



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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Scientist 'SE'

D.O. No MSC(WL)/AC/

Dated: 30th Mar '93

Dear Dr. Joshi,


We would like to improve the syllabus of our M.Sc. (WL Science) course and get the approval of Saurashtra University's Board of Studies Meeting which is likely to meet on 29th April 1993 at WII. In this connection, I would like to request you to kindly go through the present syllabus and suggest any modification/improvement if necessary.

An early action would be highly appreciated.

With kind regards.

Yours sincerely,

Encl: Copy of M.Sc.(WL)
syllabus


(G.S. Rawat)

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SYLLABUS FOR

M.Sc. WILDLIFE SCIENCE

April, 1990

University of Saurashtra, Rajkot

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PREFACE

Planning for the Master of Science postgraduate degree programme in Wildlife Science within the Wildlife Institute of India began in 1985, although the need for such a training programme was recognized by wildlife conservation organisations in the 1970s. There have been several important milestones in the brief history of planning and implementing this M.Sc. course.

The first input came from the all India symposium on "The Role of University Teaching in Wildlife" hosted by the Wildlife Institute of India and the Aligarh Muslim University at Aligarh in early 1986. This symposium offered valuable discussion between university faculty and professional wildlife biologists and scientists which helped in planning the initial syllabus.

Secondly, the preparation of the first syllabus for M.Sc. in Wildlife Science at the Wildlife Institute of India allowed much discussion. This first syllabus was published as a field document of the FAO/WII project in 1988 and formed the basis for the teaching of the first and second M.Sc. courses.

Thirdly, the actual implementation of the M.Sc. courses; the first course started in January 1988 and finished in December 1989. The second course commenced in July 1989 and will continue until June 1991. Teaching these courses and interactions with the University of Saurashtra with whom we jointly offer the degree programme, have allowed us to further refine the syllabus.

The results of the first M.Sc. course were highly satisfactory, all seven candidates achieving First Class degree, one at distinction level.

Internal discussion within the Institute, feedback from students and examiners, and formal discussion with the Board of Studies for Wildlife Science of the University of Saurashtra have led to the revision of the first syllabus. Considerations for this revision are incorporated as Appendix-I to this document.

This Revised Syllabus for the M.Sc. in Wildlife Science is now published formally, and will govern the teaching of the Third M.Sc. programme due to commence in July 1991.

INTRODUCTION

OBJECTIVES

The M.Sc. in Wildlife Science at the Wildlife Institute of India has been developed to provide trained expertise to further the cause of wildlife conservation in India and elsewhere. For many years there has been a demand for increased research and monitoring of the wildlife populations and their habitats all over the country. Many species and communities are endangered, their conservation often requires scientific understanding. Detailed management plans for the more than 400 wildlife protected areas require a strong scientific foundation for success. Management inputs, habitat parameters and species populations need constant monitoring if conservation efforts are to be effective. All of this will require trained personnel; both research staff of wildlife and forest departments, and scientific staff at universities and research institutes.

Wildlife, and animal ecology in general, are relatively new subjects within the university system in India. A number of colleges offer a paper or two at B.Sc. or M.Sc. level; very few institutions integrate animal and plant ecology into a single discipline. Only two other institutions offer a full post graduate degree in wildlife science. This programme at the Wildlife Institute of India therefore serves a second purpose beyond the training of wildlife scientists, and that is to provide a model programme (syllabus content, field work, research training, pattern of staffing, and faculty expertise) which can help develop wildlife training elsewhere in the country.

Entry to the M.Sc. Programme

The course is primarily designed for direct entrants who hold a Bachelor of Science degree containing biological subjects with a mark of 55% or above. Degrees in veterinary science, forestry, agriculture and environmental sciences (with a bias to life science) are also acceptable. In addition to new graduates, professional foresters, who have a suitable biological background and an aptitude for wildlife research, may join the course on an in-service basis.

The M.Sc. programme at the Wildlife Institute is presently offered in collaboration with the University of Saurashtra at Rajkot, Gujarat, and their entry requirements have to be met. This includes the stipulation of fifteen years of formal schooling; i.e. a 10+2+3 or 11+2+2 educational pattern. All teaching is done at the Institute in Dehra Dun, and in the field.

The programme is normally offered from July each year. Applications will be called for by advertisement in the national press earlier in the year. As the course admits ten or less students, there will be a vigorous selection process involving

scrutiny of application forms, a national level entrance examination, and interview. Appendix-V discusses financial assistance to candidates.

Teaching Inputs

The two year degree is organised into four semesters. The first three semesters will be used for lecture, seminar, practical and field work teaching. The fourth semester is for the field based research oriented dissertation.

