2">10Cs/6 LEARNINGGOALS</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
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<tr><td rowspan="2">ECTS WORK LOAD</td><td colspan="2">Lecture</td><td colspan="2">Online</td><td>Lab</td><td colspan="2">Reading</td><td colspan="2">Course activity</td><td colspan="2">Project</td><td colspan="2">Prepare exam</td><td colspan="2">Writing exam</td><td>Total</td></tr>
<tr><td colspan="2">4h</td><td colspan="2">3h</td><td></td><td colspan="2">10h</td><td colspan="2">15h</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td>32</td></tr>
<tr><td>Module 7</td><td colspan="15">Sustainable Fisheries Management Planning</td></tr>
<tr><td>Learning Outcomes</td><td colspan="15">At the end of this module students will be able to:

Understanding of the steps to develop a sustainable fisheries plan</td></tr>
<tr><td>Units</td><td colspan="15">Making Good Coastal Resource and Fisheries Management Plans

Goals and Objectives of Sustainable Fisheries Plans

Resource Co-Management

Promoting Gear Innovation

Changing Fishing Practices

Promoting Gear Innovations

Behavioral incentives</td></tr>
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<tr><td></td><td>Specific Management Considerations for Different Habitat Types
Establishing Area-Based and Time-Based Restrictions
Integrated Zonal Methodology Planning
Interconnecting Issues in Fisheries Management
Fisheries-Related Enforcement
Importance of Monitoring and Evaluation
Information Management, Education and Outreach</td></tr>
<tr><td>Readings</td><td>Islam, F.U. 2007. Self-recruiting species (SRS) in aquaculture: their role in rural livelihoods in two areas of Bangladesh. Ph.D. Thesis, University of Sterling.

Jahan, K.M., Ahmed, M. & Belton, M. 2009. The impacts of aquaculture development on food security: lessons from Bangladesh. Aquaculture Research, 41(4):481-495.

Jamu, D. &Brummett, R. 2004. Opportunities and challenges for African aquaculture. In M.V. Gupta, D.M. Acosta & B.O. Bartley. Use of genetically improved and alien species for aquaculture and conservation of aquatic biodiversity in Africa, pp.1–9. Penang, Malaysia, Worldfish Center.

Marmulla, G., ed. 2001. Dams, fish and fisheries. Opportunities, challenges and conflict resolution. FAO Fisheries Technical Paper. No. 419. Rome, FAO. 2001. 166 p.

Martin, G. 2008. ACIAR fisheries projects in Indonesia: review and impact assessment. ACIAR Impact Assessment Series Report No. 55, 76 p.</td></tr>
<tr><td>Activity</td><td>Joint group of students develop a fisheries management action plan</td></tr>
<tr><td>10Cs/6 LEARNINGGOALS</td><td>
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<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>LG</td><td>BE</td><td>KN</td><td>LT</td><td>DO</td><td>GS</td><td>TRA</td></tr>
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<tr><td>3h</td><td>3h</td><td></td><td>11h</td><td>14h</td><td></td><td></td><td></td><td>31</td></tr>
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ECTS Integration in Course Curriculum. Please add a summary table

Learning Components	No	Time Factor	Workload	Course Modules								Workload
				1	**2**	**3**	**4**	**5**	6	7	8	
Lectures (face-to-face)	10	3	29	4	3	5	4	3	4	3	3	29
Online	6	3	19	2	2	3	2	2	3	2	3	19
Lab work	0	2	0									0
Reading articles (3 pages per hour)	160	0.3	48	5	6	4	5	6	10	6	6	48
Reading book chapters (5 per/h)	215	0.2	43	5	7	4	5	5	7	5	5	43
Preparing course activities	7	15	100	12	15	13	11	13	8	14	14	100
Project work	0	20	0									0
Preparation for exam	0	50	0									0
Writing the exam	0	1.5	0									0
Total			235	**26**	**32**	**27**	**27**	**29**	**32**	**31**	**31**	235

SDGs		CC	SA	FS	COURSE MODULE
1	End poverty in all its forms everywhere		X	X	1,2,3,4,5,6,7
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		X	X	1,2,3,4,6,7
3	Ensure healthy lives and promote well-being for all at all ages		X	X	1,4,7
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		X	X	1,4,7
5	Achieve gender equality and empower all women and girls		X	X	4

