Urban Resilience and Adaptation for India and Mongolia
curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
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Template syllabus of the Revised courses

Course Name: ECOL: 462: LANDSCAPE ECOLOGY AND PLANNING

Period: Spring semester

Coordinator	**Dr. Subhankar Chatterjee**
Credits	3
Lecturers	The class will meet for 180 minutes each week over the spring semester for lectures. *In-class activities* will be of 50 hours & students will work on course learning activities like reading, writing, problem-solving, assignment, project framing, and other lab-related work –(*independent activities* 100 hours)
Level	Postgraduate
Host institution	Pondicherry University
Course duration	18 weeks
New/revised	Revised

Summary

Ecology is a broad scientific discipline that focuses on interactions, most typically involving organisms. Landscape ecology is the study of the causes of environmental patterns and the consequences of spatial heterogeneity and patterns on ecological processes. Landscape ecology provides concepts, theories, and methods that emphasize the importance of spatial patterning on the dynamics of interacting ecosystems, how to characterize the patterning, and how it might change through time. In studying landscape ecology, one will understand the dominant themes of the field, familiarize with its current research trends, and explore applications of the landscape approach. The course should be useful to students in ecology and natural resources as well as conservation biology, landscape architecture, geography, land use planning, and other related fields. As a discipline, it provides us with a new way of viewing and investigating ecological systems.

Diverse aspects of spatial patterning, its causes, development, and importance for ecological processes will be taught in this course so that students can independently apply the knowledge of landscape ecology for both management and conservation purposes.

Target student audiences

Master students majoring in Ecology and Environmental Sciences, environmental engineering, conservation biology, landscape architecture, geography, and land use planning, will be the target audiences.

Prerequisites

Required courses (or equivalents): No prerequisite courses are required although a basic understanding of ecology and environmental sciences (high school/graduate level) will be an added advantage. Strong English language skill (verbal and writing) is essential. Supplementary reading and writing courses may be advisable for students with English as a second language. Basic computer operation (Windows/Mac) knowledge is necessary for lab-related activities.

Aims and objectives

The main course objective is to make the students in-depth understanding of the concepts and salient features of Landscape ecology. Students will get an overview of the field along with current concepts, methods, and applications of landscape ecology. With hands-on training on quantitative tools of landscape ecology, field-related projects and reading-writing assignments will enable students to develop or apply these tools and concepts in their studies and/or research.

The Authentic Tasks are:

General learning outcomes:

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

1. Understand the current concepts of landscape ecology and the scale, scaling techniques, and spatial patterns.
2. Explain how ecological systems are dynamic in space and time
3. Infer the abiotic and biotic processes that structure landscape mosaics and patterns of biodiversity at multiple spatial scales;
4. Explain the basis of spatial pattern analysis using continuous and categorical spatial data;
5. Use standard software packages and the tools specific to landscape ecology, run and interpret the results of simple landscape models to answer questions about heterogeneity, scale, and ecosystem dynamics.
6. Review the theory, methodology, and application of landscape ecology to contemporary issues in conservation biology and resource management;
7. Conduct independent research in landscape ecology, including proposal writing, implementation, oral/poster presentation, and written manuscripts/popular articles.

Overview of sessions and teaching methods

Interactive and self-reflective methods of teaching and learning will be followed. A lecture followed by a student-led discussion and hands-on computational exercises on quantitative methods that are used in landscape ecology will be included. Exercise-based (continues internal assessment), student-directed learning approach will be followed where research-based teaching-learning and application of theory into practical problem solving will be given priority.

Learning methods

- In class Lectures (face-to-face)
- E-learning materials – Video lectures
- Literature review and assignment submission: reading and discussion of literature reflecting state-of-the-art research in the field and preparation of assignment based on this.
- Hands-on exercises designed to provide experience with some of the quantitative tools of landscape ecology
- One minor project – Fieldtrip, data collection, analysis, and report presentation

SYLLABUS:

ECOL: 462- LANDSCAPE ECOLOGY AND PLANNING

UNIT – I Land and Landscape processes; Hierarchy: ecosystems to land units; Ecological principles at work with Landscapes; From Ecosystem ecology to Landscape Ecology. **(8 hrs)**

UNIT – II Spatial Heterogeneity and Landscape; History of Landscape Ecology; Concept of Scale and technological advances; Patch – Corridor – Matrix model – Disturbance, remnant, environmental, and introduced patches. **(8hrs)**