Within semesters, teaching is by the course unit system, with all courses in a semester being examined at end of that semester. A course unit is ten lectures plus associated laboratory classes and seminars. There are 45 units of "core" or compulsory courses, and 5 units of "optional" courses, taught in the third semester, depending on student choice and faculty available.

Class room teaching may have inputs from all three faculties of the Institute, viz. Wildlife Biology (WB courses), Wildlife Management (WM courses), and Extension & Socio-economic Studies (ES courses). Courses at the M.Sc. level are numbered as the 300 series, e.g. ecological Concepts as WB 301.

Teaching will be arranged in four semesters according to the following pattern:-

Semester I	July - Nov.	(5 months). December Vacation
Semester II	Jan. - May	(5 months). June Vacation
Semester III	July - Oct.	(4 months)
Semester IV	Nov. - April.	Field work (6 months)
	May - June.	Dissertation Writing (2 months)

- Note:-
- Students will not be permitted to stay at the Institute for longer than 24 months.
 - Vacation scheduling may change due to teaching and field work inputs.

Teaching periods based at W.I.I. will typically consist of lectures in the mornings and practicals and seminars in the afternoons.

It must be emphasized that wildlife biology is essentially a field subject and personnel cannot be adequately trained without a very major component of field studies. Hence, in addition to a large amount of field work associated with the initial course work, a 6-month field research project is included in the second year's programme.

Another emphasis of this research-oriented training is the frequent critical examination of published research results in lectures and seminars. Students will be expected to read and discuss original research papers (not merely text books) as

background to lectures and seminars. In order to foster a mature attitude to knowledge and its critical appraisal, seminar-type discussions will be a major teaching method, alongside more formal lecture sessions. Students will be required to complete three elective papers comprising tutorial and directed reading sessions leading to an in-depth analysis and write-up of selected topics.

At present the M.Sc. degree will be awarded by the University of Saurashtra.

The gross breakdown of the 2 year programme will be as follows:-

- Course work and field courses (and examinations)	14 months
- Vacation	2 month
- Field Research Project	6 months
- Dissertation writing	2 months

	24 months

In order to obtain the degree a student would be required to (a) pass the written examination (theory and practical papers) based on the course work and (b) satisfy the examiners with his dissertation and a viva voce based on this. Detailed examination rules are published separately.

It is emphasized that details of this syllabus and of the regulations governing the M.Sc. degree are subject to change by the appropriate authorities within the Wildlife Institute of India and the University of Saurashtra.

SUMMARY OF COURSES

<u>Course No.</u>	<u>Course Title</u>	<u>Units</u>
WB 301	Community Ecology	2
WB 302	Physical Environment	3
WB 303	Conservation Biology	2
WB 304	Biology of Indian Wildlife I	3
WB 305	Biology of Indian Wildlife II	3
WB 306	Introduction to Plant Biology	2
WB 307	Vegetation Science	3
WB 308	Population Ecology	2
WB 309	Wildlife Ecology	3
WB 310	Habitat Ecology	2
WB 311	Population Analysis	2
WB 312	Animal Behaviour	2
WB 313	Quantitative Methods in Biology I	2
WB 314	Quantitative Methods in Biology II	2
WB 315	Conservation of Natural Resources	2
WB 316	Forest and Wildlife Management	2
WB 317	Human Ecology	2
WB 318	Elective Topic in Habitat Ecology	2
WB 319	Elective Topic in Wildlife Ecology	2
WB 320	Elective Topic in Wildlife Management	2
Plus 5 Optional Courses		5

Total		50

Optional Courses

(Any 5)

A) Ecology Group		
WB 321	Advanced Plant Ecology	1
WB 322	Advanced Animal Ecology	1
WB 323	Systems Analysis & Modeling	1
WB 324	Geographic Information Systems Applications in Wildlife	1
B) Wildlife Ecology Group		
WB 325	Animal Nutrition and Feeding Ecology	1
WB 326	Biology of Reproduction	1
WB 327	Wildlife Habitat Interactions	1
C) Wildlife Management Group		
WM 328	Wildlife Health	1
WM 329	Wildlife Utilisation	1
WM 330	Captive Breeding and Propagation	1
WM 331	Management Planning for Protected Areas	1
WM 332	Wildlife in Managed Forests	1
D) Ecology of Major Habitats Group		
WB 333	Wetland Ecology	1
WB 334	Aridland Ecology	1
WB 335	Himalayan Ecology	1
WB 336	Tropical Evergreen Forest Ecology	1
WB 337	Coastal Ecology	1

