SYLLABUS

Masters of Science in Wildlife Management and Biodiversity Conservation

2024

Tribhuvan University
Institute of Forestry
Kirtipur,
Kathmandu

FOREWORD

The Master of Science degree in Wildlife Management and Biodiversity Conservation, conferred by Tribhuvan University, stands as an advanced educational milestone designed to cultivate adept professionals in the field of forestry. This academic journey has been shaped by a commitment to excellence, and the number of curriculum revisions ensures that the course is aligned with the changing context. The curriculum overhaul is an integral part of the Institute of Forestry's (IOF) comprehensive review process. This revision aims to fortify the students' proficiency in applying fundamental principles of forestry and natural resource science to address contemporary challenges in professional practice.

At the heart of this revision process lies a collaborative spirit, with experts and stakeholders engaged at both national and international levels. Leveraging their insights, the curriculum has been crafted aiming that equip students to confront the evolving issues within forest science. The courses introduced are strategically designed to tackle the myriad challenges associated with Forest management, particularly in the face of escalating global changes. The envisioned outcome is to empower students with analytical skills, decision-making abilities, and the capacity to address the multifaceted nature of problems inherent in the field of wildlife while balancing the trade-off between ecological and societal needs.

Embarking on this new academic journey, the subjects are identified considering these multiple roles of forestry, where the subject committees and faculty board of the IOF took a leadership role in shaping it. Moreover, many individuals and institutions have contributed directly and indirectly to bring this curriculum to this shape. This is also an outcome of the consultative processes carried out at different levels. I express my sincere thanks to internal and external experts, subject committee chairs and members, and the Faculty Board for their kind cooperation and contributions. Special appreciation is extended to the ALIGN project WWF Nepal for their financial support in the preparation of the syllabus. Further, I would like to extend my special thanks to the Academic Council of Tribhuvan University for approving this curriculum. I appreciate the contribution of curriculum revision committee members Associate Prof. Dr. Sony Baral, Prof. Dr. Krishna Raj Tiwari, Prof. Dr. Rajesh Kumar Rai, Associate Prof. Dr. Narayan Prasad Gautam and Associate Prof. Dr. Menuka Maharjan, IOF for revising the M.Sc. syllabus with leaving no stone unturn.

I am confident that our students will serve as warriors for addressing the planetary crisis, that we are now facing, such as global climate change, biodiversity losses, and environmental issues. Moreover, they will serve in the sustainable management of the global commons. As we step into this renewed academic chapter, we remain committed to upholding the highest standards of education and fostering a learning environment that prepares our students to be leaders and innovators in their respective fields.

Prof. Bir Bahadur Khanal Chhetri, PhD
Dean

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INTRODUCTION

Wildlife is currently grappling with a confluence of challenges, including climate change, biodiversity loss, and the need for sustainable production and development on a global scale. This has led to an escalating level of pressure and threats on forests, which serve as pivotal entities in addressing numerous national and international challenges. The role of the academics is pivotal in addressing these global challenges. In response to the evolving demands of the market, the Master's program in 'Wildlife Management and Biodiversity Conservation' has been revised to enhance the skills of students and preparing them to navigate the diverse aspects of technical, field, and policy dimensions within the wildlife conservation sector. The program is designed not only to equip students with the knowledge necessary to address complex national and international forest and biodiversity challenges but also to empower them to seek, negotiate, and implement solutions in the face of a rapidly changing world.

The Institute of Forestry (IOF) aims to provide high quality education, developing critical thinking skills, and preparing students for their future careers in forestry and natural resources sectors. This is achieved through a multifaceted approach encompassing extensive field research, a dynamic forest lab, an on-campus museum, and impactful outreach programs. Established in 1947 AD, the IOF is the pioneer institute dedicated to imparting comprehensive knowledge and technical expertise in Forestry and allied sectors. As a hub for advanced education in forestry, the Institute of Forestry continues to play a pivotal role in developing skilled professionals and the sustainable management of Nepal's rich natural resources.

The IOF has been offering academic degrees, Bachelor's in forestry, Masters and PhD programs in various fields of Forest Science, including Forestry; Community Forestry; Wildlife Management and Biodiversity Conservation; Mountain Environment and Development Studies; Watershed Management; and Natural Resource Management and Rural Development. The IOF periodically revises the curriculum, engaging academicians, development practitioners, researchers, and policymakers to provide students with the current state of knowledge on forestry sciences and make them competent to address the emerging issues and challenges in the forestry sector. The M.Sc. programs have been designed as per the increasing needs of the diverse areas and expanding context and career landscape at the national and international levels. Considering the forest is key to addressing many of these national and international challenges diverse Master programs have been introduced and revised as per the need.

The updated course streamlines the learning process by introducing a unified first-year curriculum, ensuring that students, regardless of their specialization (Forestry, Wildlife Management and Biodiversity Conservation, Natural Resources Management and Rural Development, Watershed Management, Mountain Environment and Development Studies, Community Forestry), develop a foundational understanding of crucial interdisciplinary concepts against the backdrop of pressing issues such as policy, forestry, climate change, biodiversity loss, and pollution. The primary objective of the program is to produce well-trained and skillful human resources with advanced management and research techniques in the field of wildlife management and biodiversity conservation. The other specific objectives of the course are:

- Familiarize the students with the theoretical and practical concepts of wildlife management and biodiversity conservation

- Building competency to undertake research in the fields of Biodiversity, Wildlife biology, and Nature conservation.

For this program adopts a pragmatic, field-based teaching approach, emphasizing applied learning structures. Our graduates will be equipped with a versatile skill set that positions them to ascend in government service, attain notable success in academic pursuits, establish themselves as successful entrepreneurs, and secure high-profile green jobs. The comprehensive academic journey will prepare them to thrive in various career paths and to contribute significantly to their chosen fields.

PROGRAM DURATION AND ACADEMIC SESSION

The Wildlife Management and Biodiversity Conservation program will span two academic years, comprising a total of four semesters. The First semester focuses on the theoretical aspects of forest and natural resource management. The second semester emphasized on tools and techniques required for data collection and analysis. The Third semester focuses on Park recreation and tourism, Natural resource safeguards in infrastructure, Human-wildlife interface management, and Conservation biology. The Fourth semester is allocated for conducting research and sharing their findings.

COURSE CODE AND CODE NUMBERS

The course code provided in this curriculum comprises a concise representation of the Subject Committee, including a number and additional information enclosed in parentheses. The initial abbreviated text within the course code signifies the specific Subject Committee category to which the course belongs. The abbreviations corresponding to the course codes are outlined below:

PWM: Park Recreation and Wildlife Management
SFB: Silviculture and Forest Biology
SFM: Social Forestry and Forest Management
WME: Watershed Management
FPE: Forest Products and Engineering
BSH: Basic Science and Humanities

Students have the option to take any of the courses as extra electives in addition to the required courses for their enrolled Master's degree program

ADMISSION, EVALUATION, AND AWARD OF DEGREE

An applicant must have at least a 4-year B.Sc. Forestry, Environmental Science, or Zoology degree from Tribhuvan University or any university recognized by Tribhuvan University. All students must appear in the entrance examination administered by the Examination Section of the IOF and are selected for admission based on their merit score. Both academic achievements and performance in the entrance examination will play a crucial role in the admission process.

Evaluation and Examination System

Students are internally and externally evaluated each semester. Forty percent marks are set aside for 40% marks for internal assessments and 60% marks for the final exam. To pass the examination, students must secure 50% marks in the final exam, internal assessment, and practical examinations separately. A statement of marks is issued to students after the result is published for that particular semester. However, the internal examination marks will be given to the students by the respective course coordinator after the completion of the task. Students must appear in the final written examination scheduled at the end of the semester. Students cannot attend the final examinations without passing the internal assessment. Students who do not pass the regular semester examination can appear in the make-up examination. However, the students must fill up the examination form for the respective semester to enter the next semester.

The internal assessment can be divided into different activities such as assignments and attendance. Assignments include fieldwork, laboratory work, term papers, class presentations, unit tests, report writing, project work, and home assignments. The internal assessment will be evaluated by the responsible faculty. The responsible faculty will, in advance, notify the students of the criteria of evaluation for the respective courses.

The internal evaluation of the student will be monitored by the external expert(s). Expert(s) will be assigned by the exam control division based on the relevancy of the subject area. The expert(s) will facilitate to improvement of the evaluation process, coverage, relevancy and assigned tasks to the students from the internal evaluator(s)/faculties. S/he does have the authority to change the marks given by the internal evaluator if needed.

The thesis of the student will be evaluated by the Research Assessment Committee (RAC) coordinated by the main supervisor, and internal and external experts. The internal expert will be nominated by the respective campus and the external expert will be nominated by the exam control division based on the relevancy of the subject area.

Attendance Requirement

A student must attend at least 80% of classes in each subject. Attendance carries 20% marks on the internal assessment. Failure to fulfill the attendance requirement by a student may result in his/her disqualification to appear in the final examination. But, in specific cases (seriously ill, out-of-control situations) students having 70% attendance are allowed to appear for the final examination. In this case, the student should submit a medical certificate for the seriously ill, and a certificate of the concerned authority in other cases.

Academic Transcript and Grading System

After the successful completion of all the requirements prescribed by the course curriculum, a student will be eligible for the award of an M.Sc. degree in the respective programs. An academic transcript is issued by the Controller of Examination of Tribhuvan University to students who have fulfilled all requirements. The academic standard of students is based on the cumulative percentage of marks secured in all examinations. The IOF adopted the grading system indicated in credit transfer, grading system, and the academic transcript study report of 2020 approved by TU Academic Council decision no 64 on 2078/1/14 [Table 1].

Table 1: Grading System for M.Sc. Program

Grade	**GPA**	**Grading Scale (in %)**	**Performance**
A	4.0	90-100	Outstanding
A-	3.7	80- less than 90	Excellent
B+	3.3	70-less than 80	Very good
B	3.0	60- less than 70	Good
B-	2.7	50 -less than 60	Satisfactory
F	0.0	Less than 50	Fail

In this system, a student has to receive a minimum of 2.7 GPA or letter "B-" grade to pass each course.

In every semester, students will be given Semester Grade Point Average (SGPA) using the following calculation

$$\text{SGPA} = \frac{Total\ Grade\ Point\ earned\ in\ a\ semester}{Total\ Number\ of\ credit\ registered\ in\ a\ semester}$$

Based on the grades earned in each semester, Cumulative Grade Point Average (CGPA) will be calculated as follows:

$$\text{CGPA} = \frac{Total\ Grade\ Point\ earned}{Total\ Number\ of\ credits\ completed}$$

SEMESTER-WISE COURSE BREAKDOWN

Semester I	Course	Credit	Page Number
SFM 501	Forest and Environment Policy	3	7
SFM 502	Nature and Society	3	11
WME 503	Water- Energy-Food- Ecosystem Nexus	3	15
PWM 504	Landscape Management and Biodiversity Conservation	3	20
SFM 505	Natural Resource Management in Changing Environment	3	24
Semester II			
WME 551	Geoinformatics for NRM	3	28
BSH 552	Research Design and Scientific Writing	3	32
BSH 553	Advanced Statistics	3	36
SFM 554	Natural Resource Economics	3	39
PWM 551	Wildlife and Protected Area Management	3	42
Semester III			
PWM 614	Park Recreation and Tourism	3	47
PWM 615	Natural Resource Safeguards in Infrastructure	3	51
PWM 616	Human-Wildlife Interface Management	3	57
PWM 617	Conservation Biology	3	61
PWM 618	Wildlife Management Tools and Techniques (Optional)	3	65
SFM 606	Natural Resource Professional Ethics (Optional)	3	70
Semester IV			
PWM 651	Proposal	2	74
PWM 652	Pre-defense	2	74
PWM 699	Dissertation	9	74
PWM 653	Manuscript of Research Work	2	74

COURSE DESCRIPTIONS

SEMESTER I

COURSE TITLE: FORESTS AND ENVIRONMENT POLICY

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
SFM 501	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: Forest and other environmental policies play an important role in sustainable resource management. This course is designed to introduce students to the contextual understanding of policies that have shaped the management of renewable resources (i.e., forest, wildlife, water, etc.) in Nepal and beyond. Throughout the course, students will learn ideas behind natural resource policies and try to understand their role in broader natural resource decision-making.

OBJECTIVES: The objectives of this course are to:

- To facilitate student learning in forest and environmental policymaking and be able to apply this understanding to case studies of environmental and natural resource policy issues.
- To familiarize students with the development of key national and international policies for natural resources and environmental sustainability.
- To familiarize students with the organizational and administrative structure and policy-making processes of the major federal natural resource management agencies in Nepal.
- To facilitate students in their ability to critique and evaluate policy processes and policy outcomes in the context of emerging market issues and changing natural resource conditions.

LEARNING OUTCOMES: Upon the completion of this course, the students will be able to

- Have a clear understanding of the evolution and administrative functionalities of major forest and environmental policies in Nepal.
- Understand the public policy formulation process in national and international contexts.
- Understand the evolution of environmentalism in national and international contexts.
- Be familiar with the various policies and regulations in Nepal pertaining to environment and natural resources.

COURSE CONTENTS

UNIT 1: INTRODUCTION TO FOREST AND ENVIRONMENTAL POLICY (6)

1.1 Natural Resource Management and Politics
1.2 Importance of Public Policy
1.3 Evolution of Environmental Policy (forest, watershed, wildlife)
1.4 Global Challenges in Natural Resource Management / Planetary Crisis
1.5 Tragedy of the Commons
1.6 Externalities and Market Failure

UNIT 2: POLICY PROCESS MODELS (8)

2.1 Economic, Political, and Ethical Perspectives on Environmental Policy
2.2 Natural Resource Policy as a Process
2.3 Public (forest/watershed/wildlife) Policy Formulation Process in Nepal
2.4 Environmental Sustainability and Natural Resource Policies
2.5 Criteria for Policy Analysis

UNIT 3: ENVIRONMENTALISM AND ENVIRONMENTAL POLICIES (8)

3.1 Environmentalism and its Impact on Policies
3.2 Theoretical Foundation: Ecocentrism, Anthropocentrism, and Deep Ecology
3.3 Emergence of Environmental Impact Assessment as a Policy Tool
3.4 Endangered Species Conservation and International Trade

UNIT 4: INTERNATIONAL CONSERVATION POLICIES (4)

4.1 International Convention Joining and Withdrawal Process
4.2 Earth Summit 1992 and its Outcome Conventions
4.3 International Climate Agreements and their Effectiveness

UNIT 5: SECTORAL POLICIES IN NEPAL (6)

5.1 Constitutional Provisions Related to Natural Resources
5.2 Sectoral Policies (Other) and Natural Resource Conservation
5.3 Synergies in Natural Resource Related Policies (Climate, Environmental, Forests, Watershed, Wildlife)
5.4 Natural Resource Revenue Sharing Mechanism

PRACTICAL (16)

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
History of policies (Sectoral) in Nepal	Literature	Literature Review and Presentation	Unit 1, 4
Policy analysis of Nepal Forest/Environment/Watershed/ climate policy (Outcomes)	Policy document	Group work / Report	Unit 2
Improving EIA in Nepal	Expert Consultation	Group work / Critiques and Suggestions	Unit 3
Status and Challenges of International Treaties in Nepal	Literature, Expert Consultation	Group work/ Report	Unit 5
Policies in Nepal	Literature	Review / Class Discussion	Unit 6

KEY REFERENCES

Unit 1

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Unit 2

1. Bromley, D. W., & Paavola, J. (2002). Economics, ethics and environmental policy. *Economics, ethics, and environmental policy: contested choices*, 261-276.
2. Cubbage, F. W., Laughlin, J. O' & Peterson, M. N. (2017). Natural Resource Policy. Waveland Press, Inc. 10-digit ISBN: 1-4786-2965-X; 13-digit ISBN: 978-1-4786-2955-9.
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Unit 3

1. Balistrieri, Carlo A. (1993). CITES: The ESA and international trade. *Natural Resources & Environment* 8, no. 1: 33-76.
2. Bullard, R. D., & Johnson, G. S. (2000). Environmentalism and public policy: Environmental justice: Grassroots activism and its impact on public policy decision making. *Journal of social issues*, *56*(3), 555-578.
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Unit 4

1. Almer, C., & Winkler, R. (2017). Analyzing the effectiveness of international environmental policies: The case of the Kyoto Protocol. *Journal of Environmental Economics and Management*, *82*, 125-151.
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Unit 5

1. Constitution of Nepal 2015.
2. Nepal Kanun Kitab Byabastha Samiti (Acts – Land, Infrastructure, Mine, Industry, Hydropower).
3. National Natural Resource and Fiscal Commission Act.
4. National Natural Resource and Fiscal Commission. (2017). Recommendation on the Distribution of Royalties from Natural Resources Mobilization.