UNIT – III Patches as Islands – Patch Size and Edge effect; Habitat Fragmentation and Nonnative Species; Metapopulation Dynamics and Appropriate Management; Understanding Landscape Structure Using Landscape Metrics – Composition, Shape, Configuration; Spatial statistics – spatial independence, spatial structure, and spatial interpolation. **(8hrs)**

UNIT – IV Land Use/Cover Change; Ecosystem and biodiversity impacts; Organisms and landscape pattern; Ecosystems processes on landscapes; Inventory and Tools for wasteland

assessment and evaluation; Land Reclamation and Restoration; Natural hazard mitigation/erosion; Concept of ecological land degradation – desertification, deforestation, waterlogging, salinization and soil erosion. **(8hrs)**

UNIT – V Landscape ecology Practices in Planning: Landscape Connectivity and Urban Networks – Parks, greenbelts and greenways/green infrastructure; Designing Landscapes and Urban Sustainability. Field Report – Participatory Sketch Mapping of Landscape Features. **(8hrs)**

Text Books

1. Turner MG Gardner, RH, 2015. Landscape Ecology in Theory and Practice, 2nd Edition, Springer Nature.
2. Lopez, RD, Frohn, RC, 2017. Remote Sensing for Landscape Ecology: New Metric Indicators CRC Press; 2 edition
3. Forman RTT, and M Godron.1986. Landscape ecology. Wiley, New York.

Supplementary Books

1. Risser PG, JR Karr, and RTT Forman.1984. Landscape ecology: directions and approaches. Special Publ. No. 2, I11. Natural Hist. Surv., Champaign.
2. Turner MG.1989. Landscape ecology: the effect of pattern on process. Ann. Rev. Ecol. Syst. 20:171-197.
3. Turner MG.2005. Landscape ecology: what is the state of the science? Annu. Rev. Ecol. Evol. Syst. 36:319-44.
4. Forman RTT.1995. Land mosaics: the ecology of landscapes and regions. Cambridge University Press, Cambridge, England.

Course Outline:

Week -1	Introduction of the course: General overview of Landscape ecology and planning
	Scope of landscape ecology: Definitions and Scale
	Land and Landscape processes
Week -2	Hierarchy: ecosystems to land units;
	Ecological principles at work with Landscapes
	Lab 1: Creating landscape pattern
Week -3	From Ecosystem ecology to Landscape Ecology
	Exam-1 (UNIT-I)
Week - 4	Spatial Heterogeneity and Landscape
	History of Landscape Ecology
Week - 5	Concept of Scale and technological advances;
	Patch – Corridor – Matrix model
	Lab 2: Using neutral landscape models
Week - 6	Disturbance, remnant, environmental, and introduced patches.
	Exam-2 (UNIT-II)
Week - 7	**Assignment submission and presentation**
Week - 8	Patches as Islands – Patch Size and Edge effect
	Habitat Fragmentation and Nonnative Species; Metapopulation Dynamics and Appropriate Management
Week - 9	Understanding Landscape Structure Using Landscape Metrics – Composition, Shape, Configuration
	Lab 3: Understanding landscape metrics
	Lab 4: Understanding landscape metrics continued
Week - 10	Spatial statistics – spatial independence, spatial structure, and spatial interpolation
	Lab 5: Scale detection using spatial stats
	Exam-3 (UNIT-III)
Week - 11	Land Use/Cover Change; Ecosystem and biodiversity impacts
	Organisms and landscape pattern; Ecosystems processes on landscapes
	Lab 6: Spatial dynamics of ecosystem processes
Week - 12	Inventory and Tools for wasteland assessment and evaluation
	Land Reclamation and Restoration
	Natural hazard mitigation/erosion
Week - 13	Concept of ecological land degradation – desertification, deforestation, waterlogging, salinization, and soil erosion
	Exam-4 (UNIT-IV)
Week - 14	**Assignment submission and presentation**
Week - 15	Landscape ecology Practices in Planning: Landscape Connectivity and Urban Networks – Parks, greenbelts, and greenways/green infrastructure
	Lab 7: Assessing multi-scale landscape connectivity
Week - 16	Designing Landscapes and Urban Sustainability.