Theory Paper VI	Conservation, Management and Behaviour	80 marks
	(i) Conservation of Natural Resources	WE 315
	(ii) Forest and Wildlife Management	WM 316
	(iii) Animal Behaviour	WB 312
Laboratory Practical II	Ecology	80 marks
Field Practical II	Study Techniques	80 marks
	Semester Total	400 marks
Field Tour	Techniques Tour II	2 weeks
	Conservation Practices Tour I	2 weeks
Semester III		
Theory Paper VII	Habitats and Human Ecology	80 marks
	(i) Human Ecology	WE 317
	(ii) Elective Topic in Habitat Ecology	WB 318
Theory Paper VIII	Wildlife Biology	80 marks
	(i) Elective Topic in Wildlife Biology	WB 319
Theory Paper IX	Wildlife Management	80 marks
	(i) Elective Topic in Wildlife Management	WB 320
Theory Paper X	Optional Courses	80 marks
	(i) Optional courses in Wildlife Science	
Practical Examination III	..	80 marks
	Semester Total	400 marks
Field Tour	Specialised Techniques	1 week
	Conservation Practices II	1 week
Vacation Course	BASIC programming	1 week

Semester IV

Dissertation Field Work and Completion

Dissertation Evaluation 320 marks

Viva Voce Examination 80 marks

Semester Total 400 marks

M.Sc. Grand Total 1600 marks.

DETAILS OF COURSE WORK COMPONENTS

Courses 301 to 320 are obligatory (core) courses
Courses 321 to 337 are optional courses

A. CORE COURSES.

WB 301 Community Ecology **Total 2 units**

Basic concepts and structure of ecosystems: abiotic and biotic components; climatic and edaphic regimes; nutrients and minerals; producers, consumers and decomposers. Communities, populations, groups and individuals.

Functioning of ecosystems: energy flow and nutrient cycles, the establishment of trophic equilibrium; food chains, food webs, trophic levels; autotrophs, heterotrophs, saprotrophs; biogeochemical cycles. The concept of a systems approach to ecological functioning.

Productivity: concepts, net, gross, primary and secondary productivity, net community productivity. Productivity as a measure of efficiency of an ecosystem, comparison of productivity of various vegetation types.

Community interactions. Succession. Niche space and niche separation. Inter-specific competition. Community structure, dominance, diversity and stability; differences between geographic regions. Evolution of communities and their internal regulation.

Practicals: Seminar based discussion and paper analysis and criticism. Calculations of energy flow and productivities. Field analysis of diversity etc.

WB 302 Physical Environment **Total 3 units**

This course will introduce the "fundamental components of all ecosystems, viz climate, water, geology and soils. It also presents remote sensing as an important tool in understanding environmental factors. The course will comprise three components.

302.1 Climate as an Ecological Factor: **1 unit**

Basic components of climate and how they are measured (rainfall, radiation, temperature, humidity evaporation). The physical basis of world climates. Climatic patterns of India and their geographical and temporal distribution. Water cycle and introduction to

hydrology. Interpreting microclimates and climatic data in relation to biological phenomena e.g. importance of temperature and rainfall patterns, day length etc. to breeding seasons of vertebrates.

Practicals: Exercises in use of climatic maps and meteorological data; setting up and reading of meteorological instruments.

302.2 Geology, Geomorphology and Soils

1 unit.

Rock types and their origin; geological formations and geological mapping. Geomorphology: topography, aspect, land forms and their classification. Land system mapping. Geological history of India during Tertiary and Pleistocene periods including continental drift. Fossil record. Pollen core studies. Geology and climatic change. Soil types and their formation, influence of geology. Soil profiles. Water regime, permeability and soil-water relationship. Soil fertility, and simple methods of soil analysis. Interpreting soil maps and soil data. Relationships of geology and soils to vegetation and animal life. Erosion and nutrient loss. Soil conservation.

Practicals: Examination of geological processes in lab and field. Use of geological and soil maps. Examination of soil types, measurement of particle size, moisture content, PH and chemical composition in lab and field. Exercise in use of soil maps and other data sources. Field examination of erosion and soil conservation measures.

302.3 Remote Sensing

1 unit

Principles and practical applications of remote sensing techniques, including aerial photography and satellite imagery. Use of photographs as maps and in map preparation. Interpretation of photography and imagery. Importance of ground truth inputs. Introduction to digital analysis of imagery.

Practicals: Examination and interpretation of imagery. Use of imagery for quantitative analysis. Stereoscopy. Preparation of maps and field orientation. Introduction to computerised techniques.

303.1 Evolutionary Genetics

1 unit

Review of the mechanisms of evolution, importance of environmental pressures, environmental change and natural selection. The species and infra-species concepts. Mechanisms of speciation and endemism. Genotype variability, in-breeding, heterozygosity and the concept of a viable population. Meta-populations and sub-populations. The relationship of evolutionary principles to systematics, to ecology and to conservation biology.

Practicals: Seminar based discussion and paper analysis. Calculations of degree of inbreeding, MVP sizes etc.