COURSE TITLE: NATURE AND SOCIETY

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
SFM 502	3	48 (32+16)	75 (45+30)

Note: 1 Credit= 16 Lecture Hours

SCOPE: This course covers key theoretical concepts and approaches in social sciences as they relate to understanding and describing the relationship between society and nature. It is intended to help students develop contemporary knowledge and practical skills in assessing and analyzing the causes and solutions of natural resource problems by integrating concepts and foundational theories in social science disciplines.

OBJECTIVES: The objectives of this course are to:

- Foster an understanding of the evolution of human-nature relationships
- Develop a deeper understanding of the complex dynamics of coupled human and natural systems
- Enhance knowledge regarding various social science theories in explaining and predicting human behavior in the context of natural resource management
- Develop a critical foundation for further research on human-nature interactions with using the concepts and skills of conservation social science

LEARNING OUTCOMES: Upon the completion of this course, the students are expected to be able to:

- Know a range of foundational theories in social science to explain and predict the interaction between humans and nature
- Understand the evolving complexity of human and natural systems, including disturbance and adaptation
- Identify and evaluate the importance of cultural and economic institutions in the sustainability of natural resources
- Become familiar with diverse ways human values, beliefs, and norms relate to their behavior toward nature and,
- Integrate ideas and practices from contemporary social science in planning, decision-making, and policy regarding sustainable management of natural resources.

COURSE CONTENTS

UNIT 1: FOUNDATIONS OF NATURE AND SOCIETY (5)

1.1 Human History and Nature
1.2 Equilibrium and Non-Equilibrium Ecology
1.3 Philosophical Foundation of Nature-Human Relationship (Eco-centric, Anthropocentric)
1.4 The Social Construction of Nature
1.5 Nature and Culture

UNIT 2: CHANGES, CHALLENGES, AND PARADIGM SHIFT IN CONSERVATION (6)

2.1 Anthropocene Biosphere
2.2 Planetary Boundaries
2.3 Limits to Growth
2.4 Ecological Modernization
2.5 Bright Green Environmentalism
2.6 Eco-centric vs Anthropocentric

UNIT 3: HUMAN NATURE INTERACTION (8)

3.1 Social-Ecological Systems
3.2 Common Property Regimes
3.3 The Community Capital Framework
3.4 Collective Actions and Impact
3.5 Intermediate Disturbance Hypothesis

UNIT 4: SOCIAL CONTEXT OF NATURE-BASED SERVICES (5)

4.1 The Worth of Nature to Humans
4.2 Ecosystem Marketplace as a Solution
4.3 Climate Change and Social Cost of Carbon
4.4 Opportunity Cost Approach in Conservation Priorities
4.5 Environmental Consumerism

UNIT 5: CULTURE AND WORLDVIEWS (8)

5.1 Drivers of Human Behaviors
5.1.1 Theory of Behavior
5.1.2 Value-Belief Norm Theory
5.2 Demographic Influences on Conservation Values
5.3 Nature-Culture/Indigenous People Relationship
5.4 Social Trust in Natural Resource Management

PRACTICAL (16)

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
Indigenous community (ethnic group) and nature relationship (Ethnicity/culture-wise group)	Literature review/ reading materials	Group discussion	Unit 1
Influence of human-nature Interaction on Nepal's Forest/environment/wildlife /Watershed Policy Development	Literature review	Group presentation	Unit 2
Social-ecological system	Field	A report on SES / Group	Unit 3

KEY REFERENCES

TEXT BOOK

1. Misiune, I., Depellegrin, D., & Egarter Vigl., L. (2022). *Human-Nature Interactions: Exploring Nature's Values Across Landscapes* (p. 438). Springer Nature.

Unit 1

1. Kai N. Lee., W. R. Freudenburg., and R. B. Howarth. (2013). *Humans in the Landscape: An Introduction to Environmental Studies*. Pages 258-86.
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Unit 2

1. Lee, K. N., Freudenburg, W., & Howarth, R. (2012). *Humans in the landscape: an introduction to environmental studies*. WW Norton & Company.
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Unit 4

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2. Dasgupta Review
3. Westman, W. E. (1977). How Much Are Nature's Services Worth? *Science* 197: 960-964

4. Costanza, R., De Groot, R., Sutton, P., Van der Ploeg, S., Anderson, S. J., Kubiszewski, I., ... & Turner, R. K. (2014). Changes in the global value of ecosystem services. *Global environmental change*, *26*, 152-158.
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Unit 5

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COURSE TITLE: WATER-ENERGY-FOOD-ECOSYSTEM NEXUS

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
WME 503	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: Water, energy, land/food, and ecosystems (WEFE) are critical for nutrition and food security, healthy ecosystems, resilient economies, and sustainable development. Single disciplinary (or silo) approach has limitations to achieve the interconnected development goals (e.g., sustainable development goals) in inclusive manner whereas the nexus approach considers the interconnections among the sectors, quantifies synergies and trade-offs of an intervention, and also has the potential to serve as a climate change adaptation and human security solutions. However, governments, stakeholders, and investors are struggling to manage systems change in the WEFE nexus and ensure that the changes are robust under changing climate and evolving interactions among natural and human systems. In this context, this course starts with the context of natural resources under stress, introduces associated concepts, and then evolves into the system approach, nexus concept and principles, entry points for inclusion, system interactions, nexus assessment tools, nexus in practice and nexus future perspective. It includes theoretical sessions, assignments, practical/presentation sessions, and field studies. The course is divided into 5 chapters and 20 sub-chapters, with four sub-chapters in each chapter.

OBJECTIVES: This course aims for the following learning objectives

- To familiarize with the fundamentals of WEFE nexus in the context of natural resources management and climate change
- To enhance knowledge and skill in nexus assessment
- To provide exposure to practical cases and challenges for implementing WEFE nexus using context-specific and participatory approaches
- To deepen understanding of institutionalizing WEFE nexus
- To provide a future outlook of WEFE nexus as a sustainability agenda from people-centric lenses and Gender Equality, Disability and Social Inclusion (GEDSI) perspectives

LEARNING OUTCOMES: Upon the completion of this course, learners are expected to

- Internalize the nexus concept and apply as a solution in planning and designing natural resources development and management problems
- Develop interdisciplinary programs in a professional career with a focus on broader national goals rather than sector-specific goals
- Develop skills to engage with stakeholders to develop sustainable and participatory practices for WEFE nexus management
- Develop number of demonstrated cases of nexus solutions during professional practice and share in public domain

COURSE CONTENTS

UNIT 1: UNDERSTANDING OF NEXUS (6)

1.1 Stress in Natural Resources: Trends in Natural Resources Availability and Demand; Concept of Footprints (water, energy, and carbon footprints); Planetary Boundaries
1.2 System Approach: Understanding of a System and System Approach; Need of Integration Across Sectors; Evolution of the Nexus Thinking Approach (limits to growth, sustainability, and nexus)
1.3 WEFE Nexus: Concept, Principles, and Added Benefits
1.4 Entry Points for Inclusion in Nexus Interventions

UNIT 2: SYSTEM INTERACTION (6)

2.1 Water-Energy
2.2 Water-Food
2.3 Food-Energy
2.4 Interdependences and Inter-Linkages Across Multiple Systems (e.g., water, energy, food, ecosystem/biodiversity): Tradeoff and Synergies

UNIT 3: ASSESSMENT TOOLS (9)

3.1 Assessment Process and Information Flow: Steps, Actors, Location, and Sectors
3.2 Various Types of Tools and Data
3.3 FAO Rapid Appraisal Tools and WEF Nexus Tool 2.0 (including demonstration of tool)
3.4 Scenario Analysis and Practical Challenges: Evaluating Impacts in the Changed Context (institutional changes, climate/environmental/socio-economic changes, policy changes, etc.)

UNIT 4: NEXUS IN PRACTICE (6)

4.1 Dissecting Nexused Relationships on Existing Practices: Case Studies Highlighting Different Aspects of Nexus in Practice
4.2 Risks and Costs to Different Social Groups
4.3 Policy and Institutional Reforms
4.4 GEDSI and Indigenous Knowledge

UNIT 5: NEXUS FUTURE PERSPECTIVE (5)

5.1 Nexus Governance: Fundamentals of Governance and Nexus Governance; Frameworks for Governance Analysis; Improving Sectoral Governance and for Nexus Gains
5.2 Streamlining WEFE Nexus as a Common Agenda: Promoting Dialogue (between science, policy, practice/industry, private sector); Nexus Mainstreaming
5.3 Addressing Bottlenecks for Implementing Inclusive Solutions for WEFE Nexus Gains: Technical/Engineering Solutions; Nature-Based Solutions; Governance Solutions
5.4 Monitoring, Evaluation, Accountability and Learning (MEAL) Framework for Maximizing Nexus Gains

PRACTICAL (16)

- **Group assignment**: Divide the participants into different groups, each consisting of 3-5 persons. Ask the participants to identify one practical case that they are engaged with, characterize the WEFE nexus in that case, and then submit an assignment report as well as a presentation in class. There will be more discussions and inputs in the class from the instructor as well as other participants (beyond that particular group) to visualize the practical cases of the WEFE nexus. (4 hrs)

- **Assignment on application of FAO tool and WEFE nexus 2.0**: Based on data provided for a real or hypothetical case study for simulating WEFE nexus 2.0, and demonstration made in Chapter 3, students will prepare and submit a report on analysis of trade-offs and synergies and recommend potential solutions for minimizing tradeoffs and maximizing the synergies. (4 hrs)

- **Field study**: Students will join to 1-2 days field study in nearby areas to select 1-2 cases of different orientations (e.g., water, energy, food, ecosystem) but have nexuses relationships and dissect nexuses relationships in those cases, prepare a report and present in the class as post-field study report. (8 hrs)

Contents	**Equipment/ tools**	**Methodology/methods**	**Link to Unit(s)**
Dip dive nexuses relationship in existing approaches	Reference materials, Analytical thinking	Literature review to understand nexuses relationship Selected a couple of cases of different orientation Think critically to visualize interlinkages (trade-offs and synergies) Identify challenges and opportunities	Unit 1, 2, 4
Visualize nexus governance and explore the potential of WEFE nexus as a future security agenda	Field logistics, Reference materials, Analytical thinking	Field visits, Interaction with related stakeholders, Critical thinking to visualize interlinkages (trade-offs and synergies), and governance Identify the challenges faced and ways they are managed	Unit 5
Perspectives, cross-fertilization, and synthesis	Field data, Critical thinking	Analyses of field visit/data, Perspectives from different cases explored (e.g., management, policy, governance), Synthesis	Unit 1,2,3,4,5

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COURSE TITLE: LANDSCAPE MANAGEMENT AND BIODIVERSITY CONSERVATION

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
PWM 504	3	48 (32+16)	75 (45+30)

Note: 1 Credit= 16 Lecture Hours

SCOPE: This course is designed to develop an understanding of issues on conservation landscape (hereafter referred to as landscape), landscape ecology, and biodiversity conservation. To prepare for careers in landscape and biodiversity conservation, students must attain academic skills and knowledge (both theoretical and technical) related to landscape management and biodiversity conservation. This course will help enrich student's understanding of biodiversity conservation at the landscape level. It enhances students' capacity to identify the prospects and challenges of biodiversity conservation and management in multiple-use landscapes.

OBJECTIVES: The objective of this course are to:

- Familiarize students with key technical terms related to landscape ecology, and biodiversity conservation.
- Enrich students' knowledge on landscape principles, and best conservation practices at landscape levels.
- Increase students' understanding on the causes and consequences of biodiversity loss in human-dominated landscapes.
- Enrich student's knowledge and skill in landscape planning, management, and biodiversity conservation.

LEARNING OUTCOMES: At the end of the course, students will be able

- To understand the basic landscape and biodiversity-related key terminologies
- To explore and understand landscape-level conservation values and challenges
- To learn the theories and principles related to landscape ecology
- In planning and implementation of landscape-level conservation initiatives
- To gain knowledge on biodiversity conservation and management in a human-dominated landscape

COURSE CONTENTS

UNIT 1: INTRODUCTION (6)

1.1 Landscape

1.1.1 Concept of Landscape and Landscape Ecology

1.1.2 Review of the Key Terms: Habitat, Eco-region, Biomes, Biodiversity Hotspots, Biodiversity Cold Spots, Habitat Fragmentation, Edge Effect, Corridors and Connectivity, Upstream-downstream Linkages, Landscape Integrity and Functions

1.1.3 Epistemology of the Landscape

1.1.3.1 The Nature of Landscape (material and conceptual)

1.1.3.2 Role of Landscape (domain, system, Unit)

1.1.3.3 Description of Landscape (ecological and cognitive)

1.1.4 Landscape Functions and Dynamics: Linkages with Species and Human Culture (IT/TK)

1.2 Biodiversity

1.2.1 Components of Biodiversity (genetic diversity, species diversity, ecosystem diversity, functional diversity)

1.2.2 Species Richness Over Geological Time Scale (rates of species formation, rates of species extinction, current pattern of species richness)

1.2.3 Values and Importance of Biodiversity (consumptive and non-consumptive use values, productive use values)

1.2.4 Patterns of Diversity (variation along climate and environment, variation in topography, geological age, and habitat)

1.2.5 Concept of Climate Change Refugia

UNIT 2: THEORIES AND MODELS IN LANDSCAPE ECOLOGY (6)

2.1 Driving Forces for Landscape Approach (international dialogue, conservation debate, innovations)

2.2 Landscape Stability Principle and CBD Malawi Principle 1995

2.3 Theories Incorporated in Landscape Ecology: Complexity Theory, Information Theory, Cognition and Autopoiesis Theory, Hierarchy Theory, Percolation Theory, Resource Theory

2.4 Landscape Ecology Models

2.4.1 Metapopulation Model

2.4.2 Source-sink Model

2.4.3 Island Biogeography Equilibrium

UNIT 3: PRINCIPLES FOR LANDSCAPE CONSERVATION, MANAGEMENT AND DESIGN (10)

3.1 Landscape Evaluation (creating and quantifying landscape patterns)

3.2 The Cultural (human-dominated) Landscape (interaction between natural and cultural landscapes, fragility of the cultural landscapes, cultural keystone species, landscape indicators, predictive landscape models)

3.3 Principles for Landscape Management

3.4 Landscape Ecology (landscape principles for natural reserves, disturbance regime, and reserve design indications, inter-refuge corridor design)

3.5 Principles of Landscape Classification (structural patch, functional patch, resource patch, habitat patch, corridor patch)

3.6 Landscape Level Conservation

3.7 Ecosystem Processes on Landscapes

3.8 Hierarchical Structure of the System and Biodiversity Conservation

3.9 The Landscape-level Species Conservation Approach

3.10 Transborder Landscape Conservation Approaches

UNIT 4: BIODIVERSITY CONSERVATION IN HUMAN-DOMINATED LANDSCAPE (4)

4.1 Biodiversity Conservation (with examples: in-situ and ex-situ)

4.2 Issues of Biodiversity Conservation
4.3 Urban Biodiversity Conservation Challenges
4.4 Green Infrastructure: Linking Landscape and Community
4.5 Roles of Ecosystem Management in Landscape Integrity: Protected Area: Core and Buffer Zone, Habitats Outside PAs, MAB (Man and Biosphere Reserve), Other Effective Area-Based Conservation Measure (OECM)
4.6 Importance of Landscape-level Biodiversity for Promoting Ecosystem Services and Local Livelihood in Developing Countries

UNIT 5: LANDSCAPE MANAGEMENT FOR BIODIVERSITY CONSERVATION (6)

5.1 Evolution and Practices of Landscape Management Models (global to national)
5.2 Conservation Landscapes of Nepal (TAL, CHAL, Kanchenjunga, SHL, and Kailash)
5.3 Prospects and Challenges of Landscape Management and Biodiversity Conservation
5.4 Land Use Planning and Conservation
5.5 Landscape Effects: in Individuals, Populations, and Organisms
5.6 Landscape Management Approaches and Strategies
5.6.1 River Basin Approach
5.6.2 North-South and East-West Landscape Approach
5.7 Case Studies
5.7.1 Nepalese Model: Landscape (e.g., TAL, CHAL) and Corridor (e.g., Khata Corridor, Barandabhar Corridor)
5.7.2 North American Model: (e.g., Yukon to Yellow stone)
5.7.3 South African Model: (e.g., Great Limpopo Transfrontier Park)

PRACTICAL (16)

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit (s)**
Measuring biodiversity	Silva compass, measuring tape, crown-densiometer, Abney level	3 days Field Diversity index (Simpson, Shannon Wiener) Observation, FGD, meetings with nearby community, KIS, Literature review, Report writing	Unit 1
Designing biodiversity conservation activities in the urban landscape	Reports, related literature		Unit 1, 3
Study linkages with species and human culture	Checklist		Unit 1
Review of CBD Malawi Principle1995	Related literature	Group presentation, report	Unit 2
Study on urban biodiversity challenges and threats ranking	Related literature	Excursion, Observation, Review of literature, Assessment by pairwise ranking, Report writing	Unit 4

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Unit 5

1. Acharya, K. P., Tripathi, D. M., Joshi, J., & Gurung, U. M. (2011). Leveraging the Landscapes: Conservation beyond the Boundaries. *Kathmandu: Nepal Foresters Association*. **(Unit 3, 4 too)**

COURSE TITLE: NATURAL RESOURCE MANAGEMENT IN CHANGING ENVIRONMENT

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
SFM 505	3	48 (32+16)	75 (45+30)

Note: 1 Credit= 16 Lecture Hours

SCOPE: Changing the environment has jeopardized human-nature interaction, which has created a lose-lose scenario. This course focuses on understanding the changing context, its impacts on natural resources, and their mitigation, adaptation, and management strategies.

