Course title: Ecology			
Course code: NRE 121	**No. of credits:** 3	**L-T-P:** 33-08-08	**Learning hours:** 45
Pre-requisite course code and title (if any):			
Department: Natural and Applied Sciences			
Course coordinator:		**Course instructor:**	
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 to landscape and ecosystem restoration 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 (organism, populations, communities, ecosystems. landscape, biomes and biosphere)
- To introduce and work on case studies related to each of these levels.
- To help student possess good communicating skills, problem-solving and writing skills.

Course content

Module	Topic	L	T	P
1.	**Ecology:** Definition and scope of ecology, history; types of ecology; definitions of population, community, ecosystem, landscape, biome and biosphere. Biotic and abiotic factors, soils and their types. Scales in ecology. **Evolution and ecology** - origin of species; Darwin Wallace theory of inheritance. Linkages between evolution and ecology.	5 4		
2.	**Population ecology:** Population attributes, age distribution, life tables and survivorship curves, growth models, species interactions; niche concept. **Community ecology:** Community structure, habitats and niches, two-species interactions, prey-predator interaction, food webs. succession; Climax communities; Biodiversity- types and uses; Methods of studying communities.	4 6	 4	
3.	**Ecosystem ecology:** Ecosystem organisation and processes, types of ecosystems, energy flow, production, nutrient cycling, and hydrological cycling; ecosystem integrity, resilience and health; diversity-stability paradox, ecosystem services – types and benefits from different ecosystems. **Landscape Ecology:** Island biogeography theory; biogeographic zones of India. Patch, matrix and corridor model of landscapes; metapopulations, heterogeneity, patterns; fragmentation; flows between landscape elements and ecosystems.	6 4	2	
4.	**Ecosystem Restoration:** Definition, Ecosystem degradation, disturbance**,** reference ecosystem, attributes of restored ecosystems**;** preparation of restoration plan; ecosystem approach for environment	4	2	

	management; Tools for preparation of restoration plans.			
5.	**Field Work:** Visit to Aravalli/Yamuna biodiversity park/Okhla bird sanctuary and submission of report by students; Estimation of density and relative abundance of species using quadrats; estimation of species diversity.			**8**
		33	**8**	**8**

Evaluation criteria

- Minor Test: 25%
- Minor Test 2 (Practicals): 25%
- Major Test: 50%

Learning outcomes

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

- Define important ecological terms.
- Describe important ecological processes
- Use the scientific methods to design an ecological study.
- Demonstrate knowledge of the important ecological principles operating at different levels of organizations

Pedagogical approach

Course is intended to provide an understanding of the ecological principles which will help students learn essential skills in theory and practice of ecology through lectures, presentations and discussions. Students will be exposed to advanced knowledge through journals and online material. They will also be given assignments on case studies and asked to make presentations on learning of ecosystem and landscape ecology, and ecosystem restoration.

Materials

Required text

1. Molles, M.C. and Sher, A.A (2018) Ecology – Concepts and Applications, Eighth Edition, McGraw Hill Education,
2. Smith, T.M. and Smith, R.L. (2014) *Elements of Ecology*, Pearson
3. Stiling, P. (2012) *Ecology – Global Insights and Investigations*, McGraw Hill
4. Mittelbach, G.G. and McGill, B.J. (2019) *Community Ecology,* Second Edition, Oxford University

Suggested readings

5. Cox, C. Barry, Moore, P.D. and Ladle, R.J. (2016) *Biogeography – An Ecological and Evolutionary Approach*, Ninth Edition, Wiley Blackwell
6. Krebs, C.J. (2013) *Ecology – The Experimental Analysis of Distribution and Abundance*, Sixth Edition, Pearson.
7. Odum E.P. and Barret, G.W. (2005) *Fundamentals of Ecology*, Fifth Edition, Thomson Brooks/Cole
8. Greipsson, S. (2011) *Restoration Ecology*, Jonnes & Barellet Learning.
9. Jelte van Andel and James Aronson (editors) (2006). *Restoration ecology*: *The New Frontier*, Blackwell Publishing, 319p
10. Turner M. and Gardner R.H**.** (2015) *Landscape Ecology in Theory and Practice: Pattern and Process***,** Springer Verlag.
11. Walker, P. and Wood, E. (2010) *Ecology Experiments*, Infobase Publishing
12. Misra, R. (2013) *Ecology Workbook*, Scientific Publishers

Journals

1. Journal of Applied Ecology
2. Journal of Ecology
3. Journal of Tropical Ecology

4. Ecological Indicators
5. Biological Conservation

Additional information (if any)

Articles used in the Course

1. Brown, E.D. and Williams, B.K. (2016) Ecological integrity assessment as a metric of biodiversity: are we measuring what we say we are? *Biodiversity Conservation*, 25: 1011-1035.Springer. DOI 10.1007/s10531-016-1111-0.
2. Török,P. Helm, A. (2017) Ecological theory provides strong support for habitat restoration, *Biological Conservation*, 206: 85–91; Elsevier
3. Rezaa, M.I.H. and Abdullaha, S.A. (Regional Index of Ecological Integrity: A need for sustainable management of natural resources, Ecological Indicators 11: 220–229. Elsevier.
4. Qiuqin, Z. Zhang, T. and Liu, X. (2018). Index System to Evaluate the Quarries Ecological Restoration, *Sustainability*, 10, 619; doi:10.3390/su10030619

Students will be provided with more research papers during teaching of the course

Student responsibilities

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

Reviewed by

- Prof. CK Varshney, Prof. Brij Gopal, Prof. KG Saxena and Prof. KS Rao