303.2 Biogeography

1 unit

Classical biogeographical concepts; origins, radiation, barriers. The differences between plant and animal geography. Biogeographical realms and provinces, with special reference to India. The origin of India's fauna and flora. Quantitative analyses in biogeography and brief introduction to cladistic theory and classification theory. Theories of island biogeography, the SLOSS debate and contributions to conservation biology. Concept of centres of diversity and endemism, refugia, extinction.

Practicals: Map based analysis of distribution patterns. Calculations of island biogeography parameters etc.

WB 304 Biology of Indian Wildlife : I

Total 3 units

This course and WB 305, will familiarise the student with the biology and natural history of a range of species encountered by the Indian wildlife biologist, concentrating on those of particular conservation significance. It will provide general information on morphological characteristics, physiology, past and present distribution, behaviour, status, habitat, food type, group size, reproduction, and relation to human activities.

Mammals: Origins of mammals and mammalian characteristics. Review of principal patterns of morphological and physiological adaptation to environment. Review of mammal classification. Problems in taxonomy of Indian mammals. Literature on Indian mammals. Review of major groups of mammals: Primates, larger rodents & lagomorphs, Carnivora, Artiodactyla, Perissodactyla, Proboscoidea.

Practicals: Examination and drawing of museum material (skins, skulls, feet, casts of spoor, dung etc.) of above species. Use of keys in identification. Species distribution patterns. Manipulation, dissection and analysis of study material e.g. fruit bats. Collection and presentation of study material.

WB 305 **Biology of Indian Wildlife : II** Total 3 units

305.1 **Birds** 1.5 units

Origin and radiation of Birds. Morphological and physiological adaptation. Review of Indian birds: taxonomy, general natural history, literature. Biogeographic patterns in Indian avifauna and their affinities. Emphasis on Montane avifauna: Himalayas, Western & Eastern Ghats; Island avifaunas, Waterfowl, Desert avifauna; Birds of cultivation and degraded habitats. Habitat mosaics.

Migration and linkages between breeding & winter areas. Breeding ecology, wintering ecology. Avian community ecology and habitat selection; temperate-tropical comparisons. Avian guilds and competition. Bird census: review of technique and problems. Endangered/threatened groups - pheasants, bustards & floricans cranes, waterfowl, raptors; threat to passerines and general problem of avian extinction.

Practicals: Examination and drawing of museum material (skins, skulls, feet, eggs, nests etc.) of characteristic species. Bird skin preparation. Measurement of specimens. Mist netting technique and methods for handling birds, Bird census on campus. (Birds will also be observed and discussed in their natural habitat during appropriate field courses).

WB 305.2 **Reptiles and Amphibia** 1 unit

Origins and radiations of herpetofauna. Adaptations to environmental stress. Review of Indian herpetofauna, especially of groups of conservation and management importance. Conservation problems and initiatives. Importance of biology in management.

Practicals: Examination, identification and drawing of museum material (skins, skulls, preserved specimens etc.) of above species. (Animals will also be observed

and discussed in their natural habitat during appropriate field courses). Where possible herpetological research and study on campus.

WB 305.3 Invertebrates of Importance to Conservation 0.5 unit.

Insects, molluscs, and other groups of importance in wildlife biology. Disease vectors, parasites, pathogens. The role of invertebrates in food chains, especially decomposition. Insect herbivory, insect plant adaptations.

Practicals: Examination of museum material, plus field examination during appropriate field courses. Seminar discussions and paper evaluation.

WB 306 Introduction to Plant Biology 2 units

Introduction to morphology, anatomy, physiology and genetics of plants. Systematic botany including the taxonomy and classification of important plant families; floras and their use. The flora of India.

Practicals: Supporting laboratory studies of above lectures. Dissections, diagrams and use of keys given in the flora for identification.

WB 307 Vegetation Science 3 units

Principles in the classification of vegetation. Relationship between environmental factors and vegetation types. Hierarchy of vegetation units. World classification of vegetation. The major vegetation types of India and the different systems of classification. Mapping vegetation types (including structural, ecological and floristic associations) in India.

Succession and regression, degradational stages. Anthropogenic factors. The physiognomy and seasonal characteristics of vegetation. Phenology. Regeneration. Species composition. Distribution and associated fauna. Use of vegetation maps.

Brief ecology of sal, teak, Himalayan and evergreen forest communities. Mangroves, shola forest and grasslands. The question of natural grasslands in India. Endemic, endangered/threatened plants of India and causes of threat. Wild plants of economic and aesthetic value, e.g. medicinal plants, orchids. Ex-situ and in-situ conservation for plants.