OBJECTIVES: The objectives of the course are to:

- To understand the changing context
- To understand key environmental issues and their effects on nature and society
- To assess appropriate strategies for natural resource management in the changing contexts
- To understand the issues in changing contexts in NRM in Nepal

LEARNING OUTCOMES: On completion of this course, students should be able to:

- Understand the changing contexts and its effects on natural resources
- Analyze the natural resource management related issues in the changing contexts,
- Develop a conceptual and practical understanding of strategies for natural resource use and management in the changing environmental conditions
- Apply the learned concepts to a natural resource management problem of particular interest to them.

COURSE CONTENTS

UNIT 1: UNDERSTANDING THE CHANGING CONTEXT (5)

1.1 Theoretical context – Change Theory

1.2 Global Environmental Changes: Climate Change, Land use and land cover change, Invasive Species

1.3 Social Changes- Demographic Shifts, Cultural Transformations, Technological Advancement, Urbanization, Gender Roles and Equality, Environmental Movement

1.4 Economic Changes – Technological Transformations, Globalization, Labor Market Change, Financial System, Environmental and Sustainable Practices, Income equality, Global Economic Shift

UNIT 2: EFFECTS OF CHANGING ENVIRONMENT ON NATURAL RESOURCES (7)

2.1 Effects on:

2.1.1 Water Resources – Glacier's Retreat, Precipitation Pattern, Sea Level, Spring, Rivers, Groundwater, Wetlands

2.1.2 Agricultural Resources– Agro-Biodiversity, Cropping Pattern, Pest and Diseases

2.1.3 Forest and Biodiversity– Shift in Habitat Ranges, Increased Wildfire, Invasive Alien Species
2.1.4 Wildlife
2.1.5 Rangelands
2.1.6 Landscape

2.2 Alteration of Human-Nature Interactions Due to Changing Context

UNIT 3: MITIGATION AND ADAPTATION STRATEGIES (5)

3.1 Sustainable Land and Water Management
3.2 Biodiversity Conservation and Restoration
3.3 Climate Resilient Infrastructure
3.4 Traditional Knowledge, Practices, and Technologies
3.5 Renewable Energy Transition

UNIT 4: ISSUES IN NRM IN CHANGING CONTEXT IN NEPAL (5)

4.1 Shift in Demand for Natural Resources
4.2 Land Abandonment
4.3 Human-Wildlife Conflict
4.4 Governance Conflict
4.5 Level of Participation in Natural Resource Management

UNIT 5: MANAGING NATURAL RESOURCES IN CHANGING ENVIRONMENT (10)

5.1 Ecological Principles and their Application to Natural Resource Management
5.2 Adaptive Management
5.3 Forest-Landscape Restoration
5.4 Invasive Species Management
5.5 Nature Based Solutions
5.6 Disturbance-based Ecosystem Management

PRACTICAL (16)

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
Drivers of changing context	Field /Checklist	Prepare a list of drivers and strategies to address them (Group work)	Unit 1, 2
Issues of NRM in Nepal and potential solutions	Literature review	Group / Class presentation	Unit 4
Enlisting mitigation/adaptation/management interventions in own locality	Interview (Telephone), Field observation	Individual - list of interventions	Unit 3, 4, 5

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Unit 2

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Unit 3

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Unit 4

1. Laudari, H. K., Sapkota, L. M., Maraseni, T., Subedi, P., Pariyar, S., Kaini, T. R. & Volkova, L. (2024). Community forestry in a changing context: A perspective from Nepal's mid-hill. *Land Use Policy*, *138*, 107018.
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4. Devkota, K., & Neupane, K. R. (2019). Water conflicts in urbanizing regions in the Himalaya: Case studies from Dhulikhel and Bidur in Nepal. *New Angle: Nepal journal of social science and public policy*, *5*(1), 49-73.
5. *Paudel, N.S., Ojha, H., Banjade, M.R., Karki, R. & Tamang, S. (Eds.) Revitalising community forestry in the changing socioecono...*, 61.
6. Shahi, N., Bhusal, P., Paudel, G., & Kimengsi, J. N. (2022). Forest—People nexus in changing livelihood contexts: Evidence from community forests in Nepal. *Trees, Forests and People*, *8*, 100223.
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Unit 5

1. Bolte, A., Ammer, C., Löf, M., Nabuurs, G. J., Schall, P., & Spathelf, P. (2009). Adaptive forest management: a prerequisite for sustainable forestry in the face of climate change. *Sustainable forest management in a changing world: a European perspective*, 115-139.
2. von Gadow, K. (2008). *Managing forest ecosystems: the challenge of climate change* (p. 338). F. Bravo, V. LeMay, & R. Jandl (Eds.). New York: Springer.
3. Napreenko, M. G., Antsiferova, O. A., Aldushin, A. V., Samerkhanova, A. K., Aldushina, Y. K., Baranovskiy, P. N. & Konshu, E. V. (2021). New approaches to sustainable management of wetland and forest ecosystems as a response to changing socio-economic development contexts. *Innovations and Traditions for Sustainable Development*, 395-416.
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5. Kuuluvainen, T., Angelstam, P., Frelich, L., Jõgiste, K., Koivula, M., Kubota, Y., ... & Macdonald, E. (2021). Natural disturbance-based forest management: Moving beyond retention and continuous-cover forestry. *Frontiers in Forests and Global Change*, *4*, 629020.
6. Seddon, N., Chausson, A., Berry, P., Girardin, C. A., Smith, A., & Turner, B. (2020). Understanding the value and limits of nature-based solutions to climate change and other global challenges. *Philosophical Transactions of the Royal Society B*, *375*(1794), 20190120.

SEMESTER II

COURSE TITLE: GEOINFORMATICS FOR NRM

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
WME 551	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: This course is designed for the students having background on the foundation of GIS and Remote Sensing (RS). As the name says "Geoinformatics", the course contents aim to provide broader understanding on the application of GIS and Remote Sensing in NRM, with particular focus on developing skills on geospatial data extraction, analysis, modelling, management and effective communication for sharing the research widely. The course is based on both the theoretical and lab-based teaching/learning approaches.

OBJECTIVES: The course aims to provide advanced knowledge on applying geospatial technologies and remote sensing in natural resources management with the particular focus on emerging technologies for data analysis and cloud computing. The specific objectives of this course are to make students:

- Understand recent advancements/trends in Geoinformatics including theoretical and practical knowledge on the advanced concepts of RS & GIS in NRM.
- Enhance knowledge and practical skills on geo computation including exploratory data analysis and advanced concepts on spatial statistics.
- Develop a theoretical foundation on geomodelling and practical hands-on modelling related to NRM used cases.
- Provide overview and hands-on on emerging geospatial technologies for NRM like Machine Learning (ML) cloud computing with Google Earth Engine (GEE).

LEARNING OUTCOMES: After the completion of the course, the learners are expected to be able to:

- Develop a project and use advanced GIS/RS techniques for data collection to address specific problems in NRM
- Use geo-computational and statistical knowledge for data cleaning, analysis and management
- Use geospatial techniques for predictive modelling - NRM used cases.
- Use Cloud computing platform for efficient data analysis and visualization

COURSE CONTENTS

UNIT 1: OVERVIEW OF GEOINFORMATICS (6)

1.1 Fundamentals of Remote Sensing and GIS
1.2 Data to Geoinformation in NRM (data sources and availability, acquisition, interpretation and data quality issues)
1.3 RS and GIS Software (open source and commercial)
1.4 Recent Advancements/Trends in Geoinformatics
1.4.1 Mobile GIS, Drone-Based GIS, Citizen Science in GIS
1.4.2 Overview of Google Earth Engine, AI, and ML in NRM

UNIT 2: REMOTE SENSING SATELLITE AND SENSORS (8)

2.1 Sensors and Satellites (including orbits)
2.2 Scanning Systems
2.3 Optical Remote Sensing
2.4 Hyperspectral Remote Sensing
2.5 Radio Detection and Ranging (RADAR) Remote Sensing
2.6 Light Detection and Ranging (LIDAR) Remote Sensing

UNIT 3: GEOCOMPUTATION (6)

3.1 Digital Image Processing and Classification
3.2 Review Geospatial Interpolation (Kriging, / IDW, etc.)
3.3 Geospatial Statistics
3.4 Map Algebra and Raster Models Analysis
3.5 Terrain and Visibility Analysis

UNIT 4. GEOMODELLING (6)

4.1 Database Queries and Geo-Processing
4.2 Model Building for Geo-Processing
4.3 AHP Modelling
4.4 Geo-Visualization (cartographic representation)

UNIT 5. APPLICATION OF GEOSPATIAL TECHNOLOGIES (6)

5.1 Resource Assessment and Management.
5.2 Risk Assessment (forest fire, landslide)
5.3 Suitability Analysis
5.4 Analyzing Multi-Temporal Earth Observation Data

PRACTICAL (16)

Contents	Equipment/tools	Methodology/methods	Link to Unit (s)
Image acquisition and processing	QGIS, /ArcGIS	Practical: 4hrs Demo and case presentation Student Engagement: 10hrs	Unit 1
Data cleaning and/map algebra and raster models/ surface and visibility analysis	QGIS/ ArcGIS	Practical: 4hrs One demo and other can be case presentation Student Engagement: 6hrs	Unit 3
Data queries/ Analysis and geo-visualization.	QGIS/ArcGIS	Practical: 3hrs one demo and other case presentation Student Engagement: 12hrs	Unit 4
Forest resource inventory and mapping/ indices (e.g., NDVI, NDSI, NDWI calculation)/Suitability/Time-series analysis	Cloud computing/GEE/ QGIS/ ArcGIS	Practical: 5hrs one demo and other case presentation Student Engagement: 20hrs	Unit 5
Project report and presentation		Review and report	

KEY REFERENCES

Unit 1

1. Duckham, M., Goodchild, M. F., & Worboys, M. (2003). Foundations of geographic information science. CRC Press.
2. Liu, J. G., & Mason, P. J. (2016). Image processing and GIS for remote sensing: techniques and applications. John Wiley & Sons.
3. Mclnerney, D., & Kempeneers, P. (2014). Open source geospatial tools: applications in earth observations. Earth Systems Data and Models, Springer.
4. Ma, X., Mookerjee, M., Hsu, L., & Hills, D. (Eds.). (2023). *Recent Advancement in Geoinformatics and Data Science* (Vol. 558). Geological Society of America.
5. Chuvieco, E. (2020). *Fundamentals of satellite remote sensing: An environmental approach*. CRC press.
6. Bajracharya, B., Thapa, R. B., & Matin, M. A. (2021), Earth observation science and

applications for risk reduction and enhanced resilience in Hindu Kush Himalayan Region, Springer Nature, free access

Unit 2

1. Verbyla, D. L. (2022). *Satellite remote sensing of natural resources*. CRC Press.
2. Varshney, P. K., & Arora, M. K. (2004). *Advanced image processing techniques for remotely sensed hyperspectral data*. Springer Science & Business Media.
3. Richards, J. A. (2009). *Remote sensing with imaging radar* (Vol. 1, pp. 172-173). Berlin/Heidelberg, Germany: Springer.
4. Liang, S., & Wang, J. (Eds.). (2019). Advanced remote sensing: terrestrial information extraction and applications. Academic Press.
5. Lu, B., Dao, P. D., Liu, J., He, Y., & Shang, J. (2020). Recent advances of hyperspectral imaging technology and applications in agriculture. Remote Sensing, 12(16), 2659.
6. Wang, G., & Weng, Q. (2013). *Remote sensing of natural resources*. CRC Press.
7. Flores-Anderson, A. I., Herndon, K. E., Thapa, R. B., & Cherrington, E. (2019). The SAR handbook: comprehensive methodologies for forest monitoring and biomass estimation (No. MSFC-E-DAA-TN67454).

Unit 3

1. Chun, Y., & Griffith, D. A. (2013). Spatial statistics and geostatistics: theory and applications for geographic information science and technology.
2. Getis, A., Anselin, L., Lea, A., Ferguson, M., & Miller, H. (2004). Spatial analysis and modeling in a GIS environment. In A research agenda for geographic information science (pp. 157-196). CRC Press. (Unit 4 too).

Unit 4 and 5

1. McClain, B. P. (2022). Python for Geospatial Data Analysis. " O'Reilly Media, Inc.".
2. Crooks, A., Malleson, N., Manley, E., & Heppenstall, A. (2015). Agent-based modeling and geographical information systems. Geocomputation: A Practical Primer. SAGE Publications Ltd, Thousand Oaks, CA, 63-77.
3. Pourghasemi, H. R., & Gokceoglu, C. (2019). Spatial modeling in GIS and R for earth and environmental sciences. Elsevier.
4. Wani, A. A., Bali, B. S., Ahmad, S., Nazir, U., & Meraj, G. (2022). Geospatial Modeling in Landslide Hazard Assessment: A Case Study along Bandipora-Srinagar Highway, NW Himalaya, J&K, India. In Geospatial Modeling for Environmental Management (pp. 113-125). CRC Press.
5. Wang, L., Yin, D. Z., & Caers, J. (2023). Data science for the geosciences. Cambridge University Press. (Unit 5 too).
6. Moseley, B., & Krischer, L. (2020). Machine learning and artificial intelligence in geosciences. Academic Press. (Unit 5 too).

COURSE TITLE: RESEARCH DESIGN AND SCIENTIFIC WRITING

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
BSH 552	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: The scope of this course is designed to imbue M.Sc. students with a scientific perspective, bridging the gap between overarching methodological principles and the intricacies of systematic inquiry into literature. It equips students with the skills needed to adeptly select and employ a range of research methods and tools for data collection. Through this course, students are equipped with the proficiency to thoughtfully select and deploy a diverse array of research methods and tools, ensuring a holistic approach to data collection. Moreover, the course offers a guided journey through the entire research process. From the initial stages of data collection to the in-depth analysis, students receive hands-on guidance that facilitates a comprehensive comprehension of each step. Furthermore, the course guides them through the entire process, from analysis to effectively articulating and presenting their research findings in their M.Sc. thesis.

OBJECTIVES: The objectives of this course are to:

- Acquire a profound understanding of diverse research types, encompassing their distinctive characteristics and ethical considerations.
- Comprehend both quantitative and qualitative research designs, mastering the art of employing various data collection methods to ensure the generation of high-quality data.
- Cultivate the ability to conduct thorough literature reviews, organizing information systematically to build a solid foundation for research endeavors.
- Hone skills in crafting meticulous and comprehensive research proposals, coupled with the proficiency to eloquently defend them during presentations, showcasing a mastery of the subject matter.
- Develop the capacity to articulate research findings effectively through the composition of clear and concise research reports, thesis documents, and scientific articles.

LEARNING OUTCOMES: Upon course completion, students will adeptly handle the intricacies of research methodology, understanding the critical connection between research questions and theoretical frameworks.

- Gain the capability to independently formulate and develop robust research proposals aligned with overarching research objectives.
- Acquire practical skills in data generation and analysis, utilizing diverse research methods and analytical tools to produce high-quality data and insightful interpretations.
- Navigate the complexities of an M.Sc. thesis, demonstrating proficiency in structuring and integrating research findings within theoretical frameworks.
- Demonstrate adeptness in manuscript composition and effectively communicating research findings with clarity and impact.