6	Ensure availability and sustainable management of water and sanitation for all		X	X	4,6
7	Ensure access to affordable, reliable, sustainable, and modern energy for all		X	X	2,4,6
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all		X	X	2,4,5
9	Build resilient infrastructure, promote inclusive, and sustainable industrialization and foster innovation		X	X	4,5
10	Reduce inequality within and among countries		X	X	3,4
11	Make cities and human settlements inclusive, safe, resilient, and sustainable		X	X	4
12	Ensure sustainable consumption and production patterns		X	X	2,3,4
13	Take urgent action to combat climate change and its impacts		X	X	1,2,4,5,6
14	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development		X	X	3,4
15	Protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss		X	X	4,7
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions on all levels		X	X	4,7
17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development		X	X	2,4


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS


Constructing knowledge
Critical thinking and problem solving
Communi-cation
Collabo-ration
Creativity and innovation
Connectivity and networking
Critical conscious-ness
Critical reflection
Cross/inter-cultural competence
Co-responsibility
ICTs as enabling tools for the 10Cs

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CCSAFS COURSE SYLLABUS

Jerash University

Course Syllabus

Course Number ( )

Course Title

The syllabus of Unsaturated Soil in Arid and Semi-arid Region

Semester ( )

Instructor Information

Instructor: **Prof Omer Maaitah**
Office Location: **Faculty of Agriculture Building**
Telephone: 0096796629922 Office
Hours (Times & Days).
E-mail: Maaitah_noor@hotmail.com
Website: http://www.jpu.edu.jo/jpu/profile.php?id=50

Course Identification Course Number:

Course Name: **The syllabus of Unsaturated Soil in Arid and Semi-arid Region**

Course Location: **Faculty of Agriculture**
Class Times: Not Now
Prerequisites: **Soil Science and Water**
Faculty Web Page: http://www.jpu.edu.jo/jpu/fac-about.php?id=13

Course Overview

In dealing with soil in arid and semi arid region, one requires not only the principles of mechanics and hydraulics but also of fundamental interfacial physics. Physics in this regard refers primarily to the thermodynamic principles describing equilibrium among gas, solid, and liquid phases, the transition of matter from one phase to another, and the adsorption or desorption of one

phase of matter onto or from an adjacent phase of different matter. The forces and energies associated with these multiphase interactions by their very nature separate unsaturated soil behavior from saturated soil behavior.

The application of the laws of mechanics, hydraulics, and interfacial physics to engineering problems dealing with partially saturated soils. The spirit of this definition and the laws, concepts, and problems that characterize it will be addressed throughout this course. The history of unsaturated soil is embedded in the history of hydrology, soil mechanics, and soil physics. Engineering problems involving unsaturated soil span numerous subdisciplines and practices

.

Course Learning Objectives:

- be acquainted with the main features of science and technology (SDG 5, 6,10 &13).
- be aware of the fundamental characteristics of unsaturated soil (SDG 5 &6)
- learn about the effete of climate change on soil (SDG 5, 6,13 &15)
- have sufficient background and practice in all types of soil and water flow in the unsaturated soil (SDG 5, 6,10 &15)
- learn more about suction, capillarity and their measurement (SDG 5, 6&13)
- be equipped with the awareness that information technology tools are likely to dominate all phases of research in Unsaturated Soil (SDG 5, 6,10, 13 &15)

Course Content Learning Outcomes:

Upon successful completion of this course, students will be able to:

- generate research in this topics (SDG 5, 6,10, 13 &15)
- develop good summaries of the current know ledge (SDG 5, 6&13)
- design experiment (SDG 5, 6,10, 13 &15)
- conduct research efficiently in this field (SDG 5, 6,10, 13 &15)

Course Resources.

A. Atterberg: *Über die physikalische Boden untersuchung, und über die plastizität der Tone,* Internationale Mitteilungen für Bodenkunde, Verlag für Fachliteratur, G.m.b.H. Berlin, 1911.

J.V. Boussinesq: *Application des potentiels á 1 etude de 1' équilibre et du mouvement des solides élastiques",* Paris, Gauthier Villars, 1885.