Practicals: Study of vegetation types from literature and on campus; analysis of aerial photographs of vegetation; use of satellite imagery and existing vegetation maps and climatic maps. (In addition, a wide variety of vegetation types will be studied on field courses, as appropriate).

WB 308 Population Ecology

2 units

Population definition, equilibrium, natality, mortality, fluctuations with density. Intra-specific competition, density dependence. Optimal foraging theory. Limiting factors. Carrying capacity, Natural regulation of numbers. Population growth. Theoretical aspects of population analysis and population dynamics. Population ecology in plants.

Population analysis: survivorship curves, life tables, critical parameters - density, sex ratio, age distribution, fecundity by age, survival by age. Population parameters from post-mortem study. Manipulating populations - sustained yield harvesting; reduction culling; reintroduction and restocking.

Practicals: Seminar and discussion paper reading, and modelling of populations. Calculation of population growth and other parameters.

WB 309 Wildlife Ecology

3 units

Animal-habitat interactions - food, water, minerals, shelter and their effects on distribution; limiting factors. Patterns of habitat utilization and dispersion, including home range, migration and corridors; and methods of study, use of ecotones.

Feeding ecology of herbivores, carnivores, insectivores and omnivores - food selection, quantity, quality, (nutritional value), seasonal variations, relation of food to animal condition. Predator-prey interactions. Avoidance of competition for food and shelter. The niche concept.

Reproductive ecology, dispersion, patterns of growth and development. Ecophysiology - water and temperature physiology and its ecological implications. Effects of day length and temperature on reproduction, migration etc. Importance of minerals to animal health, growth and reproduction. Environmental pollutants and toxins.

Chemical capture and drug immobilisation. Theory and practice, including safety measures.

Practicals: A study of habitat specificity in birds or small mammals on campus. Field methods of studying diet. Examination and recording of stomach contents of a browser, grazer, carnivore, insectivore and omnivore. Examination of faeces. Experiments with captive reptiles and mammals in various situations of ambient temperature/insolation. Use of chemical capture equipment. (Note this will be done in detail on a field tour).

WB 310 Habitat Ecology

2 units

Physical factors influencing habitats: drought, flood, tides, erosion, soils etc. Qualifiers; grazing; logging; felling; fire; encroachments. pollution; development projects; socio-economic resource practices. Succession and natural change.

Evaluation of habitats: Availability, quality, palatability of graze and browse at various levels and seasons. Forage analysis. Utilization of graze and browse. Deriving diversity, interspersion and juxtaposition indices. Habitat fragmentation. Cover classification and mapping. Inventory of unique habitats and their distribution. Distribution of water and minerals; mapping and assessment of water quality.

Animal signs as indicators of use patterns. Identification of species specific limiting factors. Use of map overlay approach in evaluation. Monitoring changes in vegetation and the relative abundance of animals.

Use of imagery etc. and systematic reconnaissance flight methods in habitat monitoring, analysis and evaluation. Habitat mapping at landscape and land unit scales.

Practicals: Measurements of Primary Production. Comparison of several techniques for quantitative vegetation survey and mapping. Evaluation of decimating and welfare factors. Evaluating habitat utilization etc.

WB 311 Population Analysis

2 units

Age and sex determination and use in biology. Field age determination: size, colour of pelage, antler/horn development. Lab determination: tooth eruption and replacement; tooth wear, cementum lines, eye lens weight, ossification. Ageing in birds, moulting. Sex determination: dimorphism, sexually dimorphic characters;

behaviour. Sexing of mammals, birds and reptiles in the field and under restraint. Individual identification.

Census methods: Absolute versus relative density, total count versus estimates; direct and indirect counts.

Field age/sex determination of ungulates. Use of jaw series/teeth in age determination.

Practicals: Analysis of population models. Preparation of sampling designs for population estimation. Analysis of census data. (Studies of various population parameters and use of census techniques will be carried out on field courses).

WB 312 Animal Behaviour

2 units

This course assumes some background knowledge of animal behaviour from WB 305 and concentrates on aspects of vertebrate behaviour which are related to the environment in which a species lives.

Relevance of ethology to wildlife biology. Evolution of behaviour patterns and adaptive significance of behavioural patterns. Concepts of behavioural ecology. Behaviour patterns of individuals. Activity budgets. Use of space, territoriality. Patterns of social organization in birds and mammals. Reproductive behaviour: breeding cycles, courtship, copulation, nesting, parturition, care of young etc. The adaptability of social organization to environment. Implications of body size and group size. Sociobiology. Concept of ecological fitness.

Study methods: Use of scan and focal sampling etc. Relevance of captive studies. Behaviour in captivity. Abnormal behaviour. Behaviour and wildlife management.