COURSE CONTENTS

UNIT 1: RESEARCH CONCEPTS (6)

1.1 Definition and Purpose
1.2 Research Paradigm (Normative, Explorative, Critical)
1.3 Research Types (Qualitative, Quantitative and Mixed)
1.4 Conceptual Framework of Research
1.5 Research Ethics: Informed Consent, Data Use & Confidentiality, Research Interpretation, Authorship and Publication, Plagiarism)

UNIT 2: RESEARCH DESIGN (10)

2.1 Meaning, Concept, Importance
2.2 Research Design: Components and Features
2.3 Characteristics
2.4 Types of Designs
- 2.4.1 Descriptive
- 2.4.2 Diagnostic
- 2.4.3 Experimental and Quasi-experimental
- 2.4.4 Exploratory Formulative
- 2.4.5 Case Study

2.5 Quantitative Research Design
- 2.5.1 Definition
- 2.5.2 Purpose
- 2.5.3 Analytical Framework
- 2.5.4 Data Collection Methods (sampling design and methods, survey)
- 2.5.5 Data Reliability and Validity
- 2.5.6 Data Analysis Methods (descriptive, inferential and casual analysis)

2.6 Qualitative Research Design
- 2.6.1 Definition
- 2.6.2 Purpose
- 2.6.3 Analytical Framework (use of theories)
- 2.6.4 Data Reliability and Validity
- 2.6.5 Data Collection Methods (observation, focus group discussion, semi-structured interview, content analysis)

UNIT 3: LITERATURE REVIEW AND ORGANIZATION (4)

3.1 Purpose and Types of Review
3.2 Review Organization
3.3 Citation and Reference Management

UNIT 4: RESEARCH PROPOSAL WRITING (4)

4.1 Research Proposal (purpose, components, and format)
4.2 Research Subject and Object
4.3 Formulating of Research Problem
4.4 Defining Research Objectives
4.5 Setting Research Hypothesis/Questions (meaning, definitions, nature, functions, importance, kinds, characteristics, formulation and testing)
4.6 Research Matrix

4.7 Research Site Selection
4.8 Respondent Selection
4.9 Data Collection Methods
4.10 Data Analysis
4.11 Work Plan
4.12 Budget Estimation

UNIT 5: THESIS WRITING AND PRESENTATION (4)

5.1 Purpose and Characteristics of the Good Thesis
5.2 Outline of the Thesis /Major Chapters or Sections
5.3 Data Analysis and Interpretation
5.4 Discussion on Findings (convergence and divergence Analysis)
5.5 Establishing a Causal Link Between Objective, Findings, Conclusion and Recommendations
5.6 Thesis Presentation: Slide Preparation, Table Graph, etc.

UNIT 6: SCIENTIFIC PAPER WRITING (4)

6.1 Step-wise Procedure
6.2 Selecting a Journal for Publication / Predatory
6.3 Communicating with the Journal Editor/Editorial Board
6.4 Peer Review Processes and Responding to Reviewer

PRACTICAL (16)

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
Research Design	Classwork	Group discussion and panel discussion	Unit 1 & 2
Scientific paper writing	4-5 person in a team review and write paper	Review paper/research paper on the contemporary subjects related to their field of study (able to identify knowledge gap, analyses and interpreted study findings).	Unit 3, 6
Research proposal	Literature review	Each student will write, submit and present a research proposal in their area of interest.	Unit 4
Presentation	4-5 person in a team) will prepare and present their research findings	Prepare and present among students on their research findings and solicit comments and suggestions from students and faculties	Unit 3, 5, 6

KEY REFERENCES

Unit 1

1. Kumar, R. (2018). Research methodology: A step-by-step guide for beginners. *Research methodology*, 1-528.
2. Kerlinger, F. N. (1966). Foundations of behavioral research.

3. Mligo, E. S. (2016). *Introduction to research methods and report writing: A practical guide for students and researchers in social sciences and the humanities*. Wipf and Stock Publishers.

Unit 2

1. Bryman, A. (2012). Social Research Methods. Oxford University Press, New Delhi.
2. Cohen, L., Lawrence, M., & Morrison, K. (2005). Research Methods in Education, 5th edition. Oxford University Press, Oxford.
3. Denscombes, M. (2010). The Good Research Guide, For Small-Scale Social Research Projects. Open University Press, Maidenhead, Berkshire, UK.
4. Gregory, J., Miller, S., & Miller S. (2000). Science in Public: Communication, Culture and Credibility, Reprint edition. Perseus Book Group, New York.

Unit 3

1. Field, A. (2003). How to Design and Report Experiments. Sage Publications, Newbury Park, California.
2. Glass, D. (2006). Experimental Design for Biologists. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.
3. Holliman, R., Whitelegg, L., Scanlon, E., Smidt, S., & Thomas, J. (2009). *Investigating science communication in the information age: Implications for public engagement and popular media*. Oxford University Press.
4. Singh, Y.K. (2006). Fundamental of Research Methodology and Statistics. New International (P) Limited, Publishers, New Delhi.

Unit 4

1. Soraya, M.C. & Cynthia, A.S. (2001). Proposal Writing. Sage Publications, Newbury Park, California.
2. Wallinman, N. (2006). Your Research Project: A Step-by-Step Guide for the First Time Researcher. Sage Publications, London.

Unit 5

1. Adu, P & Miles D. A. (2024). Dissertation Research Methods: A Step-by-Step Guide to Writing Up Your Research in the Social Sciences. Routledge, New York.

Unit 6

1. Thomas, C.G. (2021). Research Methodology and Scientific Writing (2nd eds). Springer. https://link.springer.com/book/10.1007/978-3-030-64865-7
2. Hoffmann, A.H. (2009). Scientific Writing and Communication: Papers, Proposals, and Presentations. Oxford, UK.
3. Mligo, E.S. (2016). Introduction to Research Methods and Report Writing. A Practical Guide for Students and Researchers in Social Sciences and the Humanities. Resource Publications, Eugene, Oregon.
4. Day, R. A., & Gastel, B. (2024). *How to write and publish a scientific paper*. Cambridge University Press.

COURSE TITLE: ADVANCED STATISTICS

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
BSH 553	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: The course will increase understanding on general concepts, meaning & use of statistics, and develop basic skills for computing and interpreting social and bio-physical data, and their applications using computer software in applied research. More importantly, the course aims to help M.Sc. students in selecting and use of different regression models in forestry research.

OBJECTIVES: The objectives of this course are to:

- Demonstrate the concepts of descriptive statistical measures, probability distribution, and their uses in forestry research.
- Demonstrate basic concepts of hypothesis testing and experimental designs.
- Learn different types of parametric and non-parametric tests and use them in forestry research.
- Understand correlation and regression analysis and apply different types of regression models in forestry research and interpretation of results.
- Understand the concept of factor and discriminant analysis and develop skills for computation.

LEARNING OUTCOMES: Upon the completion of this course students will be able to

- Demonstrate the ability to understand the different types of variables and data
- Understand the appropriate use of statistical analysis
- Develop basic skills for computing & interpreting the data and their applications using computer software in applied forestry research.

COURSE CONTENTS

UNIT 1: INTRODUCTION (4)

Review**:** Data, Variables and Scale of Measurement, Population and Sample, Central Tendency and Dispersion, Sampling Techniques

UNIT 2: PROBABILITY DISTRIBUTIONS (4)

Review of Binomial, Poisson and Normal Probability Distribution, and their Applications

UNIT 3: ESTIMATION AND TESTING OF HYPOTHESIS (4)

Point estimation, Interval Estimation; t-test, z-test, Non-Parametric Tests: Chi-square Test, Median Test, Mann Whitney u-test, Kruskal Wallis test, Friedman ANOVA, Wilcoxon Sign Rank Tests

UNIT 4: ANALYSIS OF VARIANCE AND EXPERIMENTAL DESIGNS (6)

One-way and two-way ANOVA, Simple and Factorial Designs

UNIT 5: CORRELATION AND REGRESSION ANALYSIS (10)

Correlation Analysis, Ordinary Least Square Regression Models, Regression with Dummy Variables, Probit, Logit, Ordered Logit and Probit, MNL

UNIT 6: MULTIVARIATE ANALYSIS (4)

Principal Component Analysis (PCA), Factor Analysis, Cluster and Discriminant Function Analysis

PRACTICAL (16)

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
Data entry, coding, and editing in statistical software	Computer	Use of the questionnaire/ data	Unit 1
Computation of frequency distribution, diagram, and graphs, descriptive measures and their interpretations	With appropriate software	Using student's own or the given data	Unit 1
Testing of different types of hypotheses: T–tests. F-test etc.	With appropriate software	Using student's own or the given data	Unit 2, 3
Use of different non-parametric tests and their interpretations	With appropriate software	Using student's own or the given data	Unit 3, 4
Linear regression models and testing assumptions: Normality, Multicollinearity	With appropriate software	Using student's own or the given data	Unit 5
heteroscedasticity and auto-correlation; analysis of residuals	With appropriate software	Using student's own or the given data	Unit 5
Fitting of the logit, Probit, ordered logit, multinominal logit regression models and their interpretations	With appropriate software	Using student's own or the given data	Unit 5
Principal component analysis	With appropriate software	Using student's own or the given data	Unit 6

KEY REFERENCES

Unit 1

1. Shrestha, S. & Silwal D.P. (2003). Statistical Methods in Management. Taleju Prakashan, Bhotahity Kathmandu.

Unit 2

1. Gupta, S. C., & Kapoor, V.K. (1994). Fundamentals of Mathematical Statistics, 4th edition. Sultan Chand & Sons; 23, Daryagunj, Delhi.

Unit 3

1. Levine, D. M., & Stephan, D. F. (2009). *Even you can learn statistics: A guide for everyone who has ever been afraid of statistics*. FT Press.
2. Shrestha, S. & Silwal, D.P. (2003). Statistical Methods in Management. Taleju Prakashan, Bhotahity Kathmandu.
3. Triola, M. F., Goodman, W. M., Law, R., & Labute, G. (2004). *Elementary statistics* (p. 794). Boston: Pearson/Addison-Wesley.

Unit 4

1. FAO (1999). A Statistical Manual for Forestry Research. Forestry research support program, for Asia and the Pacific, Food and Agricultural Organization of the United Nations Regional Office for Asia and the Pacific, Bangkok.
2. Nargundkar, R. (2008). Marketing Research: Text and Cases- Third edition. Tata McGraw-Hill Publishing Company Limited, NEW DELHI

Unit 5

1. FAO (1999). A Statistical Manual for Forestry Research. Forestry research support program, for Asia and the Pacific, Food and Agricultural Organization of the United Nations Regional Office for Asia and the Pacific, Bangkok.
2. Levine, D. M., & Stephan, D. F. (2009). *Even you can learn statistics: A guide for everyone who has ever been afraid of statistics*. FT Press
3. Snedecor, G.W., & Cochran, W.G. (1994). Statistical Methods, eighth edition. Iowa State University Press, Ames Iowa.

Unit 6

1. FAO (1999). A Statistical Manual For Forestry Research. Forestry research support program, for Asia and the Pacific, Food and Agricultural Organization of the United Nations Regional Office for Asia and the Pacific, Bangkok.
2. Levine, D. M., & Stephan, D. F. (2009). *Even you can learn statistics: A guide for everyone who has ever been afraid of statistics*. FT Press
3. Nargundkar, R. (2008). Marketing Research: Text and Cases- Third edition. Tata McGraw-Hill Publishing Company Limited, NEW DELHI

COURSE TITLE: NATURAL RESOURCE ECONOMICS

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
SFM 554	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: This course focuses on the concept of both theoretical and empirical evaluation of natural resources (forests, biodiversity, and water) pertaining to management. It includes subjects related to the time value of money, evaluation of a natural resource management project from an economic perspective, application of different valuation techniques to estimate the non-market benefits obtained from an ecosystem, practice of ecosystem service market, and green economy promotion for strong sustainability. Basically, it aims to capacitate students to analyze the problems and practices prevailing in the natural resource management sector from an economic perspective.

OBJECTIVES: The general objective of this course is to train students to promote economically viable natural resource management. Specific objectives are to:

- Enable students to understand and practice economic evaluation of natural resource management projects
- Enable students to estimate non-market benefits received from ecosystems
- Understand the importance of the ecosystem service market
- Prepare strategies for green economy promotion towards sustainable development

LEARNING OUTCOMES: After the completion of this course, students will be able to

- Understand and analyze the existing problems associated to natural resource management from the economic perspective
- Apply different economic evaluation tools in natural resource management
- Estimate non market benefits of ecosystem services and provide policy feedback for its proper management
- Practice activities for green financing promotion and support for green accounting of natural resource

COURSE CONTENTS

UNIT 1: INCORPORATING ENVIRONMENT INTO THE ECONOMIC SYSTEM (4)

1.1 Ecological Economics vs Environmental Economics
1.2 Economy-Environment Systems
1.3 Modelling Economy-Environment Interactions

UNIT 2: VALUATION OF ECOSYSTEM SERVICES (12)

2.1 Concept of Valuing the Ecosystem Services
2.2 Valuation Techniques
    2.2.1 Direct Market Approach
        2.2.1.1 Market Price Method
        2.2.1.2 Production Function Approach
        2.2.1.3 Cost-based Approach

2.2.2 Non-Market Based Valuation Techniques
2.2.2.1 Contingent Valuation
2.2.2.2 Travel Cost Method
2.2.2.3 Hedonic Price Method

UNIT 3: BENEFIT-COST ANALYSIS (8)

3.1 The Foundations of Benefit-Cost Analysis
3.2 Steps of Benefit-Cost Analysis
3.3 Time Value of Money (Discounting and Compounding, One-time payment, Annual Payment and Perpetual, Periodic Payment and Perpetuity)
3.4 Decision Criteria (Net Present Value, Benefit-Cost Ratio, Internal Rate of Return)
3.5 Sensitivity Analysis

UNIT 4: ECOSYSTEM SERVICES MARKET (4)

4.1 Financing Green and Greening Financing
4.2 Payment for Ecosystem Services
4.3 Forest Carbon Offset and Market
4.4 Biodiversity Offsets

UNIT 5: ENVIRONMENT AND SUSTAINABLE DEVELOPMENT (4)

5.1 Concept of Weak and Strong Sustainability
5.2 Sustainable accounting (Green accounting): System of National Accounting (SNA) and System of Environmental Economics Accounting (SEEA)

PRACTICAL (16)

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
Natural Resources	Questionnaire, Excel, Data	Contingent Valuation Method	Unit 1, 2
Recreation areas such as protected areas/wetlands	Questionnaire, Excel, Data	Travel Cost Method	Unit 1,2
Evaluation of an environmental project/ Opportunity cost of carbon	Excel, Data	Benefit-cost analysis	Unit 3
Financing solutions	Peer-reviewed papers	Group presentation	Unit 4
SEEA of protected area/ CF	Peer-reviewed papers	Class Room discussion	Unit 5
Nature as an Input	Data, Excel	Production Function Approach	Unit 2

KEY REFERENCES

Unit 1

1. Adger, W. N. (2014). Environmental and ecological economics. In *Environmental science for environmental management* (pp. 93-118). Routledge.
2. Asafu-Adjaye, J. (2005). *Environmental economics for non-economists: techniques and policies for sustainable development*. World Scientific Publishing Company. (Chapter 2)

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Unit 5

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COURSE TITLE: WILDLIFE AND PROTECTED AREA MANAGEMENT

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
PWM 613	3	48 (32+16)	75 (45+30)

Note: 1 Credit= 16 Lecture Hours

SCOPE: This course will equip the students with theoretical as well as practical knowledge and skills related to Wildlife Conservation and Protected Area management in the global and national context. In addition to the basic principles and practices, this course will familiarize the students with the recent advancements in this field of study and provide practical knowledge on population monitoring and habitat assessment techniques. Likewise, this course offers students basic exposure to policy and legislation related to wildlife conservation and protected area management. This course amalgamates theoretical classes, practical sessions, and field exercises related to wildlife and their habitat monitoring techniques.

OBJECTIVES: The objectives of the course are to:

- To understand types of biodiversity and associated threats, management issues, and key gaps
- To develop knowledge and skills in various wildlife and habitat management and monitoring techniques
- To understand the current policies and approaches to biodiversity conservation, wildlife, and protected area management
- To analyze, evaluate, and prepare protected area (PA) management plans
- To develop the capability to engage in research activities linked with wildlife management

LEARNING OUTCOMES: After the completion of this course, the students are expected to be able to

- Know and practice habitat management activities.
- Familiarize students with the recent advancements in biodiversity monitoring and ecological modeling techniques.
- Choose appropriate wildlife census techniques and use the main census methods.
- Carry out research works related to wildlife, protected areas, and biodiversity conservation.

