Course title: Ecology			
Course code: NRE 121	**No. of credits:** 3	**L-T-P:** 25-13-8	**Learning hours:** 42
Pre-requisite course code and title (if any):			
Department: Department of Energy and Environment			
Course coordinator:	**Course instructor:** Prof. C.K. Varshney		
Contact details:			
Course type: Core	**Course offered in:** Semester 1		

Course Description

The course will lead the students through the different levels of the living world starting with the biology of organisms, continues through populations and introduces finally in communities. In the last part of the course the students will be introduced and work on case studies related to each of those levels.

The course work will be guided by work on scientific papers and field experience.

Course objectives

- The course will introduce students to the techniques that ecologists use to develop hypotheses and observe these in the field
- To draw through different levels of the living world (biology of organism to communities)
- To introduce and work on case studies related to each of these levels.

Course content

SNo	Topic	L	T	P
1.	Part 0: Introduction **Earth as a live supporting system** Life support on earth, human systems Definitions	**1**		
2.	Part 1: Organisms **Organisms in their environments: evolutionary background** Discussion on the Wallace (1855), Natural selection and adaptation, speciation, impact of earth history	**1**	**1**	
3.	**Conditions and Resources** Conditions: Ecological niches, temperature, pH, salinity, physical factors Recourses: radiation, carbon dioxide (C_3 and C_4 plants), nutrients, oxygen	**2**		
4.	**Life, death and life histories** What is an individual/population, life cycle Life table, life history, options set and fitness contours	**2**		
5.	Intraspecific competition and dynamics Intraspecific competition, mortality, regulation of population size and density, models, territoriality,	**2**		
6.	Dispersal, Migration in time, Metapopulations Active and passive dispersal, patterns of distribution, patterns of migration, inbreeding-outbreeting, philopatry, dispersal within populations, demographic significance of dispersal, demography of metapopulations	**2**		

7.	Application Students will be introduced to cases as examples for the application of the knowledge about organisms		**2**	
8.	Part 2: Species Interactions **Interspecific Competition** Type of species interaction, ecological and evolutionary aspects, competitive exclusion principle, niches and coexistence	**1**		
9.	Predation Forms of predation, defence response, effect on prey population, foraging approaches, Population dynamics of predation	**2**		
10.	Decomposers and Detritivoures Organisms, role of decomposers and detrivores, detrivores-resource interactions	**2**		
11.	Parasitism, Symbiosis and Mutualism Definitions, types of parasitism, effect parasites on hosts and hosts population, populations dynamics of infections Symbiosis, examples of mutualism	**2**		
12.	Application Students will work on cases as examples for the application of species interaction		**2**	
13.	Part 3: Communities and Ecosystems **Community dynamics** Introduction, description of community composition, community pattern in space and time Succession, types of succession, species replacement during succession, biological underlying mechanisms, patch dynamics, Journal article to work on	**2**	**2**	
14.	Energy and Productivity Definition of ecosystem, pattern in primary production, limiting factors, energy flow in ecosystems Journal article to work on	**2**	**2**	
15.	Nutrient cycling Energy flux and nutrient cycling, nutrient budgets (terrestrical, aquatic), biochemical cycles (H_2O,N, P, K) Journal article to work on	**2**	**2**	
16.	Population interaction and food webs Community structure and competition, niche differentiation in space and time, equilibrium and noneequilibrium, food web structure, productivity and stability, trophic levels	**2**		
17.	Application Students will work on cases in the field of restoration and conservation		**2**	
18.	Part 4: Field trip **Field trip in Delhi** Students will work on small projects conducted during the field to green areas in and around Delhi			**8**

Additional Module				
	Global Vegetation Classification System. Life forms of World Terrestrial vegetation and Functional traits.	**3**		
	Essential Climate and Biodiversity Variables. A quantitative approach to vegetation – climate interaction, History of modelling impacts of Climate change on Vegetation	**2**	**2**	
	India's National Communication to United Nations Framework on Convention on Climate Change (UNFCCCC)			
		30	**15**	**8**

Evaluation criteria

- 1 minor test: 25%
- Practicals: 25%
- Major test: 50%

Learning outcomes

Upon completion of this course, a fully-engaged student will be able to:

- Define important scientific/ecological terms.
- Describe important ecological processes
- Use the scientific method to design an ecological study in the lab and/or field.
- Demonstrate knowledge of the important ecological principles operating at different levels of organization

Pedagogical approach

Materials

Required text

Barnes Z., Denton and Spurr (1988) *Forest Ecology*, 4th Edition, John Wiley and Sons, New York.

Begon M., Townsend C.R. and Harper J.L. (2006) *Ecology: From Individuals to Ecosystems,* 4th Edition, Balckwell Publishers, Malden - Oxford-Carlton.

Odum E.P. (2007) *Ecology: A Bridge between Science and Society*.

Suggested readings

Champion and Seth (1968) *Forest Types of India*, Government of India Press, New Delhi.

Chazdon R.L. and Whitmore T.C. (2002) *Foundations of Tropical Forest Biology, The University of Chicago Press*, Chicago & London.

GaneshaiahK.N., Uma Shaanker R. and Bawa K.S. (2001) *Tropical Ecosystems: Structure, Diversity and Human Welfare*, Oxford & IBH.

Herman H.S. (1998)*Terrestrial Ecosystems in Changing Environments*, Cambridge University Press.

Judith H.M. (2003)*Ecology and Control of Introduced Plants*, Cambridge University Press.

McPherson G.R. and DeStefano S. (2003)*Applied Ecology and Natural Resource Management*, Cambridge.

Odum E.P.(2005)*Fundamentals of Ecology*, Natraj Publishers, Dehradun.

Packham J.R. and Willis A.J. (1997)*Ecology of Dune, Salt Marsh and Shingle***,** Chapman.

Scheffer M. (1997) *Ecology of Shallow Lakes*, Chapman and Hall.

Tewari D.N. (1994)*Desert Ecosystem*, International Book Distributors, Dehradun.

Thomas P.A. (200)*Trees: Their Natural History*, Cambridge University Press.

Turner M. and Gardner R.H**.**(2001)*Landscape Ecology in Theory and Practice: Pattern and Process***,** Springer Verlag.

Case studies

Websites

Journals
Journal of Applied Ecology
Journal of Ecology
Journal of Tropical Ecology

Additional information (if any)

Articles used in the Course

Kira T. (1978) Community Architecture and Organic Matter Dynamics in Tropical Rain Forests of Southeast Asia with Spezial Reference to Pasoh Forest, West Malaysia, In: P.B. Tomlinson u. M. H. Zimmermann (Ed..) *Tropical Trees as Living Systems*, Cambridge Univ. Press, S. 561-590.

Wallace A.R. (1895) On the Law which has regulated the introduction of new species, p 51-62 in Chazdon R.L. and Whitemore T.C. eds (2002) *Foundation of Tropical Forest Biology*, The University of Chicago Press.

Withmore T.C. (1998) *Forest Dynamics*,Kapitel 7 in, An Introduction to Tropical Rain Forests, Oxford University Press, S. 109-155.

Withmore T.C. (1998) *Nutrients and their Cycles*, Kapitel 8 in, An Introduction to Tropical Rain Forests, Oxford University Press, S. 156-178.

Student responsibilities

The students are expected to submit assignments in time and come prepared with readings when provided.