Practicals: Observation/recording of group structures and spatial distribution in readily observable species on campus e.g. rhesus macaques, birds. (Further studies of group structure and interaction e.g. in cervids, will be made in the field.) Behavioural sampling techniques, ethograms, nearest neighbour etc. (Observation of rutting, courtship, matting, nest building and care of young will be made, as appropriate, on field courses).

WB 313 Quantitative Methods for Wildlife Science: I

2 units

This course aims to provide a basic knowledge of data handling and presentation, elementary biostatistics and sampling design.

313.1 Introduction and Data Presentation

"The Scientific Method" and the formulation and testing of hypotheses. Experimentation. Proof. The importance of quantification and statistics. Concepts of biological variation, hypothesis testing, and statistical inference. Mathematics for biologists: logarithms, indices and power functions, regression equations and linear graphical relationships.

Data presentation: measures of central tendency, mean, median, mode. Frequency distribution, graphical portrayal, histograms and scatter diagrams.

313.2 Elementary Biostatistics and Sampling Theory

The concepts of a population and sample. Probability. The normal distribution. Dispersion: mean, variance, deviation, standard error and confidence limits. Testing differences between means, "d & t" tests. Association and contingency testing, chi square tests. Correlation and correlation coefficients. Simple linear regression and lines of best fit. Covariance. Simple analysis of variance. Introduction to non-parametric tests.

Sample theory and design: random, cluster, systematic and stratified sampling. Precision and accuracy. Determination of sample size. Designing sample surveys. Testing assumptions.

Practicals: Practicals will arrange and analyse raw data from wildlife situations in India, preferably using student's own data from field work.

314 Quantitative Methods in Wildlife Science : II 2 units

314.1 Introduction to computing

Types of equipment: calculators, microprocessors, main frames and their uses. Hardware and software components, languages. Database and large scale data handling. Multivariate analyses, programmes for wildlife biology, statistics packages.

314.2 Advanced Biostatistics

Designing surveys and experiments, testing assumptions. Analysis of variance. Introduction to non-parametric tests. Use of computer statistical packages. Multivariate statistical techniques and their application in wildlife biology.

Practicals: Students will have time for hands on experience on microprocessors.

Note: There will be a compulsory vacation course in BASIC programming of one week duration. This will not be examinable.

WE 315 Conservation of Natural Resources

2 units

This course will impart the basic philosophy of conservation management. Specific emphasis is laid on conservation in India and its human dimensions, as well as a consideration of the World Conservation Strategy and approaches to a National Conservation Strategy. The course deals with the concept of conservation with special reference to wildlife management and the management of forests in India and chronicles the decline of wildlife and habitats in India.

Discussion of past and philosophies of conservation, the colonial and post-independence periods. Creation of IBWL, Wildlife (Protection) Act, 1972, the new conservation awareness, establishment of Department of Environment - 1981. Project Tiger and newer project schemes. Role of voluntary agencies (WWF, Wildlife Preservation Society, Bombay Natural History Society etc.).

Conservation and development. Political and economic realities. Human dimensions, threats to protected areas, socio-economic development of indigenous communities. Environmental impact assessment methodologies. Environmental impact studies of developmental works in India. Protected areas: IUCN classification and legal categories in India including forest categories. Biosphere reserves and zoos in India and their role in conservation.

Conservation programmes: IUCN, UNEP, MAB etc. Conservation laws and ethics: International conventions for wildlife protection e.g. Conservation of Wetlands of International Importance; Conservation on Migratory Species; International Whaling Convention; CITES. Conservation law and policies in India.

Practicals: Class based discussion with faculty and range of conservation activists. Review of literature. Preparation of conservation statements and brief EIA statements, etc.

316 Forest and Wildlife Management in India

316.1 Wildlife Management

The concepts of ecosystem and species featured systems, ameliorative and restorative management. Prey-predator

relationships. Manipulation of populations. The management of small populations. The problem of over abundance. Control of over abundance: Culling, repellents, barriers, capture and release elsewhere reproductive control. Control of poaching and regulation of resource use. Study of selected case histories from India: Project Tiger, Gir Lion, Project Hangul, Rhino Reintroduction etc. The Wildlife Action Plan in practice. The role of the Wildlife Institute of India. The role of biology in wildlife management.

Practicals: Class based discussion and literature review. Field discussion of management parameters in nearby forests and on tour.

316.2 Forest Management

Review of forest management in India. Principles of forest management; silvicultural systems. Erosion control. Development of water. Management of fire. Management of weeds. Wildlife in plantations and managed forests. Management of riparian zones. Range/Grassland management practices

Practicals: Review of forest working plans and maps. Study of nearby forests and grasslands under various management regimes. (Management practices will also be studied on field courses).