COURSE CONTENTS

UNIT 1: INTRODUCTION (3)

1.1 Concept, Threats, Management, Key Gaps, and Issues in Biodiversity Conservation in Nepal
  1.1.1 Forest Biodiversity, Grassland Biodiversity, Wetland Biodiversity, and Mountain Biodiversity
1.2 Major Wildlife of Nepal and their Management and Conservation Practices
1.3 Significance of Protected Areas in Wildlife Conservation (Global to Nepal)
1.4 National and International Stakeholders Involved in Biodiversity (wildlife) Management and Conservation

UNIT 2: WILDLIFE MONITORING TOOLS AND TECHNIQUES (7)

2.1 Wildlife Surveys and Quantification Techniques, Data Collection and Analysis Methods

2.2 Tools and Techniques in Wildlife Research and Conservation: Telemetry, satellite collaring, drones, and aerial surveys, SMART eyes and patrols, handling of different traps, camera trapping surveys, DNA-based surveys, Bioacoustic monitoring, sign-based surveys, mark-recapture techniques, line transect, presence/absence analysis, survival analysis

2.3 Habitat Selection/Resource Selection, Carrying Capacity Assessment, Animal Food Habit Studies

UNIT 3: WILDLIFE HABITAT MANAGEMENT (6)

3.1 Wildlife Habitat and its Components, Niche, and Limiting Factors

3.2 Species Distribution Modeling Techniques (Habitat Occupancy Modeling, Generalized Linear Models (GLM))

3.3 Assessment of Wildlife Habitat (quantitative and qualitative)

3.3.1 Quantitative: Habitat Suitability Models (HSMs); Vegetation Analysis (frequency, density, abundance, Importance Value Index (IVI), species diversity)

3.3.2 Qualitative: Field Observation, Behavior Observation, Interviews, and Survey

3.4 Wildlife Habitat Management (food, grassland, waterhole management, invasive species management) Techniques and Restoration of Degraded Habitat

UNIT 4: WILDLIFE POPULATION MANAGEMENT (4)

4.1 Strategies and Approaches of Threatened Species Conservation, Anti-poaching, and Wildlife Crime Investigation

4.2 Captive Breeding and Zoological Park, Reintroduction of Wildlife, Metapopulation Management and Species Recovery

4.3 Identification and Management of Problematic Wildlife, Rescue/Rehabilitation Center, and Wildlife Hospital

4.4 Wildlife Rescue and Orphanage Management

4.5 Management of a Large Population

4.6 Wildlife Disease Management

4.7 Wildlife Farming and Ethical Consideration

UNIT 5: PROTECTED AREA MANAGEMENT (8)

5.1 Concept and Categories of Protected Areas

5.2 Genesis and Advancement of Protected Areas: Approaches and Management Modalities (Global to National)

5.3 International and National Criteria, Guidelines for PA Design

5.4 Status of Protected Areas (Global to National), Global Protected Area Target, Nature Positive by 2030

5.5 Concept of Other Effective Area-Based Conservation Measures (OECM) and its Relevance in Nepal

5.6 Protected Area Management Planning and Management in Nepal

5.6.1 Role of Zoning in Protected Area Management

5.6.2 Early Warning Systems for Climate-Related Events

5.7 Role of Local Communities in Protected Area Management (e.g., buffer zone and conservation area management, Community-Based Anti Poaching Unit (CBAPU), local bodies in PA management)
5.8 Contents and Elements of the PA Management Plan
5.9 Implementation of Protected Area Management Plan, Monitoring, and Management Effectiveness Evaluation

UNIT 6: POLICY AND LEGISLATION FOR BIODIVERSITY CONSERVATION (4)

6.1 Silent Features of Global and Regional Conventions and Treaties (MEA, CITES, CBD, IUCN, RAMSAR, CMS, UNESCO World Heritage Convention)
6.2 National Policies- NBS/NBSAP, Protected Area Management Strategy 2022-2030, All Species Action Plans
6.3 Critical Analysis of NPWC Act; Forest Act and their Regulations Related to Wildlife Conservation and Conservation Forests

PRACTICAL (5 days field in relevant nearby NP) **(16)**

Learning objectives

- To gain hands-on experience related to wildlife and their habitat monitoring
- To prepare data for ecological modeling and run the models
- To learn using the tools and techniques used for wildlife research

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
Effectiveness of Telemetry, drones, and SMART patrol in wildlife management	Satellite collar, drone, and phone with smart patrol software	Hands-on exercise, or Orientation, or Observation	Unit 2
Population survey (Tiger and other predator survey)	Camera traps and accessories, GPS. Or Camera trap data	Practice the installation of a camera trap, data management and analysis (CAPTURE): orientation-based or practice-based	Unit 2
Prey density estimation using Distance	Line transect prey base monitoring data Or range finder, Compass, GPS, Binoculars, Protocol	calculation of population density, detection probability using DISTANCE	Unit 2
Genetic analysis	GPS, Sample collection kit	Fecal, hair and/or blood sample collection and genetic analysis at the lab	Unit 2
Rescue center, wildlife hospital, Orphanage management	Notebook	Visit the rescue center and wildlife hospital, Observation/lecturing	Unit 4

Contents	Equipment/tools	Methodology/methods	Link to Unit(s)
Management effectiveness evaluation of PAs	Checklist, Progress report	KIS, Interview, Effectiveness scoring and ranking, interaction with the protected area manager	Unit 5

KEY REFERENCES

Unit 1

1. MFSC (2002). Nepal Biodiversity Strategy, Ministry of Forests and Soil Conservation, Kathmandu, Nepal. **(Unit 6 too)**
2. MFSC (2014). Nepal Biodiversity Strategy and Action Plan 2014-2020, Ministry of Forests and Soil Conservation, Kathmandu, Nepal. **(Unit 6 too)**
3. Clark, T. D., Colwell, R. K., Danielsen, F. & Evengard, B. 2017. Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being, *Scienc*e, 355.

Unit 2

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2. Fowler, M., (2011). Restraint and handling of wild and domestic animals, 3rd edition. ISBN: 978-0813814322. John Wiley & Sons.
3. Coetzee, K., (2016). Practical techniques for habitat & wildlife management. A guide for game ranches, conservation areas and farmland. ISBN: 978-0-986-70844-9 (print). **(Unit 3 too)**

Unit 3

1. Odum, E. P. & Barrett, G. W. (1971). Fundamentals of Ecology, Saunders Philadelphia.
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3. Foden, W. B. & Young, B. E. (2016). IUCN SSC guidelines for assessing species' vulnerability to climate change, International Union for Conservation of Nature and Natural Resources (IUCN) Species Survival Commission. **(Unit 6 too)**

Unit 4

1. Krausman, P.R. & Cain, J.W. (eds) (2013). Wildlife management and conservation: contemporary principles and practices. JHU Press. **(Unit 2, 3)**
2. Shaw, J. H. (1985). Introduction to Wildlife Management. McGraw Hill. **(Unit 3 too)**

Unit 5

1. CNP (2013). Chitwan National Park and its Buffer Zone Management Plan 2013-2017, Chitwan National Park Office, Chitwan, Nepal.
2. DNPWC (2017). An Assessment of Protected Areas Contribution on National Economy and Environmental Conservation in Nepal, Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.
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5. SNP (2016). Sagarmatha National Park and its Buffer Zone Management Plan 2016-2020, Sagarmatha National Park Office, Namche, Solukhumbu, Nepal.
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8. DNPWC (2022). Protected Area Management Strategy 2022-2030, Department of National Parks and Wildlife Conservation, Kathmandu, Nepal. **(Unit 6 too)**

Unit 6

1. DNPWC (2022). Wildlife-friendly Infrastructure Construction Directives, 2022, Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.
2. HMG 1973. National Park and Wildlife Conservation Act 2029, *Nepal Gazette 2029-11-28*
3. MEA (2005). Millennium Ecosystem Assessment. Ecosystems and Human Well-Being: Current State and Trends. World Resources Institute, Washington, D.C.
4. MFSC (2014). Nepal Fifth National Report to Convention on Biological Diversity, Ministry of Forest and Soil Conservation, Kathmandu, Nepal.
5. MFSC (2016). Conservation Landscapes of Nepal, Ministry of Forests and Soil Conservation, Kathmandu, Nepal.

SEMESTER III

COURSE TITLE: PARK RECREATION AND TOURISM

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
PWM 614	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: This course builds knowledge and skills in various dimensions of tourism, recreation theories, and planning frameworks. It examines the interaction of the tourism and recreation industry within the natural protected environment, their impacts, and strategies to balance conservation over development for its sustainability. The teaching style of this course will include both classroom learning and field study.

OBJECTIVES: The objectives of this course are to:

- Understand the scope and applications of nature-based tourism and recreation management policies and practices
- Apply and develop competency in tourism enterprise planning of nature-based tourism and recreation for national and international tourism markets
- Appraise social, economic, and environmental impacts associated with nature-based tourism and recreation

LEARNING OUTCOMES: Upon the completion of this course students will be able to:

- Enable in-depth knowledge on nature-based tourism and recreation management policies and practices in and outside protected areas.
- Demonstrate managerial skills to plan and evaluate nature-based tourism in a sustainable way.

COURSE CONTENTS

UNIT 1: INTRODUCTION (6)

1.1 Concept of Tourist, Tourism Typology and Ecotourism, Relation of Leisure, Tourism and Recreation, Tourism Resources (nature, culture and physical), tourism products and its characteristics)
1.2 History, Nature, and Importance of Outdoor Recreation
1.3 Park Tourism and Recreation Activities in National, Regional and Global
1.4 Current Trend and Scope of Recreation and Tourism (global to national)
1.5 Philosophy of Leisure and Characteristics of Outdoor Recreation
1.6 Motivation, Travel Experience and Benefits of Recreation and Tourism

UNIT 2: THEORIES AND PRACTICE OF TOURISM (7)

2.1 Theories of Tourism and Recreation
2.1.1 Crompton's Push and Pull
2.1.2 Leiper's Tourism as a System

2.1.3 Theory of Recreation (Play theory: classical and modern theories)
2.1.4 Progressive Model of Jafar Jafari
2.1.5 Butler's Tourism Area Life Cycle

2.2 Practices and Application of Ecotourism (based on case study from global to national)
2.2.1 In and Around the Protected Area
2.2.2 Ecotourism Promotion (e.g., homestay, jungle safari, village tourism)
2.2.3 Ecotourism Entrepreneurship and Conservation
2.2.4 Application of Ecotourism: Demand and Supply Aspects, Multiplier and Leakages, Contribution in Local, National, and Global Economy
2.2.5 Ecotourism Entrepreneurship: Legal Provision, Institutional Support, Financing

UNIT 3: ROLE OF PARKS IN RECREATION AND ECOTOURISM (6)

3.1 Protected Areas of Nepal and Associated Tourism Activities
3.2 Relationship between Tourism and Environment (symbiosis and potential conflict)
3.3 Wildlife-Based Ecotourism (Case Study of Dhorpatan Hunting Reserve, Bardiya and Chitwan National Park, Koshi Tappu Wildlife Reserve)
3.4 Unique Landscape and Culture in Ecotourism (case study of Annapurna Conservation Area, Langtang, Sagarmatha, and Shey-Phoksundo National Park)
3.5 Role of Community Forestry (case study of Kumroj BZCF or attractive nearby CFUG), Conservation Forest (case study of Panchase, Kakrebihar, Barandabaar), Green Space (Sahid Smarak Hetauda, Rani Ban Pokhara) for Ecotourism
3.6 Role of Botanical and Zoological Parks, Fun Parks, Theme Parks, and Other Tourist Sites and Destinations for Ecotourism

UNIT 4: ECOTOURISM PLANNING AND MANAGEMENT (8)

4.1 Roots of Conservation and Community Development
4.2 Ecotourism Planning: Concept, Principles, Process, Activities
4.2.1 Traditional/Classical methods
4.2.1.1 Carrying Capacity (CC): Determining Optimum CC
4.2.1.2 Recreation Opportunity Spectrum (ROS)
4.2.1.3 Limits of Acceptable Change (LAC)
4.2.1.4 Visitor Impact Management (VIM)
4.2.2 Participatory/Modern Methods
4.2.2.1 Strength Weakness Opportunity Threats (SWOT)
4.2.2.2 Goal-oriented Project Planning (ZOPP)
4.2.2.3 Appreciative Participatory Planning and Action (APPA)
4.3 Ecotourism Management
4.3.1 Eco-infrastructure (eco-lodge, eco house, eco trek, drinking water)
4.3.2 Waste Management
4.3.3 Host and Guest Conflict
4.3.4 Resource Conflict
4.3.5 Capacity Building
4.4 Ecotourism Marketing (marketing mix, eco branding, labeling, communication and extension materials)

UNIT 5: TOURISM ISSUES, IMPACT AND ASSESSMENT TECHNIQUES (5)

5.1 Determinants of the Tourism and Tourist Characteristics

5.2 Benefits and Costs of Ecotourism in Protected Areas
5.2.1 Existing and Potential Opportunities
5.2.2 Existing and Potential Threats
5.3 Impact of Tourism in Rural Areas
5.4 Issues Associated with Measuring Tourism Impacts
5.5 Tourism Impacts: Positive and Negative (socio-cultural, economic, physical) and their Assessment Techniques
5.5.1 Index of Tourist Irritation (Doxey Irridex Model)
5.5.2 Host Attitudinal-Behavior Response to Tourist Activities (Allan Behavior Matrix)
5.6 Possible Mitigation of Negative Impacts on the Environment

PRACTICAL (16)

Learning objectives: Students should understand the application of tools, techniques and practice of Ecotourism impact assessments, planning ecotourism resources and impacts in and around protected areas for hands-on experiences. This section is separated into two broad classes- one is practical, which should be based on three days field-tour and another is term paper. In term paper, the tutor could give assignments to prepare the term paper report related to the theory part as an internal assessment.

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
SWOT of tourism & recreation parks, sites, and destinations or organizations within PAs	Recording instruments (Notebooks, tape recorder), Brown paper, Meta card, Sign-pen, Board-marker	Fieldwork Meetings with stakeholders Observation Review secondary sources	Unit 3, 4
Analysis of tourist characteristics and Estimating tourism carrying capacity	Framework for tourism CC assessment (e.g., Sharma, 1995; Santos & Brilha, 2023), Meta card, Sign-pen, Brown paper, Board-marker	Fieldwork Sampling, Inventory (if needed) Meeting or workshop Report preparation	Unit 4
Tourism strategic plan preparation using ZOPP and APPA	Meta card, Sign-pen, Brown paper, Board-marker	Fieldwork Observation Stakeholder workshop Group work Log frame and 4D mapping	Unit 4
Tourism impact assessment (Doxey Irridex Model and Allan Behavior Matrix approach)	Checklist, Meta card, Sign-pen, Brown paper, Board-marker	Survey (if needed) Meetings, Observation, Stakeholder workshop, Group work Matrix-based report preparation	Unit 5

KEY REFERENCES

Unit 1

1. Lickorish, L. J. & Jenkins Carson, L. (1997).“An Introduction to Tourism”. *Addison Wesley Longman*, Essex.
2. McIntosh, R. W., Goeldner, C. R., & Ritchie, J. B. (1995). *Tourism: principles, practices, philosophies* (No. Ed. 7). John Wiley and Sons. **(Unit 2 too)**
3. World Bank (2020). Tools and resources for nature-based tourism. Washington DC. www.worldbank.org
4. Youell, R. (1998). *Tourism: an introduction*. Addison Wesley Longman Ltd.

Unit 2

1. Mellou, E. (1994). Play theories: A contemporary review. *Early child development and care*, *102*(1), 91-100.

Unit 3

1. Eagles, P.F.J. & McCool, S.F. (2002). Tourism in National Parks and Protected Areas: Planning and Management. CABI Publishing. **(Unit 2,4 too)**
2. Eagles, P.F.J., McCool, S.F. & Haynes, C.D. (2002). Sustainable tourism in protected areas: Guidelines for planning and management. IUCN **(Unit 2,4 too)**
3. Nyaupane, G. P. & Timothy, D. J. (Eds.). (2022). *Tourism and Development in the Himalaya: Social, Environmental, and Economic Forces*. Routledge. Chapter 1 and 8 **(Unit 2 too)**

Unit 4

1. Drumm, A. & Moore, A. (2005). An introduction to ecotourism planning. *The Nature Conservancy: Arlington, VA, USA.*
2. Fennell, D. A. & Dowling, R. K. (Eds.). (2003). *Ecotourism policy and planning*. CABI.
3. Santos, P. L. & Brilha, J. (2023). A review on tourism carrying capacity assessment and a proposal for its application on geological sites. *Geoheritage*, *15*(2), 47.
4. Sharma, P. (1995). A framework for tourism carrying capacity analysis. *Kathmandu: International Center for Integrated Mountain Development*.
5. Shrestha, S.K. (2001). Recreation and tourism planning and management in the protected areas. IOF/NACRMP Nepal. **(Unit 5 too)**

Unit 5

1. Matias, Á., Nijkamp, P. & Romão, J. (Eds.). (2016). *Impact assessment in tourism economics*. Springer International Publishing.