C.A. Couloumb: *Essai sur une application des régles de maximis et minimis á quelques problémes de statique relatifs à 1' architecture.* Mémoires de la Mathématique et de physique, présentés à 1'

Academie Royale des sciences, par divers Savans, et lûs dans sés Assemblées, Paris, De L' Imprimerie Royale, 1776.
W. Fellenius: *Caculation of the Stability of Earth Dams,* Trans. 2nd Congress on large Dams, Washington, 1979.
T.W. Lambe: *The Structure of Inorganic Soil,* Proc. ASCE, Vol. 79, Separate No. **315,** Oct., 1953.
O. Mohr: *Techiniche Mechanik,* Berlin, William Ernst und Sohn, 1906.
L. Prandtl: *Über die Härte plastischer Körper,* Nachrichten von der Königlichen Gesellschaft der Wissenschaften zu Göttingen (*Mathematisch—physikalische Klasse aus dem Jahre* 1920, Berlin, 1920).
W.J.M. Rankine: *On the Stability of Loose Earth,* Philosophical Transactions, Royal Society, London, 1857,

M.G. Spangler: *Soil Engineering,* International Textbook Company, Scranton, USA, 1951.
K. Terzaghi: *Erdbaumechanik auf bodenphysikalischer Grundlage,* Leipzig und Wien, Franz Deuticke Vienna, 1925.

Alam Singh and B.C. Punmia: *Soil Mechanics and Foundations*, Standard Book House, Delhi-6. .
A.W. Bishop: *The Measurement of Pore pressure in the Triaxial Test,* Pore pressure and Suction in soils, Butterworths, London, 1961.
A.W. Bishop, I. Alpan, E.E. Blight and I.B. Donald: *Factors controlling the strength of Partly Saturated Cohesive Soils,* Proc. ASCE Research conference on shear strength of cohesive soils, Boulder, Colorado, USA, 1960.
H. Darcy: *Les fontaines pulaliques de la ville de Dijon*, Paris : Dijon, 1856.
J. Dupuit: *Etudes théoretiques et pratiques sur la mouvement des eaux dans les canaux découvert et a travers les terrains perméables*, 2nd edition, Paris, Dunod, 1863.
A Hazen: *Some Physical Properties of Sand and Gravels with Special Reference to Their Use in Filtration*, Massachusetts State Board of Health, 24th Annual Report, 1892.
A Hazen: *Discussion of* '*Dams on Sand Foundations*', by A.C. Koenig, Transactions, ASCE, 1911.
IS : 2720 (Part XVII)—1986 : *Methods of test for soils – Laboratory Determination of Permeability*. IS : 2720 (Part XXXVI)—1987 : *Methods of test for soils—Laboratory Determination of Permeability of Granular Soils* (*constant head*).
. A.R. Jumikis: *Soil Mechanics*, D. Van Nostrand Co., Princeton, NJ, USA, 1962.

J.S. Kozeny: *Über Kapillare Leitung des wassers in Boden*, Berlin Wein Akademie, 1927. . T.W. Lambe: *The Measurement of Pore Water Pressures in Cohesionless Soils*, Proc 2nd Internal Conference SMFE, Rotterdam, 1948.
. T.W. Lambe: *Soil Testing for Engineers*, John Wiley and Sons, Inc., NY, USA, 1951.
T.W. Lambe and R.V. Whitman: *Soil Mechanics*, John Wiley and Sons, Inc., NY, USA, 1969.
. A.G. Loudon: *The Computation of Permeability from Simple Soil Tests, Geotechnique*, 1952. .
D.F. McCarthy: *Essentials of Soil Mechanics and Foundations*, Reston Publishing Co., Reston, VA, USA, 1977.
. A.S. Michaels and C.S. Lin: *The Permeability of Kaolinite*—Industrial and Engineering Chemistry, 1952.
M. Muskat: *The Flow of Homogeneous Fluids through Porous Media*, McGraw-Hill Book Co., New York, USA, 1937.
M. Muskat: *The Flow of Homogeneous Fluids Through Porous Media*, J.W. Edwards, 1946.
A.E. Scheidegger: *The Physics of Flow Through Porous Media*, The MacMillan Co., New York, USA, 1957.
S.B. Sehgal: *A Testbook of Soil Mechanics*, Metropolitan Book Co. Pvt. Ltd., Delhi-6, 1967. .
G.N. Smith: *Elements of Soil Mechanics for Civil and Mining Engineers*, 3rd edition, Metric, Crosby Lockwood Staples, London, 1974.
M.G. Spangler: *Soil Engineering,* International Test Book Company, Scranton, USA, 1951.
D.W. Taylor: *Fundamentals of Soil Mechanics*, John Wiley and Sons, Inc., New York, USA, 1948.
. K. Terzaghi and R.B. Peck: *Soil Mechanics in Engineering Practice*, John Wiley and Sons, Inc., 1948.
. A. Thiem: *Über die Ergiebig Keit artesicher Bohrlocher, Schachtbrunnen und Filtergalerien*, Journal für Gasbeleuchtung und Wasseracersorgung, 1870.
27. R.V. Whitman, A.M. Richardson, and K.A. Healy: *Time-lags in Pore pressure Measurements*, 5th International Conference SMFE, Paris, 1961.