WB 317 Human Ecology

2 units

Scope of human ecology, its importance in understanding conservation issues. The People of India, diversity of culture and lifestyle. Society and development; Political, social and economic factors, rural economics, concepts of sustainability, the urban-rural and rich-poor divides. Social development initiatives in India.

Demography. Methodologies of social survey and impact survey.

Changing land use and resource use patterns in wilderness regions. Discussion of fuelwood, livestock and forest produce case studies. Review of rural development and tribal welfare programmes, and the impact of resource use practices and development programmes on people and natural resources of these regions.

Impact of major development projects on people in wilderness regions and implications for conservation.

Strategies for sustainable development. Revival of rural ecosystems using ecodevelopment and compatible utilisation of wilderness resources.

Man-wildlife interaction; domestication, commensalism, disease zoonoses and epidemiology.

Practicals: Class based discussion with faculty and invited environmental and social activists. Analysis of human and cattle population statistics. Review of pressures and case studies in neighbouring forest areas.

ELECTIVE TOPICS IN ECOLOGY AND MANAGEMENT

These courses are designed to introduce the student to independent bibliographic search, information collection and interpretation, and the formulation of scientific hypotheses and conclusions. This is achieved by a tutorial/directed reading approach to pre-set elective topics. The student is examined by presenting a major paper in each of three elective courses.

318 Elective Topics in Habitat Ecology 2 units

Subjects will be chosen which integrate the physical and biotic factors of the habitat of a particular species or community. Examples would include 'A critical assessment of the role of fire in determining habitat structure for large grazing mammals' or 'Evaluate the role of plant secondary compounds in anti-herbivory strategies in evergreen forest'.

319 Elective Topics in Wildlife Biology 2 units

Subjects will be chosen which involve the use of several aspects of wildlife science, to allow the student to develop a broad holistic view to wildlife problems. Examples would include 'Discuss the role of nutritional and day length factors in determining breeding season in Indian ungulates'. 'Develop a population model for a tiger-single herbivore community in a simulated protected areas'.

320 Elective Topics in Wildlife Management 2 units

Subjects will be chosen which have an accessible literature, and which allow an element of real life practicality (e.g. economics). Examples would include: "A comparison of possible management strategies to alleviate elephant crop damage conflict", and "Discuss the teak non-regeneration problem in protected areas in Central India and suggest potential solutions".

B. OPTIONAL COURSES

Optional courses are loosely arranged in specialist groups. Students are required to select five courses from the following options, in consultation with their faculty advisers. Optional courses should normally be within specialist groups to give to the student's study plan.

A. ECOLOGY GROUP

✓WB 321 Advanced Plant Ecology 1 Unit

Modern approaches to plant ecology. Concept of plant population dynamics. Stability, patch dynamics and cycling, Co-evolution of animal and plant communities. Quantitative techniques of community classification and ordination.

WB 322 Advanced Topics in Animal Ecology 1 unit.

The course is designed around seminar discussions on modern concepts in animal ecology. Topics include: Optimal foraging strategies; ecological fitness and reproductive potential; body size limitations and ecological parameters, competition and community organisation.

WB 323 Systems Analysis and Modelling 1 unit.

An introduction to ecological systems analysis and the modelling of simple population and population-habitat interactions using computers.

WB 324 Geographic Information Systems: Applications in Wildlife 1 unit.

This course examines the growing use and value of GIS approaches to wildlife ecology and management issues, and integrating wildlife into forest and human land use systems.

B. WILDLIFE ECOLOGY GROUP

✓WB 325 Animal Nutrition and Feeding Ecology 1 unit

The course is designed to build on the foundation taught in course WB 309 - Wildlife Ecology.

Protein and energy metabolism; nutritive requirements for basal metabolism and work, growth and reproductive requirements.

Feeding strategies and morphological, physiological adaptations, from a variety of vertebrates. Factors affecting food selectivity by animals. Study techniques for analysing feeding behaviour, nutritional analysis and dietary inputs.

WB 326 Biology of Reproduction

1 unit

Variation in structure and function of male and female reproductive systems. Adaptative advantage of such variations. The ovarian cycle. Spermatogenesis. Conception, gestation, parturition, lactation. Hormone control. Patterns of reproduction: single and multiple births; length of gestation; seasonality of breeding. Effects of social context and nutrition on breeding.

WB 327 Wildlife - Habitat Interactions

1 unit

Classical habitat components of food and cover. Limiting factors. Habitat evaluation and habitat suitability models. Detailed analysis of carrying capacity in static and variable environments.

C. WILDLIFE MANAGEMENT GROUP

WM 328 Wildlife Health

1 unit

Basic concepts of disease, health and condition. Review of major diseases of Indian wild mammals, birds, amphibia and reptiles. Epidemiology of disease. Disease and population dynamics. Disease transmission between domestic and wild populations. Malnutrition, starvation, dehydration as disease syndromes. Condition, health and nutritional assessment in free-ranging populations. Control of disease. Planning and management of wildlife health programmes. Zoonoses of importance to man.

