

Course title: Food Security and Agriculture			
Course code: NRE 168	No. of credits: 3	L-T-P: 26-16-06	Learning hours: 45
Pre-requisite course code and title (if any):			
(i) Environmental Geosciences – NRE 139			
(ii) Introduction to sustainable development – NRE 165			
(iii) Basics of climate sciences – NRC 131 (Optional ... only for MSc in CSP students)			
Department: Energy and Environment			
Course coordinator:		Course instructor: Dr. Chubamenla Jamir	
Contact details: chubamenla.jamir@terisas.ac.in			
Course type: Elective		Course offered in: Semester 3	
<p>Course Description</p> <p>Changing climate and management of environment and natural resources (e.g., water, soil nutrients, etc.) has become a major issue of concern at both regional and global level, influencing livelihood of people, especially the less advantaged people, in the developing countries. Both these factors have a major interplay with the arable agricultural systems especially in the developing countries and are key to livelihood of majority of the population and subsequently food security and sustainability in these regions. Achieving food security remains a major social, political and economic issue both globally as well as at regional level. It is more challenging in developing countries where effort to address the issue of food insecurity are hampered by environmental and climatic changes (e.g., pollution, rainfall pattern, global temperature, etc.) and depletion of natural resources (e.g., soil degradation, ground water depletion and contamination). In view of this, sound research, strategic decision-making and management for sustainable development of agriculture and food supply systems are the need of the hour.</p> <p>The main aim of the course is to provide students with the necessary knowledge, understanding and skills to contribute effectively to research, decision and policymaking, and management of climate, environmental and natural resources towards a food secure and sustainable future. Such knowledge and skills will be useful for employment in various interdisciplinary academic and professional fields related to climate change and natural resource management.</p> <p>Through this course, the students will first gain an understanding of the food security and its inter-relationship with the environment and climate through its linkages with arable agricultural systems. The students will then learn how global climate change, environmental pollution and natural resources management influences the key components of food security. They will also learn ways of adapting to the changing climate and environment and how this can aid in achieving food security and sustainability through science and technological advancements, policy economic and social intervention. These will be first studied at the global scale in general and later studied in more detail at a regional level (India) through various case studies related to what has been taught in the lectures.</p> <p>Skill set</p> <ol style="list-style-type: none"> 1. A good understanding of inter-relationship between climate change, environment, food security and sustainability at global and regional (India) level. 2. To understand the concept of food security and issues in achieving it. 3. Understand ways of adapting to climate change and managing the environment keeping in mind food security and sustainability. <p>Course objectives</p> <ol style="list-style-type: none"> 1. A good understanding of inter-relationship between climate change, environment, food security and sustainability at global and regional (India) level. 2. To understand the concept of food security and issues in achieving it. 3. Understand ways of adapting to climate change and managing the environment keeping in mind food security and sustainability. 			

Course content				
Module	Topic	L	T	P
1.	<p>Environment, climate and food security</p> <p>Food security concept; types of food insecurity; poverty, hunger and malnutrition; [4]</p> <p>Inter-relationship between environment, climate and agricultural (arable agriculture and livestock) and non-agricultural (marine; fresh water; forests) food production; impact on food security. [2]</p> <p>Role of arable agriculture in increasing and decreasing climate change and natural resources; how this can subsequently impact food security. [1]</p> <p>Case study</p> <p>Climate change and food security problems in global and regional (India) context. [6]</p> <p>Practical</p> <p>Crop growth models- computer software</p>	7	6	2
2.	<p>Food production (availability)</p> <p>Current production of food from different sources (global and regional); Issues/ constraints for food production. [1]</p> <p><i>Adapting to changing climate and management of environment towards food security and sustainability.</i> [3]</p> <p>Methods and strategies for improving crop yield under climate and environment stress- plant breeding, bio-pesticides, GM crops; sustainable agriculture; traditional agriculture; agro-ecology; organic agriculture; subsistence agriculture; and, resource management systems (e.g., IWRM, INRM, IPM, etc.).</p> <p>Case study</p> <p>Recent research developments and impact on agricultural food production. [4]</p>	4	4	
3.	<p>Accessibility of food resources</p> <p>Issues for food accessibility and affordability; how changing climate and environment are likely to impact access to adequate food and energy; competition between food and fuel (fuel from plants sources). [2]</p>	2		
4.	<p>Food distribution</p> <p>The food supply chain (from producers to consumers) - harvesting, transportation, storage, marketing and equitable distribution; impact of changing environment and climate on equitable distribution of food. [3]</p>	3		
5.	<p>Food safety</p> <p>Nutritional security, balanced diet, hunger and human health; Impact of various abiotic environmental pollutants (air, water and soil) and changing climate (heat stress, drought) factors and biotic factors (pests) on quality of food crops; impact on health of farmers. [3]</p>	3		
6.	<p>Policy, economic and social aspect of food</p> <p>Economics and policy of food security; role of institutions (e.g., FAO, NABARD, FCI, NAFED, RRB, APMC); agricultural planning in India (including recommendations of various committees for e.g., Bhutani committee, RB Gupta Committee, K N Raj Committee, etc.). [2]</p>	4	6	