Course Website(s)

Required Course Texts and Materials

Optional Course Texts and Materials

Assignments and Grading Scheme

Grading System

0 to 10 (where 5 is the least pass mark)

Grading Policy

Component	Grade
Assignments	80%
Exams	
Class Attendance/ Participation	20%
Total Points	100%

Course Policies

Late Assignments

It is essential that papers and other assignments be completed and submitted on time. Once the due date is past, without notice and justification, the submission is not accepted.

Classroom Protocol

This is a seminar type of course, which means that students are expected to all classes. You cannot pass the class under any circumstances if you miss more than three classes. Students are expected to arrive on time and stay until the class period ends. If you know that you have to leave early, you should notify me early before class starts. You are expected to treat faculty and other students with respect. During class students are obliged to not disrupt class by making noise and / or leaving and re-entering during class. Students who violate these minimal expectations will be asked to leave and counted as absent. You are expected to have read and thought about the assignment materials before you come to class. I expect active class participation, which counts for 20% of the grade.

Dissability

Students who have disabilities should have a confidential appointment to discuss their needs for accommodations. Establishing reasonable accommodations should be considered on a case- by- case basis.

Course Syllabus

Week No.	Subject Title	Subject Details
1. week 2 lectures	**Chapter one** Introduction soil in arid and semi arid region	Role of Climate on soil Definition of Unsaturated Soil Types of Problem associated with unsaturated soil Terminology and Definitions Historical Developments and background Summary of Unsaturated Soils Examples Typical Profiles of Unsaturated Soils Phases of an Unsaturated Soil Need for Unsaturated Soil
week2 2 lecture	Chapter two 2Lecture Phase Properties and Relations	Properties of the Individual Phases Density and Specific Volume Soil particles Water phase Air phase Viscosity Surface Tension Interaction of Air and Water Solid, Liquid, and Vapor States of Water Water Vapor Air Dissolving in Water Solubiliry of Air in Water Diffusion of Gases through Water

Week 3	Chapter three Volume-Mass Relations	Porosity Void Ratio Degree of Saturation Water Content Soil Density Basic Volume-Mass Relationship Changes in Volume-Mass Properties Density of Mixtures Subjected to Compression of the Air Phase Piston-porous stone analogy Conservation of mass applied to a mixture Soil particles-water-air mixture Air-water mixture
Week 4 Week 5	Chapter Four Measurements of Soil Suction	Theory of Soil Suction Components of Soil Suction Typical Suction Values and Their Measuring Devices Capillarity Capillary Height Capillary Pressure Height of Capillary Rise and Radius Effects Measurements of Total Suction Psychrometers Seebeck effects Peltier effects Peltier psychrometer Psychrometer calibration Principle of measurement (filter paper method) Measurement and calibration techniques (filter The use of the filter paper method in practice Filter paper paper method Measurements of Matric Suction

		High Air Entry Disks Direct measurements Tensiometers Osmotic tensiometers Axis-translation technique Indirect Measurements Thermal conductivity Measurements of Osmotic Suction Squeezing technique
Week 6 Week 7	Chapter five Flow Laws	Flow of Water Driving Potential for Water Phase Darcy's Law for Unsaturated Soils Coefficient of Permeability with Respect to the Water Phase Fluid and porous medium components Relationship between permeability and volume- Effect of variations in degree of saturation on Relationship between coefficient of permeability and soil Hysteresis of the permeability suction permeability Relationship between permeability and matric suction Relationship between permeability and volumetric water content
Week 8 Week 9	Chapter six Flow of Air	Driving Potential for Air Phase Fick's Law for Air Phase Coefficient of Permeability with Respect to Air Phase Relationship between air coefficient of permeability and matric suction Diffusion Air Diffusion Through Water

		Chemical Diffusion Through Water Summary of Flow Laws
Week 10 Week 11	Chapter seven Measurement of Permeability	Measurement of Water Coefficient of Permeability Direct Methods to Measure Water Coefficient of Permeability Laboratory test methods Steady-state method Computations using steady-state method Presentation of water coefficients Difficulties with the steady-state method Instantaneous profile method In situ field methods In situ instantaneous profile method Computations for the in situ instantaneous Permeability
Week 12	Chapter eight Pore Pressure Parameters	Compressibility of Pore Fluids Air Compressibility Water Compressibility Compressibility of Air-Water Mixtures The use of pore pressure parameters in the compressibility equation
Week 13 Case study		
Week 14 Field trip		
Week 15 Student Presentations		
Week 16 Final exam		