Week - 17	Field Report – Participatory Sketch Mapping of Landscape Features
	Exam-5 (UNIT-V)
Week - 18	**Assignment submission and presentation**

Course workload

The table below summarizes course workload distribution:

Activities	Learning outcomes	Assessment	Estimated workload (hours)
In-class activities (50 hours)			
Lectures and in-class discussion	Students will be able to (i) understand the current concepts of landscape ecology scale, scaling techniques, and spatial pattern; (ii) explain how ecological systems are dynamic in space and time; (iii) infer the abiotic and biotic processes that structure landscape mosaics and patterns of biodiversity at multiple spatial scales; (iv) explain the basis of spatial pattern analysis using continuous and categorical spatial data.	Class participation and active involvement in discussion	33 hours
Lab work and in-class participation	Students will be able to use standard software packages and the tools specific to landscape ecology, run and interpret the results of simple landscape models to answer questions about heterogeneity, scale, and ecosystem dynamics.	Class participation and performance in the lab work (e.g. timely submission of the results and quality of the work done)	7 hours
Reading assignments and discussion of assigned papers (*All the students are expected to have read the assignment before class and given thought to the paper's content and context*).	Review the theory, methodology, and application of landscape ecology to contemporary issues in conservation biology and resource management	Active contribution to Discussion, presentation, and taking part in the question-answer session	10 hours

Activities	Learning outcomes	Assessment	Estimated workload (hours)
Independent work (100 hours)			
Group work: Execution of Project & Project presentation (In group or individual)	Ability to conceptualize the framework of landscape ecology, collect and critical interpretation of data, teamwork, problem-solving, group discussion, convey the ideas clearly, ability to make the presentation, effective communication, and respond to audience	The merit of the project and individual presentations	30 hours
Take-home exam - In this course, multiple take-home examinations will be assigned that will require students to use the methodology and techniques learned in the lab exercises.	The exam will ask students to address a series of real-world questions pertinent to landscape ecology using the approaches, computer programs, and information provided during the course.	Performance and quality of the answers.	20 hours
Group presentation	A short, 20-minute, conference-style presentation will facilitate the students to use the concepts,tools, and methods for communicating the strategy developed	Quality of the assignments and individual presentations	25 hours
Individual study	Understanding of concepts, application framework, and, comprehensive knowledge of landscape ecology and planning	Quality of answers to questions in the final term exam	25 hours
Total			***150 hours***

Grading

The student's performance will be based on the following:

Continuous internal Assessment (10%):	Marks will be calculated based on the performance in the exam (at end of each unit, exams 1 to 5) during the course
Progress assessment (10%):	(i) Exercise (5%): students have to complete the take-home exam on the topic assigned during the course
	(ii) Assignment completion and presentation (5%): Journal paper review and presentation
Project completion and presentation (20%):	Either the entire class will be divided into groups of 4-5 students and will be assigned a group project or individual students will be assigned a particular topic for the project work.
Final assessment (60%):	Final examination (60%)

Evaluation

Performances of students in each paper are expressed in terms of marks as well as in Letter Grades. In the case of fractions, the marks shall be rounded off to the nearest integer. The class interval to award the grades can be arrived at by dividing the difference between the highest mark secured and the minimum pass mark by 6 as there are six passing grades. The formula is given below:

K = (X-50)/6

Where, K = class interval, X= the highest mark in the subject. The grades may be awarded as given in the following Table II.

Table II

Range of Marks in %	**Letter Grade**	**Points for Calculate of CGPA**
X to (X-K)+1	O	10
(X-K) to (X-2K)+1	A+	9
(X-2K) to (X-3K)+1	A	8

(X-3K) to (X-4K)+1	B+	7
(X-4K) to (X-5K)+1	B	6
(X-5K) to 50	C	5
Below 50	F	0
Failure due to lack of attendance	FA	0

K should not be rounded off to less than two decimal places. The numbers given in the Range of Marks column, (X-K), (X-2K), (X-3K), etc., can be rounded off to the nearest whole number.

In courses where the number of students who have secured 50 marks and above is less than 10then grading may be given based on Table III.

Table III

Range of Marks in %	**Letter Grade**	**Points for Calculate of CGPA**
81-100	O	10
71-80	A+	9
66-70	A	8
61-65	B+	7
56-60	B	6
50-55	C	5
Below 50	F	0
Failure due to lack of attendance	FA	0

In order to declare the pass, a Student should get
a) A minimum of 40% marks in the end-semester exam, and
b) A minimum of 50% marks in aggregate when Internal Assessment and End-Semester marks are added.

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