COURSE TITLE: NATURAL RESOURCE SAFEGUARDS IN INFRASTRUCTURE

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
PWM 615	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: This course explores the intersection of infrastructure development and Natural Resource (NR) safeguards. The course focuses on developing foundational concepts of road ecology and infrastructure planning for safeguarding natural resources, particularly wildlife and their habitat and livelihood of local communities mainly poor, women, and indigenous people. NR includes forests, wildlife (terrestrial and aquatic), soil/land, water, and air which are found in nature and can be used by people. Students will understand the environmental, economic, and social impacts of infrastructure projects and learn strategies for safeguarding NR while pursuing development goals. Students will write case studies of best practices in sustainable infrastructure planning and will have opportunities to visit field sites and see how different structure and design considerations of mitigation/safeguard measures are being implemented.

OBJECTIVES: This course aims to educate students on the significance of integrating NR safeguards into infrastructure development. The specific objectives are as follows:

- To understand the impacts of infrastructure development on natural resources and gain insight into NR safeguard measures.
- To know the concepts and principles of road ecology.
- To understand the importance of appropriate planning, policies, and programs related to infrastructure development to safeguard NR.
- To learn the reduction/mitigation of the impacts of infrastructure on NR through extensive case studies and best practices adopted, specifically focusing on mitigating the impacts of infrastructure on biodiversity conservation and social well-being.

LEARNING OUTCOMES: Upon completion of this course, students should be able to:

- Establish a clear understanding of the relationship between infrastructure development and NR safeguards.
- Analyze the environmental impacts of infrastructure projects on biophysical, economic, and social components including the local community.
- Understand strategies for nature-positive infrastructure development that minimize harm and maximize benefits to natural resources, with a specific focus on wildlife and their habitat.
- Evaluate case studies demonstrating the impacts of infrastructure projects on wildlife habitat and identify best practices adopted to mitigate these impacts.
- Understand the principles of road ecology in the context of natural resources safeguards.

COURSE CONTENTS

UNIT 1: INTRODUCTION (4)

1.1 Key Concepts and Terminologies (natural resources and their type, green financing,

empty forests, edge effects, change in landscape pattern, meta-population, natural resource safeguard, linear and non-linear infrastructure, wildlife-friendly infrastructure, habitat fragmentation, wildlife behavior)

1.2 Importance of Infrastructure Development and Basic Standards

1.3 Historical Background and Current State of Natural Resource Safeguards Measures

1.4 Driver of Habitat Fragmentation

1.4.1 Natural Drivers (e.g., natural stochasticity: volcano, earthquake, lightning, and natural wildfire)

1.4.2 Anthropogenic Drivers (e.g., land use change, agriculture, human settlement, forest fire, infrastructure, pollution, over-harvesting of forest resources)

1.5 Consequences of Habitat Fragmentation on Biodiversity (e.g., reduced connectivity and gene flow/inbreeding, reproductive isolation, extinction debt)

UNIT 2: INFRASTRUCTURE IMPACT ON WILDLIFE (8)

2.1 Types of Infrastructure and their Spatial Configurations

2.1.1 Linear Infrastructure: Roads, Railways, Ropeways, Trenches and Fences, Electric Transmission Lines, Pipelines, Irrigation canals, Barrages for Water Diversion

2.1.2 Non-linear Infrastructure: Towers, Hydroelectric Dam, Airport, Other Point Infrastructures (industries, solid waste treatment site, septic tank)

2.2 Basic Concept and Guidelines for Impact Assessment

2.3 Relative Impact of Different Types of Linear Infrastructure on Ecology

2.3.1 Direct Impacts (habitat loss and fragmentation, change in configuration of existing habitat, creation of edge effect, barrier effect, attraction effect, local extinction of native species, bottleneck; road kills-wildlife vehicle collision; obstruction in migratory routes – birds and aquatic animals, electrocution, drowning)

2.3.2 Indirect Impacts (barrier effect and avoidance zone, modification of the environment, downstream impact), water availability, change in wildlife behavior (change in wildlife intra and interspecific interactions), human development/settlement, encroachment, possible illegal harvest and poaching/increased fire risk, water and noise pollution, and the spread of invasive species, changes in wildlife behavior)

2.4 State of Impact/Intersection of Infrastructure on Wildlife Resources and their Habitats

2.5 Case Studies of Linear Infrastructure's Impacts and Safeguard Practices

UNIT 3: ROAD ECOLOGY (8)

3.1 Key Terminologies and Concept of Road Ecology (road ecology, the foundation of road ecology, network theory for road ecology, road vehicle and transportation planning, road networks and their interaction with landscape, traffic, sound and noise, and travel behavior)

3.2 Biotic and Abiotic Interactions of Roads

3.3 Roadsides is a Novel Ecosystem (habitat function, corridor function) as Corridor or as Barrier or Attraction

3.4 Ecological and Evolutionary Consequences of Roads

3.5 Road and Wildlife Population

3.5.1 Wildlife Mortality on Roads, Factors Affecting Roadkills, Changes in Amount

and Quality of Habitat, Effects on Landscape Connectivity, Cumulative Effects and Road Density

3.6 Review of Case Studies on Road Ecology

3.7 Integration NR Safeguards in Planning and Road Design

UNIT 4: ECOLOGICAL SAFEGUARD MEASURES IN LINEAR AND NON-LINEAR INFRASTRUCTURES (8)

4.1 Mitigation Hierarchy to Achieve No Net Loss of Environmental Value During and After Construction (avoid, minimize, mitigate, offset).

4.2 Types of NR Safeguard Measures for Linear and Non-Linear Infrastructure and Design Considerations (roadways, railways, power lines, irrigation canals, hydropower dams)

4.3 Social and Economic Considerations (cost-optimal, social impacts)

4.4 Various Mitigation Measures: Underpass, Overpass, At-Grade Crossings, Wildlife "Crosswalks," Fencing, Arboreal Mammals Canopy Bridges, UV (390–400 nm) Avian Collision Avoidance Systems (ACASs) used in Electric Transmission Lines, etc.

4.5 Infrastructure Planning, Principles, and Design Considerations

4.5.1 Process Involved in Infrastructure Project Selection (project concept note preparation, pre-feasibility study, feasibility study, detail project report preparation, and environment studies); Framework for Green Retrofitting

4.6 Sustainable Transportation Planning (time card, Vehicle Tracking and Recovery System (VTRS), speed limit, animal crossing sign post, avoiding vehicle movement in peak periods of animal movement, awareness to driver and passengers)

4.6.1 Case Studies in Natural Resources and Social Safeguard Integration in Infrastructure Design and Planning

4.7 Road Water Management

4.7.1 Roads for Water and Resilience

4.7.2 National and International Case Studies on Roads for Water

4.8 Construction and Operation of Safeguard Measures

4.8.1 Construction Management of Safeguard Measures in Infrastructure Projects

4.8.2 Operation and Maintenance of Safeguard Measures

UNIT 5: NATIONAL AND INTERNATIONAL POLICY ON NATURAL RESOURCE SAFEGUARDS (4)

5.1 Importance of Policy and Regulatory Safeguards in Infrastructure Development Planning and Implementation

5.2 National Policies and Legal Safeguards (e.g., Wildlife Friendly Infrastructure Construction Directives, 2022. Forest Act, Rules, Environmental Protection Act and Rules, National Park and Wildlife Protection Act, etc.)

5.3 International Policy Safeguards (green financing and safeguard measures such as Strategic Environmental Impact Assessment and other policy tools adopted by financing institutions and donors, eg., World Bank's Environmental and Social Framework)

5.4 International and Regional Commitments (treaties and conventions) Related to Natural Resource Safeguard (GEF environmental and social safeguard policy, Convention on Migratory Species (CMS) guidelines emphasizing safeguard from linear infrastructure projects)

PRACTICAL (16): 5 days field visit

Contents	Equipment/tools	Methodology/methods	Link to Unit(s)
Study on the impact of point infrastructure such as hydropower in the environment/wildlife on indigenous people and local communities	Demo, practical " how point structure impacts the environment including wildlife"-sign survey, camera trap, line transect (distance and angle measuring instruments digital) to verify and cross-check	Dhap dam in Shivapuri-Nagarjun NP or Indrasarobar dam or nearby campus for point infrastructure Narayanghat-Mungling section or Narayanghat-Butwal section for Linear infrastructure Observe the signs of wildlife along and within the infrastructure locations, and interpret whether the infrastructure is permeable, impermeable, or partly permeable and discuss why	Unit 2
Study on impact of linear infrastructure such as roads, canals, electricity and transmission lines, and tunnels in the environment/wildlife	Demo, practical " how Linear structure impacts the environment including wildlife"-sign survey, camera trap, line transect to verify and cross-check		
Study on effectiveness of safeguard measures of infrastructure project	Checklist, Protocol	Visit one of the sites where both pre-feasibility and feasibility are completed and implementation in progress Interaction, site visit, study/review the documents, interview with concerned agencies, write discussion report (work in a small group). Get the reports and write your discussion on all the stages	Unit 4
Study on factors responsible for roadkill	Secondary data, SPSS/R/Stata	Regression, Report writing	Unit 3

Internal assessment: Group project; the students will be divided into groups of 3-4 students, and they will submit this case study project. Based on the theoretical part and the current context of forest management in Nepal, the following five topics seem rational. A tutor could give assignments to prepare the report on given topics as an internal assessment.

Develop a case study report outlining, explaining, and including the following topics:

1. Identify the context/location where there was an issue of/need for wildlife-friendly infrastructure development/road planning etc.

2. Outline the process followed for infrastructure planning (What was the basis of planning, what ecological and socio-economic considerations were followed? Was it targeted for a particular species, say elephant or multiple species?)
3. What is the success story, lessons learned, any stories of failures, and what are the outcomes?
4. Effectiveness assessment criteria and/or framework

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1. Andrews, K. M., Nanjappa, P., & Riley, S. P. (Eds.). (2015). Roads and ecological infrastructure: concepts and applications for small animals.
2. Habib, B., Rajvanshi, A., Mathur, V. B., & Saxena, A. (2016). Corridors at crossroads: linear development-induced ecological triage as a conservation opportunity. *Frontiers in Ecology and Evolution*, *4*, 132. **(Unit 4 too)**
3. Laurance, W. F., Goosem, M., & Laurance, S. G. (2009). Impacts of roads and linear clearings on tropical forests. *Trends in ecology & evolution*, *24*(12), 659-669. **(Unit 4 too)**
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6. Seiler, A. (2001). *Ecological effects of roads: a review*. Uppsala: Swedish University of Agricultural Sciences. **(Unit 3 too)**

Unit 3

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2. Forman, R. T. (2003). *Road ecology: science and solutions*. Island press. https://arc-solutions.org/wp-content/uploads/2012/03/Forman-et-al.-2003-Road-Ecology-Sci-and-solutions.pdf
3. Santos, R., Shimabukuro, A., Taili, I., Muriel, R., Lupinetti-Cunha, A., Freitas, S. R., & Calabuig, C. (2023). Mammalian Roadkill in a Semi-Arid Region of Brazil: Species, Landscape Patterns, Seasonality, and Hotspots. *Diversity*, *15*(6), 780.
4. Saxena, A., & Habib, B. (2022). Crossing structure use in a tiger landscape, and implications for multi-species mitigation. *Transportation Research Part D: Transport and Environment*, *109*, 103380. https://doi.org/10.1016/j.trd.2022.103380 **(Unit 4 too)**

5. Van Der Ree, R., Smith, D. J., & Grilo, C. (2015). *Handbook of road ecology*. John Wiley & Sons.

Unit 4

1. ACAS: https://academic.oup.com/condor/article-abstract/121/2/duz008/5476728
2. Ament, R., Clevenger, A., & van der Ree, R. (2023). *Addressing ecological connectivity in the development of roads, railways and canals* (No. 5). IUCN WCPA technical report series. https://portals.iucn.org/library/sites/library/files/documents/PATRS-005-En.pdf
3. Asian Development Bank (2019). Green infrastructure design for transport projects a road map to protecting Asia's wildlife biodiversity. https://www.adb.org/sites/default/files/publication/547891/green-infrastructure-design-transport.pdf (Manual)
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9. WII (2016). Eco-friendly Measures to Mitigate Impacts of Linear Infrastructure on Wildlife. Wildlife Institute of India, Dehradun, India. https://wii.gov.in/images/images/documents/eia/EIA_BPG_Report_2017.pdf (Manual)

Unit 5

1. CMS guidelines: https://www.cms.int/sites/default/files/publication/cms-cami_pub_linear-infrastructure_wcs_e.pdf
2. GEF guidelines: https://www.thegef.org/sites/default/files/documents/gef_environmental_social_safeguards_policy.pdf
3. World Bank's Environamntal and Social Framework: https://consultations.worldbank.org/content/dam/sites/consultations/doc/migration/the_esf_clean_final_for_public_disclosure_post_board_august_4.pdf
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COURSE TITLE: HUMAN-WILDLIFE INTERFACE MANAGEMENT

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
PWM 616	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: The human-wildlife Interface Management course is multifaceted and encompasses a wide range of activities and areas of focus (viz. Wildlife Conservation**,** Conflict Resolution and Mitigation, and Community Engagement). The primary goal of this field is to promote the coexistence of humans and wildlife while minimizing conflicts and ensuring biodiversity conservation.

OBJECTIVES: Human-wildlife Interface Management is designed to equip students with the necessary knowledge and skills to effectively manage interactions between humans and wildlife, reduce conflicts, and promote wildlife conservation. The student will be able to learn new skills as specified.

- Understanding Wildlife Ecology and Behavior
- Conflict Identification and Assessment
- Conflict Resolution and Mitigation
- Community Engagement and Participation
- Research and Monitoring

LEARNING OUTCOMES: Upon completion of this course, students should be able to:

- Understand the ecological requirements and behavior of wildlife species, including their habitats, migration patterns, and dietary preferences.
- Proficient in identifying and managing conflicts between humans and wildlife. They will be able to develop and implement strategies to reduce and prevent conflicts, such as crop damage and livestock predation.
- Well-versed in wildlife conservation principles and strategies, including habitat management, population monitoring, and endangered species protection.
- Learn how to engage with local communities and involve them in wildlife conservation efforts.
- Enhance skills in community-based conservation and the development of collaborative approaches.

COURSE CONTENTS

UNIT 1: INTRODUCTION TO HUMAN-WILDLIFE CONFLICT (8)

1.1 Key Wildlife Species and their Distribution in Nepal
1.2 Wildlife Damage Typology
  1.2.1 Crop Damage
  1.2.2 Livestock Predation
  1.2.3 Human Injuries and Causality
  1.2.4 Property/Infrastructure Damage

1.3 Introduction to Human-Wildlife Conflict (HWC)
  1.3.1 Cause and Consequences of HWC
  1.3.2 Human-Wildlife Coexistence
1.4 Historical Perspective of HWC in Nepal

UNIT 2: HUMAN-WILDLIFE INTERACTION (6)

2.1 The Ecological and Economic Values of Wildlife
2.2 Dynamics of Human-Wildlife Interaction (demography, economics, spiritual, cultural, awareness level, human psychology)
2.3 Wildlife Behavior and its Impact on Human Interactions
2.4 Human Behavior (Conflict Causing) and its Impact on Wildlife
2.5 Ethnozoology (Case study of the Indigenous Community, e.g., Raute, Bhote, Musar community; Beyul practices in Tsum, Khumbu, Rowaling Valley)

UNIT 3: LEGAL FRAMEWORK FOR HUMAN-WILDLIFE COEXISTENCE (6)

3.1 Policy and Legal Provisions Related to HWC Management
  3.1.1 Wildlife Damage Relief Distribution Guidelines (with all amendments)
  3.1.2 Wildlife-Friendly Infrastructure Construction Directives 2022
3.2 Conflict Resolution and Management (Community-based approaches)
  3.2.1 Communities for Coexistence and Conservation (buffer zone, Conservation Areas (CA), community forests, CBAPU, RRT)
  3.2.2 Income-generating Activities Related to Wildlife Conservation
3.3 National Park Congress, CBD, CITES (illegal trade control)

UNIT 4: HUMAN-WILDLIFE COEXISTENCE (6)

4.1 Human-wildlife Damage Preventive and Control Measures
  4.1.1 Physical Measures (fence, trench, scarecrow, watch tower, lighting and threatening devices, cover removal, predator-proof corals, animal traps, etc.)
  4.1.2 Biological Measures (bee hives, alternative crops/profession, e.g., fishery, citrus, spices, bio fencing)
  4.1.3 Chemical Measures: Fumigants, Smoking, Chemical Immobilization, Chemical Repellents
  4.1.4 Community-based (social) Measures
  4.1.5 Other Measures (insurance, early alarm system, fireworks, sound and noise, chili powder)
4.2 Lethal Control and Ethical Considerations: Human Safety, Target Species and Population Health, Cultural and Ethical Values
4.3 Case Studies of Conflict and Coexistence

UNIT 5: RESEARCH AND MONITORING (6)

5.1 Key Problematic Animal: Priority Setting for Identification, Monitoring and Handling
5.2 Spatio-temporal Pattern of Wildlife Damage (a case study of Blue bull, Rhino, Elephant, Monkey, Leopard, Tiger, Snow leopard)
5.3 Wildlife Damage Assessment Tools and Techniques
  5.3.1 Estimating Damage Valuation
  5.3.2 Cost-benefit Analysis of Best Control Measures (any three)

5.4 Monitoring of Different Damage Control Measures (e.g., electric fence, predator-proof corals, and alternative crops)
5.5 HWC Mapping (tools and techniques)
5.6 Case Studies of Control Measures: Effectiveness and Learnings
5.7 Prospect and Constraint of Wildlife Damage Research and Monitoring (e.g., motivation, resources, application and implication)

PRACTICAL (16)

The first five topics seem rational based on the theoretical part and current context of Human-Wildlife Interface Management in Nepal. The student should prepare a conflict management strategic plan at the end of the practical.