Unsaturated Soil in Arid and Semi-arid Region -COURSE MODULE

Course	Unsaturated Soil in Arid and Semi-arid Region
Module 1	**Effect of Climate Change on soil**
Key Concepts	Introduction soil in arid and semi arid region Phase Properties and Relations
Overview	This module provides a general overview of effect of climate on soil and the basic concept on soil and soil physics. Climate projections for the Middle East and North African (MENA) region soil indicate warmer and drier conditions. Soil moisture affects the Agriculture.
Aim	The overriding aim of this module is to turn students able to understand the following: 1. Introduce the basic concept of the soil to the students 2. Provide a basic understanding of the role of the climate. 3. Provide a basic understanding of the workings of the global climate system.
Learning Outcomes	At the end of this module students will be able to: 1. Gain a general understanding of the issues of Climate Change and soil. 2. Understand and critically assess the concepts of basic relation of the soil 3. Understand the behavior of soil in arid and semi-arid region
Units	1. Role of Climate on soil 2. Definition of Unsaturated Soil 3. Types of Problem associated with unsaturated soil 4. Terminology and Definitions 5. Historical Developments and background 6. Summary of Unsaturated Soils Examples 7. Typical Profiles of Unsaturated Soils 8. Phases of an Unsaturated Soil 9. Need for Unsaturated Soil 10. Properties of the Individual Phases 11. Density and Specific Volume 12. Soil particles 13. Water phase 14. Air phase 15. Viscosity 16. Surface Tension 17. Interaction of Air and Water 18. Solid, Liquid, and Vapor States of Water 19. Water Vapor

	20. Air Dissolving in Water 21. Solubiliry of Air in Water 22. Diffusion of Gases through Water
Readings	Soil Mechanics for Unsaturated Soils (D. G. Freund, Ph. D and. Rahurc) *G.* E. Blight, "Flow of Air through Soils," *ASCE J. Soil Mech. Found. Eng. Div.,* vol. 97, SM4, pp. 607-624, 1971
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.

10Cs/6 LEARNING GOALS	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
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SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
					√	√			√	√			√	√			

Module 2	**Suction**
Key Concepts	Osmotic suction, matric suction, tensiometers, Measurements technique of Suction, Axis-translation technique, capillarity, and Thermal conductivity
Overview	This module will provide an overview of soil suction. It will focus on the theory of suction and Measurements technique of Suction. The module will provide concept of capillarity and the basic of soil physics
Aim	Objectives Upon completion of this course, students should be able to: 1. Use critical reading skills to guide interpretation of articles in the theory of matric suction. 2. Identify the key principles of water retention; 3. Describe several different models of suction measurements. 4. able to understand most of the problem in soil physics
Learning Outcomes	At the end of this module students will be able to: 1. Learn how the mechanism of soil suction 2. Learn to think critically about capillarity and surface tension

	3. Gain knowledge about suction measurement
Units	1. Theory of Soil Suction 2. Components of Soil Suction 3. Typical Suction Values and Their Measuring Devices 4. Capillarity 5. Capillary Height 6. Capillary Pressure 7. Height of Capillary Rise and Radius Effects 8. Measurements of Total Suction 9. Psychrometers 10. Seebeck effects 11. Peltier effects 12. Peltier psychrometer 13. Psychrometer calibration 14. Principle of measurement (filter paper method) 15. Measurement and calibration techniques (filter 16. The use of the filter paper method in practice 17. Filter paper paper method 18. Measurements of Matric Suction 19. High Air Entry Disks 20. Direct measurements Tensiometers 21. Osmotic tensiometers 22. Axis-translation technique 23. Indirect Measurements 24. Thermal conductivity 25. Measurements of Osmotic Suction 26. Squeezing technique
Readings	A. W. Bishop, “The Measurement of Pore Pressure in Triaxial Test,” in *Proc. Con$ Pore Pressure and Suction in Soils.* London: Butterworths, 1960, pp. 38-46. A. W. Bishop, “Discussion on General Principles and Laboratory Measurements,” in *Proc. Con$ Pore Pressure and Suction in Soils.*

	W. Bernatzik, “The Determination of the Capillary Rise in Sand by Means of Prism Pressure Test,’’ in *Proc. 2nd Int. Con$ Soil Mech. Found. Eng.* (Rotterdam, The Netherlands), vol. *5 ,* 1948, p. 28 D. G. Fredlund, “Prediction of Ground Movements in Swelling Clays,’’ presented at the 31st Annu. Soil Mech. Found. Eng. Conf., ASCE, Invited Lecture, Minneapolis, MN, 1983
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.