	Economic viability of (a) small-scale agriculture, (b) regional food systems; farmers' income and livelihood; agricultural financing, credit and crop insurance, challenges ahead. [1] Changing dietary habits and its impact on food security, climate and environment. [1] Case study [6]			
7.	Food security assessment tools	3		
8.	Field trip Visit to agricultural research institutes (e.g., IARI) to learn different experimental facilities for studying agricultural crop and environment interaction.			4
	Total	26	16	6
Evaluation criteria				
<ul style="list-style-type: none"> ▪ Tutorial assignments 2: 40 (20 each) ▪ Test 1: 20 ▪ Test 3: 40 				
Learning outcomes				
<ul style="list-style-type: none"> • A good understanding of inter-relationship between climate change, environment, food security and sustainability at global and regional (India) level. • To understand the concept of food security and issues in achieving it. • Understand ways of adapting to climate change and managing the environment keeping in mind food security and sustainability. 				
Pedagogical approach				
Materials				
Required text				
<ol style="list-style-type: none"> 1. 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 2. Interna W. (2004) Climate Change and India, Universities Press, India. 3. Reynolds M. P. (2010) <i>Climate Change and Crop Production</i>, CABI Series in Climate Change, Volume I. CABI Publishing, UK. 4. Wani S.P., Rockstrom J. And Oweis T. eds. (2009) <i>Rainfed Agriculture: Unlocking the Potential</i>, Comprehensive Assessment of Water Management in Agriculture Series (7), CAB International, Wallingford, Oxon, UK. 				
Suggested readings				
<ol style="list-style-type: none"> 1. Beddington J., Asaduzzaman M., Clark M., Fernández A., Guillou M., Jahn M., Erda L., Mamo T., Van Bo N., Nobre C.A., Scholes R., Sharma R. and Wakhungu J. (2012) <i>Achieving Food Security in the Face of Climate Change: Final Report from the Commission on Sustainable Agriculture and Climate Change</i>. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark, Available online at: www.ccafs.cgiar.org/commission. 2. FAO, WFP and IFAD. 2012. <i>The State of Food Insecurity in the World 2012. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition</i>, Rome, FAO. http://www.fao.org/docrep/016/i3027e/i3027e.pdf 3. Giovannucci D., Scherr S., Nierenberg D., Hebebrand C., Shapiro J., Milder J. and Wheeler K. (2012) <i>Food and Agriculture: The Future of Sustainability</i>, 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 				

4. 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

Case studies

Websites

Journals

1. Agriculture and food security – Springer
2. Agriculture, Ecosystems and Environment
3. Current Opinion in Environmental Sustainability
4. Environmental Science & Policy
5. Fields crops research
6. Food security – Springer
7. Indian Journal of Agricultural Sciences
8. Kulshetra
9. Nature Climate Change
10. Science

Additional information (if any)

Student responsibilities

Attendance, feedback, discipline, guest faculty etc

Courses Reviewers

1. Prof. P.C. Tiwari, Kumaon University, Sleepy Hollow, Nainital.
2. Prof. C.K. Varshney, former Professor, School of Environmental Sciences, JNU, New Delhi.
3. Dr. Lisa D. Emberson, Stockholm Environment Institute, York, UK.
4. Sir John T. Houghton, former IPCC co-chair, JRI, UK.