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
Understanding wildlife damage typology in hills and terai	Survey checklist, observation checklist	Conducting field observations and data collection: listing out (excursion to nearby wildlife damage-prone sites)	Unit 1
Damage assessment and attitude survey	Questionnaire and checklist	KII, FGD, Direct observation, SPSS (excursion to nearby wildlife damage-prone site)	Unit 1, 5
Exploring adopted/adapted damage control measures and local perception	Questionnaire and checklist	Meeting with community, FGD, Perception ranking (excursion to nearby wildlife damage-prone site)	Unit 4
Effectiveness analysis of damage control measure	Checklist	Observation, Meeting, FGD, Effectiveness ranking	Unit 5
Critical review: Wildlife damage Relief distribution guidelines	Review	Desktop review, report writing, presentation	Unit 3

KEY REFERENCES

Unit 1

1. R. Woodroffe, S. Thirgood, & A. Rabinowitz. (Eds). "Human-Wildlife Conflicts: Causes, Consequences, and Management". **(Unit 2, 4 too)**
2. Acharya, K. P., & Paudel, P. K. (2016). Human-Wildlife Conflicts in Nepal: Patterns of Human Fatalities and Injuries Caused by Large Mammals. PLOS ONE, 11(9), e0161717.
3. Bhattarai, B. R., Kindlmann, P., Jana, S., & Lhendup, T. (2013). Understanding Human-Wildlife Conflicts in the Annapurna Conservation Area, Nepal. Environmental Management, 51(5), 1042-1053.
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7. Sharma, N. P. (2015). Human Wildlife Conflict and Local People's Perception in Bardia National Park, Nepal. Journal of Applied Science and Engineering, 18(3), 237-246. **(Unit 4 too)**

Unit 2

1. Bolton, M. (Ed.). (1997). *Conservation and the use of wildlife resources* (Vol. 8). Springer Science & Business Media.
2. Department of National Parks and Wildlife Conservation, Nepal. (2014). Annual Report: 2013/14. Government of Nepal. **(Unit 4 too)**

Unit 3

1. GoN (2022) Wildlife-Friendly Infrastructure Construction Directives 2022. Department of National Park and Wildife reserve, Kathmandu Nepal.
2. GoN (2080). Wildlife Damage Relief Distribution Guideline. Department of National Park and Wildife reserve, Kathmandu Nepal. (all amendments)
3. Human-Wildlife Conflict Expert Committee (2018). Human-Wildlife Conflict Management Action Plan. Ministry of Forests and Environment, Government of Nepal.

Unit 4

1. Attia, T. S. N., Martin, T. N., Forbuzie, T. P., Angwafo, T. E., & Chuo, M. D. (2018). Human-wildlife conflict: causes, consequences and management strategies in Mount Cameroon National Park South West region, Cameroon. *International Journal of Forest, Animal and Fisheries Research*, *2*(2), 34-49. **(Unit 2, 1 too)**
2. Carter, N. H., Shrestha, B. K., Karki, J. B., Pradhan, N. M. B., & Liu, J. (2012). Coexistence between wildlife and humans at fine spatial scales. Proceedings of the National Academy of Sciences, 109(38), 15360-15365.

Unit 5

1. Fall, M. W., & Jackson, W. B. (2002). The tools and techniques of wildlife damage management—changing needs: an introduction. *International biodeterioration & biodegradation*, *49*(2-3), 87-91.
2. Lamichhane, B. R., & Persoon, G. A. (2014). The Political Ecology of Human-Wildlife Conflict: Producing 'Problem' Elephants in Nepal. Geoforum, 57, 197-206. **(Unit 1 too)**
3. Lamichhane, B. R., Persoon, G. A., Leirs, H., Poudel, S., Subedi, N., Pokheral, C. P., ... & De Iongh, H. H. (2018). Spatio-temporal patterns of attacks on human and economic losses from wildlife in Chitwan National Park, Nepal. *PloS one*, *13*(4), e0195373.

COURSE TITLE: CONSERVATION BIOLOGY

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
PWM 617	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: This subject aims to make students understand concepts and principles of conservation biology and make them able to apply these principles in the sustainable management of biological resources. Moreover, this course will familiarize students with a multitude of phenomena that impact the preservation, extinction, and restoration of biodiversity, as well as the scientific principles governing the maintenance of evolutionary processes that result in genetic, population, species, and ecosystem diversity.

OBJECTIVES: The objectives of this course are to:

- Describe the conceptualization, evolution, and ethics of conservation biology
- Assess the nature and extent of habitat transformation and threats to species extinction
- Understand the key factors that may affect evolution and extinction
- Know biological principles for restoring degraded habitat

LEARNING OUTCOMES: Upon completion of this course, students should be able to:

- Understand the principles and ethics of conservation biology
- Know past and current patterns of threats to species evolution and extinction
- Know the cause of threats to biological diversity
- Familiar with various genetic issues and the importance of genetic heterogeneity in species conservation
- Hands-on tools and technology of conservation genetics
- Prepare plan and execute programs for restoring degraded ecosystems

COURSE CONTENTS

UNIT 1: INTRODUCTION TO CONSERVATION BIOLOGY (5)

1.1 Introduction, History, and Evolution of Conservation Biology
  1.1.1 Principles of Conservation Biology
  1.1.2 Origin of Conservation Biology (case study on sea turtles to an interdisciplinary approach)
  1.1.3 Conservation Biology's Ethical Principles
  1.1.4 Conservation Biology- A Crisis Discipline
1.2 Scope of Conservation Biology
1.3 Conservation Ethics (Anthropocentrism: The Judeo-Christian Stewardship Ethics, Traditional Non-Western Environmental Ethics, Biocentrism: The Easter Ethics of the Spirit of Diversity, Ecocentrism: The Importance of Value System)

UNIT 2: THREATS TO BIODIVERSITY: EXTINCTIONS AND HABITAT DEGRADATION (8)

2.1 Extinction of Biodiversity

2.1.1 Current Patterns of Threats to Extinction
2.1.2 Extinction Rates on Islands or Fragmented Patches: Drivers, Types, Processes and Extinction Rates
2.1.3 Estimating Extinction Rates: Island Biogeography Model
2.1.4 Local Extinctions
2.1.5 Vulnerability to Extinction (Endemic Species: Types, Patterns, Causes and Classifications of Endemic Species, Species Rarity and Vulnerability)
2.1.6 IUCN Red List of Threatened Species (Barometer of Life: Goal, Progress, Limitations of Current Data, Gaps; Rules, Categories, Criteria and Procedures for IUCN Red List Assessment

2.2 Patterns of Habitat Transformations
2.2.1 Causes of Habitat Degradation and Loss
Deforestation Patterns; Loss of Grassland, Savanna, and Scrublands; Degradation of Freshwater and Marine Wetlands; Anthropogenic Causes of Transformation: Agriculture (permanent/seasonal); Resources Extractions; Urbanization and Infrastructure Development, Pollution; The Civil War Effects (Nepalese case)
2.2.2 The Fragmentation Processes
2.2.3 Consequences of Fragmentation on Biodiversity (initial exclusion, crowding effects, insularization and area effects, isolation, edge effect, matrix effects, road casualties, species invasion, effects on ecological processes)
2.2.4 Biodiversity Threat Assessment (e.g., The CAMP Process)

UNIT 3: CONSERVATION GENETICS (10)

3.1 Issues, and Importance of Genetic Diversity
3.1.1 Genetic Variations (variation among individuals, between populations, and at the metapopulation level)
3.1.2 Field of Conservation Genetics (basic terminology review): Identification of Origin of Current Wildlife Population; Population survey; Importance in Forensics; Taxonomic Uncertainties; Outbreeding/inbreeding, Population Structure, Fragmentation; Conservation of Severely Reduced Gene Pools; Captive Breeding and Reintroduction
3.1.3 Factors Affecting Genetic Diversity
3.1.3.1 Positive factors: Mutation, Heterozygosity, Natural Selection, The Effective Population Size (N_e), Outbreeding, Outcrossing
3.1.3.2 Negative Factors: Mutation, Population Bottleneck, Founder Effects, Genetic Drift, Homozygosity, Inbreeding and Inbreeding Depression

3.2 General Concept of Tools and Technologies of Conservation Genetics
3.2.1 Protein Electrophoresis
3.2.2 Mitochondrial DNA Analysis
3.2.3 Nuclear DNA Analysis
3.2.4 Polymerase Chain Reaction (PCR)
3.2.5 DNA, RNA, mRNA Analysis
3.2.6 Phylogenetic Analysis

3.3 Non-Invasive Genetics (NIG): Sampling
3.3.1 Concept, Ethical Considerations, and Recent Development in NIG
3.3.2 NIG protocols (e.g., Snow leopard monitoring protocol using NIG)

3.3.3 Prospects and Constraints of NIG in Nepal

UNIT 4: RESTORATION OF DEGRADED ECOSYSTEMS AND SPECIES (5)

4.1 Restoration of Biodiversity
- 4.1.1 Principles of Restoration Ecology: Concept and Principles
- 4.1.2 Restoration of Degraded Wildlife Population (eg., rescue, animal treatment, rehabilitation; capture and handling of injured animals; rescue center, animal hospital)
- 4.1.3 In-situ Restoration (e.g., relocation of human settlements)
- 4.1.4 Reintroduction and Translocation (definition, process, types, and learning from Nepalese contexts; sensitivity of translocation)

4.2 Restoration of Degraded Habitat/Ecosystem (enhancement, replacement, rehabilitation, restoration; plant community restoration; riverine restoration; restoration from greenhouse gas emission)

4.3 Restoration of Genetic Diversity (seed orchard, gene bank; control over hybridization dispersal)

4.4 Government Initiation on Restoration of Biodiversity; Wild/Domestic Animals, Plant, Habitat Restoration

4.5 Success Stories on Restoration Ecology from Around the Globe

UNIT 5: APPROACHES AND APPLICATION OF CONSERVATION BIOLOGY (4)

5.1 Approaches Against Conservation Problems
- 5.1.1 Ecosystem Level Approaches of Conservation (understanding dynamism of ecosystem and resilience; Protected Areas (PA); conservation outside PAs)
- 5.1.2 Population and Landscape-level Conservation Approaches (metapopulation, source-sink concept for conservation; population regulation; population viability assessment; ecologically functional population; problem of very small population)

5.2 Landscape Models for Conservation

5.3 Traditional Ecological Knowledge (TEK) and Conservation (traditional institutions; cultural rules and regulations (Taboos) for sustainable conservation)

PRACTICAL (16)

Contents	**Equipment/tools**	**Methodology/methods**	**Link to Unit(s)**
Review of traditional conservation practices of Eastern Culture	Eastern Philosophy, Literature	Literature review	Unit 1
Assessment of major threats of habitat transformation in nearby areas (e.g., Churia region)	Checklists	Structured and Semi-Structured Interviews	Unit 2
Study on field procedures, sampling, data collection, handling of samples, and analysis process	Genetics lab, apparatus, devices, protocols, and sample	Visit (excursion) to the nearby genetic lab Orientation	Unit 3
Critical review on restoring degraded habitat	Related literature	Reviews of literature Presentations Report writing	Unit 4

Review of applications of conservation biology in biodiversity conservation	Related literature	Reviews of literature Presentations Report writing	Unit 5

KEY REFERENCES

Unit 1

1. Hunter Jr, M. L., & Gibbs, J. P. (2006). *Fundamentals of conservation biology*. John Wiley & Sons.
2. Primack, R. B., Paudel, P. K., & Bhattarai, B. P. (2013). Conservation biology: A primer for Nepal. *Dreamland Publication, Kathmandu, Nepal*. **(Unit 2 too)**

Unit 2

1. Caughley, G., & Gunn, A. (1996). *Conservation biology in theory and practice*. Cambridge, Mass., Blackwell Science.
2. Eldredge, N. (Ed.). (1992). *Systematics, ecology, and the biodiversity crisis*. Columbia University Press.

Unit 3

1. Ehrlich, P.R. (1981). *Extinction: The Causes and Consequences of the Disappearance of Species*. Random House, New York.
2. Falconer, D. S. (1996). *Introduction to quantitative genetics*. Pearson Education India. Or Falconer, D.S. (1981). *Introduction to Quantitative Genetics.* Longman. New York.
3. Soulé, M. E. (Ed.). (1987). *Viable populations for conservation*. Cambridge university press.

Unit 4

1. Fiedler, P.L. & Jain, S.K. (1992). *Conservation Biology: Theory and Practice of Conservation, Preservation and Management.* Chapman and Hall, New York. **(Unit 1 too)**

Unit 5

1. Board, P. A. (2006). Protected Areas Programme. https://www.iucn.org/sites/default/files/import/downloads/14_3lowres.pdf
2. Gilpin, M. (Ed.). (2012). *Metapopulation dynamics: empirical and theoretical investigations*. Academic press.
3. Hudson, W. E. (Ed.). (1991). *Landscape linkages and biodiversity*. Island Press.
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COURSE TITLE: WILDLIFE MANAGEMENT TOOLS AND TECHNIQUES (OPTIONAL)

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
PWM 618	3	48 (32+16)	75 (45+30)

Note: 1 credit= 16 lecture hours

SCOPE: This course introduces the principles and application of wildlife management tools and techniques at the regional level. The course will provide in-depth theoretical knowledge on tools and techniques to monitor and manage wildlife species, including occupancy, population density, abundance, behavior and ecology, capture and handling, conservation genetics, and other technologies for their effective conservation and management. Practical sessions will familiarize the use of such tools and techniques available in Nepal.

OBJECTIVES: The objectives of this course are to:

- Gain knowledge of technological advancements and their potential use in the wildlife conservation sector.
- Understand different techniques, tools, and technologies and their application for wildlife management.
- Demonstrate skills in handling tools and techniques of wildlife research, conservation, and management.

LEARNING OUTCOMES: After the completion of this course, the students are expected to be able to

- Acquire diverse knowledge and skills in wildlife management tools and techniques.
- Improve student skills and confidence in wildlife research and enable them to design biodiversity monitoring and ecological modeling techniques.
- Enhance hands-on experiences and get exposure to field methods used in habitat management.
- Familiarize students with the recent advancements in wildlife science, i.e., wildlife capture and handling techniques, molecular ecology, and AI for wildlife management.