10Cs/6 LEARNINGGOALS	1	2	3	4	5	6	7	8	9	10	LG	BE	KN	LT	DO	GS	TRA
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	

SDGs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
					√	√			√	√			√	√			

Module 3	**Flow of water**
Key Concepts	Permeability, upward and down ward flux, filed method
Overview	This module will provide students for an overview of water in arid and semi region. The module looks at unsaturated flow. Students will gain basic understanding of the environmental problems caused by arid and semi arid region on sustainable agriculture.
Aim	Objectives Upon completion of this course, students should be able to: 1. Understand ways of adapting to climate change and managing the environment keeping in mind effect of arid soil. 2. To understand the concept of water flow in arid soil.
Learning Outcomes	At the end of this module students will be able to: 1. Understands the capillarity and suction. 2. Identify the problem in suction measurement.

Units	1. Flow of Water 2. Driving Potential for Water Phase 3. Darcy's Law for Unsaturated Soils 4. Coefficient of Permeability with Respect to the Water Phase 5. Fluid and porous medium components 6. Relationship between permeability and volume 7. Effect of variations in degree of saturation on soil 8. Relationship between coefficient of permeability and soil 9. Hysteresis of the permeability suction 10. Permeability and degree of saturation 11. Permeability and matric suction 12. Permeability and volumetric water content 13. Measurement of Water Coefficient of Permeability 14. Direct Methods to Measure Water Coefficient of Permeability 15. Laboratory test methods 16. Steady-state method 17. Apparatus for steady-state method 18. Computations using steady-state method 19. Presentation of water coefficients of 20. Difficulties with the steady-state method 21. Instantaneous profile method 22. Instantaneous profile method proposed by 23. Computations for the instantaneous profile 24. In situ field methods 25. In situ instantaneous profile method 26. Computations for the in situ instantaneous Permeability
Readings	D. *G .* Fredlund, "Comparison of Soil Suction and One-Dimensional Consolidation Characteristics of a Highly Plastic Clay," Nat. Res. Council Tech. Report No. 245. v, Div. of Building Res., Ottawa, Ont., Canada, 26 pp., July 1964. D. G. Fredlund. "Consolidometer Test Pmcedural Factors Affecting Swell Properties," in *Proc. 2nd Con$ Expansive Cby Soils.* College Station, TX: Texas A and M Press, 1969,

	D. *G.* Fredlund, “Manual of Volume Change Test Procedures for Unsaturated Soils,’’ Internal Note SM12, Univ. of Alberta, Edmonton, Alta., Canada, 1972. D. G. Fredlund, “Volume Change Behavior of Unsaturated Soils,” Ph.D. dissertation, Univ. of Alberta, Edmonton, Alta., Canada, 490 pp.. 1973.															
Activity	1. Seminars / Lectures; a series of lectures and seminars. 2. Group exam task with presentation; with the acquired understanding achieved through the course. 3. The students will also be asked to write critical summaries on the lectures content. 4. For each unit the students will submit an individual reflection paper of approximately 1000 words.																
10Cs/6 LEARNINGGOALS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**LG**	**BE**	**KN**	**LT**	**DO**	**GS**	**TRA**
	√	√	√	√	√	√	√	√	√	√		√	√		√	√	
SDGs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
					√	√			√	√			√	√			

Table 1. A 10 ECTS workload allocation for the course “Climate Change, Sustainable Agriculture, and Food Security”.

Learning Components	**No**	**Time Factor**	**Workload**	**Workload**			
				1	**2**	**3**	
Lectures (face-to face)	24	1.5	**36**	12	12	12	**36**
Online	5	2.2	**11**	1	4	6	**11**
Lab work	8	2	**16**	6	6	4	**16**
Reading articles (3 pages per hour)	210	0.3	**63**	22	21	20	**63**

Reading book chapters (5 per/h)	150	0.2	**30**	9	10	11	**30**
Preparing course activities	4	9.5	**38**	10	12	16	**38**
Project work	6	8.5	**51**	15	21	15	**51**
Preparation for exam	2	23	**46**	12	16	18	**46**
Writing the exam	2	1.5	**3**			3	**3**
Total				**87**	**102**	**105**	**294**

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