COURSE CONTENTS

UNIT 1: WILDLIFE RESEARCH AND MONITORING TECHNIQUES (5)

1.1 Overview of Wildlife Taxa in Nepal (mammals, birds, herpetofauna, fish, invertebrates, insects)

1.2 Wildlife Monitoring Techniques and their Application

1.2.1 Species Diversity Estimation

1.2.2 Species Distributions and Niche Modeling

1.2.3 Count-Based Methods (e.g., Rhino, Wild water buffalo and Swamp deer, Gaur, Blackbuck count, and Gharial survey as a case study)

1.2.4 Distance Sampling for Prey-Base Survey

1.2.5 Mark-Recapture Methods (closed or open population: small mammals survey,

herpetofauna)

1.2.6 Micro Histological Analysis for Carnivore and Herbivore

1.2.7 Occupancy Modeling (e.g., prey species presence-absence with threat as a case study)

UNIT 2: REMOTE SENSORS FOR WILDLIFE RESEARCH (6)

2.1 Camera Trapping

2.1.1 History, Advantages, Features

2.1.2 Field Procedure (sampling and protocol)

2.1.3 Camera Trap Data Management and Interpretation

2.1.4 Application of Camera Trapping in Wildlife Research

2.1.4.1 Presence/Absence and Species Inventory

2.1.4.2 Species and Community-Level Occupancy Analysis

2.1.4.3 Abundance and Density Estimation

2.1.4.4 Behavioral Studies (Spatio-Temporal activity pattern, species interactions)

2.2 Acoustic Sensors

2.2.1 Monitoring of Vocalizing Wildlife (terrestrial fauna: birds, bats, insects; Aquatic fauna dolphins, crocodiles):

2.3 Drone and Radar Technology and its Application

2.3.1 Visual (RGB) and Thermal Imaging Drones for Wildlife Surveys (e.g., rhinos, crocodiles, birds)

UNIT 3: CAPTURE, HANDLING AND TRACKING TECHNIQUES OF WILDLIFE (6)

3.1 Capturing and Handling

3.2 Chemical Immobilization: Procedure and Application (e.g., tiger, elephant, and rhino as a case study)

3.3 Tagging and Tracking

3.3.1 Types and Features of Geo-tags for Wild Animals, e.g., satellite tags for birds, gharial

3.3.2 Wildlife Radio Telemetry and Remote Monitoring (GPS tags, satellite tracking for mammals, reptiles and birds)

3.3.3 Application of Radio Collars and Remote Monitoring (behavior and home range analysis, demography, and interactions)

UNIT 4: WILDLIFE CONSERVATION AND HABITAT MANAGEMENT (9)

4.1 Population Management

4.1.1 Population Viability Analysis (PVA) and Minimum Viable Population (MVP)

4.1.2 Translocation

4.1.3 Conservation Breeding

4.1.4 Surplus Hunting

4.1.5 Culling

4.2 Habitat Management

4.2.1 Habitat Mapping and Suitability Analysis

4.2.2 Grassland Management (grass cutting, mowing)

4.2.3 Invasive Control (biological agents, chemical)

4.2.4 Fertilization and Nutritional Enrichment

4.2.5 Waterholes Management

4.2.6 Creation of Habitat Mosaics

4.2.7 Disaster Management (mounds to protect from floods)

4.3 Human Dimensions of Wildlife Management

4.3.1 Use of Technology for Human-Wildlife Conflict Mitigation

4.3.2 Dogs, Drones, Spy Cameras, and Other Surveillance Tools for Poaching Control

4.3.3 Mobile Apps and Citizen Science

UNIT 5: CONSERVATION GENETICS AND MOLECULAR ECOLOGY (3)

5.1 Introduction

5.2 Molecular Markers, PCR, DNA, eDNA, Phylogenomics

5.3 Hormone Level Study

UNIT 6: MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE (3)

6.1 Basic Concept of Machine Learning and Neural Networks

6.2 Use of Artificial Intelligence for Big Data Analysis and Decision-Making

6.3 AI for Biodiversity Conservation and Wildlife Management

PRACTICAL (16)

Field Visit and Exercises: 60% of the courses will be taught in the field

The students will visit nearby protected areas and related organizations to study (12)

- Learn about tools and techniques used in wildlife research and management
- Equipment handling and use: Capturing and handling techniques, Radio Telemetry, GPS/satellite collaring, camera trap, drone, capture equipment, etc.
- Field practice and calculation: Distance sampling, occupancy analysis, and Mark-recapture (nearby forest area- Dummy exercise)
- Study ongoing activities of a molecular lab and wildlife hospital

Lab work (4)

- Identification and practice (handling) of equipment for wildlife population survey and habitat management (GPS, Silva compass, Binocular, range finder, camera trap, telemetry equipment, conservation drone, AudioMoths)
- Camera trap image processing for wildlife species inventory: e.g., Exif data extractor, Visual Object Tagging Tool (VoTT), Artificial intelligence: Mega detector, Machine learning
- Population and habitat viability analysis and habitat suitability analysis

All students will prepare, submit, and present a report for each exercise (any four) for evaluation by the instructor.

Contents	Equipment/tools	Methodology	Link to Unit (s)
Equipment handling and use: Capturing and handling techniques, Radio Telemetry, GPS/satellite collaring, camera trap, drone, capture equipment, etc.	Wildlife traps, radio telemetry, GPS, collars, drone	Lecture, Observation, Dummy exercise	Unit 1
Field practice and calculation: Mark-recapture	Permanent marker, Measuring tape, Silva compass, Binocular	Dummy, exercise in closed population, in 2 episodes)	Unit 2
Study ongoing activities of molecular lab and wildlife hospital	Lab equipment	Lab visit, report writing, presentation	Unit 5
Micro-histological analysis for carnivore and herbivore	Lab equipment, chemicals	Lab works and report writing	Unit 1
Use of VORTEX software for analyzing PVA (MVP)	Software and computer, Dummy/secondary data	Lab works and report writing	Unit 4
Camera trap image processing for wildlife species inventory or Exif data extractor, or Visual Object Tagging Tool (VoTT)	Camera trap, data/software/VoTT	Lecture/hands on experience/ observation	Unit 3
Habitat suitability analysis	Protocol, compass, densitometer, range finder, tape, abneys level	Excel, reporting, presentation	Unit 4

A student should pay NPR 20000 extra if he/she wants to enroll in this subject.

KEY REFERENCES

Unit 1

2. Silvy, N. J. (2012). The Wildlife Techniques Manual (7th Edition). Vol 1. & 2. The Johns Hopkins University Press. Baltimore, Maryland. **(Unit 2 too)**

Unit 2

1. Kenward, R. E. (2001). *A Manual for Wildlife Radio Tagging*. Academic Press. ISBN 0-12-404242-2
2. Robson, G. J., & Tsou, J. Y. (Eds.) (2023). *Technology Ethics: A Philosophical Introduction and Readings (1st ed.)*. Taylor & Francis, New York. ISBN 978-1-032-03870-4. **(Unit 3 too)**
3. Rovero, F., & Zimmermann, F. (2016). *Camera Trapping for Wildlife Research*. Exeter: Pelagic Publishing, UK. **(Unit 3 too)**

Unit 3

1. DNPWC (2017). Tiger and Prey Base Monitoring Protocol, Nepal. Department of National Parks and Wildlife Conservation Babarmahal, Kathmandu, Nepal **(Unit 2 too)**

Unit 4

1. Coetzee, K. (2016). *Practical Techniques for Habitat & Wildlife Management: A Guide for Game Ranches, Conservation Areas and Farmland*. New Voices Publishing Services.
2. Wich, S. A., & Alex K. P. (Eds.) (2021). Conservation Technology. (Online edition), Oxford Academic.

Unit 5

1. Joanna R. F., Petersen, S. D. & Kirk, H. (2011). *Molecular Ecology*, 2nd ed. Wiley-Blackwell. ISBN: 0470748338:9780470748336

Unit 6

1. Li, C. (2020). Biodiversity assessment based on artificial intelligence and neural network algorithms. *Microprocessors and Microsystems*, *79*, 103321.
2. Shivaprakash, K. N., Swami, N., Mysorekar, S., Arora, R., Gangadharan, A., Vohra, K., ... & Kiesecker, J. M. (2022). Potential for artificial intelligence (AI) and machine learning (ML) applications in biodiversity conservation, managing forests, and related services in India. *Sustainability*, *14*(12), 7154.
3. Silvestro, D., Goria, S., Sterner, T., & Antonelli, A. (2022). Improving biodiversity protection through artificial intelligence. Nature Sustainability, 5 (5), 415-424.

COURSE TITLE: NATURAL RESOURCE PROFESSIONAL ETHICS (OPTIONAL)

Course Code	Credit	Lecture Hours (Theory + Practical)	Total Marks (External/final + Internal)
SFM 606	3	48 (32+16)	75 (45+30)

Note: 1 Credit= 16 Lecture Hours

SCOPE: This course focuses on the ethical aspects of the delivery of professional services in the field of natural resource management. It emphasizes the importance of conducting one's work in a just, fair, and ethically responsible manner, especially when balancing the demands of resource conservation and the fulfillment of legitimate human needs. The course offers valuable guidance on how to navigate these complex ethical dilemmas and make decisions that align with a strong moral and environmental compass. Students will gain the knowledge and skills necessary to address these issues in a professional and responsible manner, ensuring sustainable management of natural resources for the benefit of current and future generations.

OBJECTIVES: Upon completion of the course, students will have acquired a deep understanding of professional ethics in natural resource management and developed the ability to apply ethical principles to real-world challenges in this field, leading to responsible and sustainable resource management practices. The specific objectives are:

- Students will demonstrate a comprehensive knowledge of historical and contemporary ethical frameworks in the management of natural resources, allowing them to recognize ethical dilemmas and principles in this context.
- Students will develop problem-solving skills to address practical ethical challenges through case analysis, discussions, and group work within a professional setting.
- Students will cultivate a personal commitment to ethical conduct and develop a code of professional behavior consistent with the principles of professional ethics in the management of natural resources.

LEARNING OUTCOMES

- **Ethical competence:** Graduates will have a strong ethical foundation and deep understanding of professional ethics in natural resource management, enabling them to navigate complex ethical challenges in their careers.
- **Problem-solving:** Graduates will demonstrate the ability to effectively address practical ethical dilemmas within the field of natural resource management, employing analytical skills and critical thinking to develop sound ethical solutions.
- **Personal ethical commitment:** Graduates will cultivate a personal code of professional conduct consistent with the principles of professional ethics in natural resource management, reflecting a commitment to ethical behavior in their careers.

COURSE CONTENTS

UNIT 1: INTRODUCTION (4)

1.1 Define Ethics, Areas of Ethics (meta, normative, and applied), Norms and Values.

1.2 Applied Ethics Approaches (utilitarianism, deontological, virtue) and Major Subfields.
1.3 Profession, Professionalism, Professional Ethics, and Professional Practice.
1.4 Developing Professional Ethical Reflections on Natural Resource Management.

UNIT 2: NATURE AND ETHICS (8)

2.1 Rights of Trees and Nature, Animal Rights and Welfare.
2.2 Definition, Types, Principles and Importance of Environmental Ethics in Nature Conservation and Protection.
2.3 Anthropocentrism vs. Ecocentrism Views on Nature.
2.4 Environmental Justice: Concept of Justice and Fairness, Distributional Inequality and Environmental Injustice, Interlinkage Between Environmental Ethics, Social Justice and Sustainable Resource Management.

UNIT 3: PROFESSIONAL ETHICS (8)

3.1 Loyalty to Employer, Responsibility and Duty, Confidentiality and Proprietary Information, Occupational Safety and Ethics, Digital and Cyber Ethics Including the Use of Robotics and Artificial Intelligence (AI)
3.2 Public Duties: Moral Obligations of Government Servants, NGOs, INGOs and Other Public Institutions, Professional Consulting and Advertising
3.3 Conflicts of Interest in Decision Making: Recognizing and Resolving Conflicts of Interest in Professional Judgments in Natural Resources Management
3.4 Program Operation and Activities: Institutional Ethical Board/Committee, Code of Conduct, Program Activity Plans and Inclusiveness, Prior Informed Consent, Request for Permission

UNIT 4: ETHICAL DECISION-MAKING METHODS AND TOOLS (6)

4.1 Methods: Situation Analysis, Moral Reasoning, Practical Reasoning, Precautionary Principle
4.2 Tools: Ethics Codes and Professional Standards; Compliance with Laws, Regulations and Standards; Code of Conduct; and Ethical Checklists
4.3 Audits: Social Audit, Social Media Audit

UNIT 5: ETHICAL ISSUES AND DILEMMAS (6)

5.1 Ethical Issues: Corruption, Lack of Transparency, Prioritizing Private Interests Over Public Good, and Influence of Special Interests and Politics on Policies
5.2 Ethical Dilemmas: Balance Economic Interests with Conservation, Managing Competing Demands on Land Resources, Weighing Single vs. Multiple Values in Forests, and Conflicts between Short-term and Long-term Goals

PRACTICAL (16)

At least two practical tasks (1 individual and 1 group work) must be performed, and the instructor of the course should organize a workshop in which students present their individual assignments.

- **Ethical reflection paper (Individual):** This assignment encourages students to engage in individual ethical reflection on a specific interest, aligning their personal ethical values

with the course's ethical principles.

- **Role-play scenario (Group):** Through this group assignment, students will investigate ethical dilemmas within various environmental philosophies, allowing them to apply ethical principles in a practical context.

- **Conflict resolution (Individual):** By providing students with a real case of conflict of interest in resource management, this assignment assesses their ability to recognize and manage conflicts of interest in a professional context.

- **Situation analysis (Group):** Student groups engage in situation analysis by examining real-world case studies with ethical dilemmas. This promotes their practical skills in ethical decision-making.

- **Professional ethics workshop (Individual/Group):** Student groups organize and conduct a workshop on professional ethics in natural resource management, providing an opportunity for them to demonstrate and share their understanding of the course's ethical principles and their practical application by presenting their ethical reflection paper.

Contents	Equipment/tools	Methodology/methods	Link to Unit(s)
Ethical reflection paper (individual)	A case for a student	Review of the literature	Unit 1, 2, 3, 4, 5
Role-play scenario (group)	Ethical dilemmas and environmental philosophy	Assign student groups a role-play scenario on an ethical dilemma using environmental philosophy	Unit 2
Conflict resolution (individual)	Cases of conflict of interest, one per student	Provide real cases of conflict of interest in resource management and guide students in solving it	Unit 3
Situation Analysis (Group)	Ethical dilemmas in decision-making in resource conservation	Provide student groups with real-world case studies that involve ethical dilemmas in decision-making	Unit 4
Professional ethics workshop	Space for workshops, audiovisual aids	The teacher/students organize an in-house presentation workshop on professional ethics in natural resource management, and students present their individual assignment	Unit 1, 2, 3, 4, 5

KEY REFERENCES

Unit 1

1. Irland. L.C. (2007). Professional Ethics for Natural Resource and Environmental Managers: A Primer. Yale School of Forestry & Environmental Studies, Forestry & Environmental Studies Publications Series. 7. [Chapter 1, 2]
2. Jamieson, D. (2008). Ethics and the environment: an introduction. Cambridge University Press. United Kingdom. www.cambridge.org/9780521864213. [Chapter 1]

3. Kelly, T.M. (2018). Professional ethics: a trust-based approach. Lexington Books, London. [Chapter 1]
4. T. Airaksinen. (2012). Professional Ethics: Ruth Chadwick, Encyclopedia of Applied Ethics (Second Edition), Academic Press, Pages 616-623. ISBN 9780123739322. https://doi.org/10.1016/B978-0-12-373932-2.00080-6.

Unit 2

1. Jamieson, D. (2008). Ethics and the environment: an introduction. Cambridge University Press. United Kingdom. www.cambridge.org/9780521864213 [Chapter 1, 6]
2. Lee, W. N. (2022). This is environmental ethics: an introduction. John Wiley and Sons Ltd. United Kingdom. [Chapter 1, 6]
3. Mohai, P., Pellow, D. & Roberts, J.T. (2009). Environmental justice. *Annual Review of Environment and Resources*, *34*, pp.405-430. https://doi.org/10.1146/annurev-environ-082508-094348
4. Hale, B., Light, A., & Lawhon L. A. (2023). The Routledge Companion to Environmental Ethics. Taylor and Francis, New York and London. [Chapter 1, 5, 63]

Unit 3

1. Irland. L.C. (2007). Professional Ethics for Natural Resource and Environmental Managers: A Primer. Yale School of Forestry & Environmental Studies, Forestry & Environmental Studies Publications Series. 7 [Chapter 6 to 10]
2. Kelly, T.M. (2018). Professional ethics: a trust-based approach. Lexington Books, London. [Chapter 3, 6]
3. Meyers, C. (2018). The professional ethics toolkit. John Wiley and Sons Ltd. United Kingdom. [Chapter 6-8]
4. T. Airaksinen. (2012). Professional Ethics: Ruth Chadwick, Encyclopedia of Applied Ethics (Second Edition), Academic Press, Pages 616-623. ISBN 9780123739322

Unit 4

1. Meyers, C. (2018). The professional ethics toolkit. John Wiley and Sons Ltd. United Kingdom. [Chapter 2, 9]
2. Lee, W. N. (2022). This is environmental ethics: an introduction. John Wiley and Sons Ltd. United Kingdom. [Chapter 1]
3. Hale, B., Light, A., & Lawhon L. A. (2023). The Routledge Companion to Environmental Ethics. Taylor and Francis, New York and London. [Chapter 58]

Unit 5

1. Jamieson, D. (2008). Ethics and the environment: an introduction. Cambridge University Press. United Kingdom. www.cambridge.org/9780521864213 [Chapter 6]
2. Meyers, C. (2018). The professional ethics toolkit. John Wiley and Sons Ltd. United Kingdom. [Chapter 9]
3. Hale, B., Light, A., & Lawhon L. A. (2023). The Routledge Companion to Environmental Ethics. Taylor and Francis, New York and London. [Chapter 54-56]

SEMESTER IV

Proposal
Pre-defense
Dissertation
Manuscript of Research Work