WM 329 Wildlife Utilization

1 units

Non-consumptive and consumptive utilization, their economic benefit. Tourism: objectives, planning, economics. Game ranching and controlled off-take from wild populations, rationale, management design, harvesting by management or hunting licences, marketing procedures. Wildlife farming: objectives, management design. Wildlife products: skins, meat, musk etc.

WM 330 Captive Breeding and Propagation

1 unit

Objectives: rehabilitation, education, (utilization), gene banks. Principles: understanding biological requirements of species; design of facilities, food, hygiene, disease control, breeding. Propagation of threatened plants. Case histories.

WM 331 Management Planning for Protected Areas

1 unit

Objectives. Resource surveys. Analysis of surrounding region. Planning of boundaries, management zones, communications, staff and visitor amenities. The management programme: institutional framework and infrastructure; establishing control; habitat and wildlife management; data collection; monitoring; extension and education; tourism. Finance.

WB 332 Wildlife and Managed Forests

Analysis of wildlife problems in plantation and exploited forests; Indian, American and South-East Asian case histories. Discussion of potential management inputs and solutions and research needs to allow such inputs.

D. ECOLOGY OF MAJOR HABITAT GROUP

WB 333 Wetland Ecology

The classification and distribution of wetlands in India. Introduction to key issues of fresh water ecology and limnology, including eutrophication. Values of wetlands: physical, aesthetic and biological values including plants, fish, reptiles and water fowl. Conservation issues for Indian wetlands including detailed case studies, e.g. Bharatpur, Chambal, Kolleru, Kashmir Valley etc. Introduction to river valley development controversies such as Narmada.

WB 334 Aridland Ecology

Review of the physical features of deserts and semi-deserts and the processes of desertification. The arid regions of India (Thar, Kachh, Mid-Peninsular and the cold-desert of Ladakh). Adaptation to life in deserts by plants, animals and man. Conservation issues and the development debate in arid lands; overgrazing, water development. Desert wildlife and conservation planning.

WB 335 Himalayan Ecology

Review of the physical and biological features of the Himalayas, stressing both altitudinal and longitudinal diversity. The wildlife and conservation values of the Himalayas. The Himalayas as a watershed. Protected areas and conservation status. Biotic pressures, development and conservation issues.

WB 336 Tropical Evergreen Forest Ecology

A review of the classification, distribution and status of the Tropical Evergreen Forests in India. Principal issues in tropical forest ecology - stability, diversity, energy and nutrient flows, regeneration and resistance to disturbance. The values of tropical evergreen forests - land, exploitive resources, water and biological components. Land-use in tropical forest regions. Timber exploitation. Conservation planning: patch size, connectivity and exploitation. Case history studies from India and South East Asia.

WB 337 Coastal Ecology

A review of the physical and biological components of India's coastline (mangroves, estuaries, mud, sand and rocky shores, coral and offshore waters). Coastal resources and conservation, protected area planning. Reconciling exploitation, development and conservation. Coastal erosion, pollution, mangrove exploitation and over-fishing. Case history studies: Sunderbans, other mangroves, Gulf of Mannar, Andamans. Turtle nesting beaches, Dugongs.

FIELD COURSES

The following field courses and tours will be undertaken in association with the course unit programme prescribed above.

1. Orientation Course

1 week

Introduction to wildlife species and their habitats. Quantitative observations, collection of study material etc., wildlife signs and evidences. Field visit and visit to a major zoological garden.

2. Techniques Field Course IA (Terrestrial Ecology)

3 weeks

Exercises on wildlife population parameters and census methods for various species. Habitat analysis and

evaluation. Studies on animal behaviour. Studies impact from human use and settlement.

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|---|----------------------------|
| 3. Technique Field Course IB (Aquatic Ecology) | 1 week |
| 4. Techniques Field Course II (Varied locations) | 2 weeks |
| Applications of different study techniques to varied groups and habitats, e.g. grasslands, closed forest, mountains, reserve forests, zoos etc. | |
| 5. Specialised Field Techniques Course | 1 week |
| Capture, restraint, telemetry, barriers etc. | |
| 6. Conservation Practices Tour I | 2 weeks |
| Field tour designed to examine wildlife conservation and biology issues in a variety of ecological situations in Peninsula India. | |
| 7. Conservation Practices Tour II | 1 week |
| Field tour designed to examine wildlife conservation and biology issues in a variety of ecological situations in Himalayas. | |
| Total | -----
11 weeks
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DISSERTATION PROJECTS

Each student will undertake an 8 month project consisting of approximately 5-1/2 - 6 months field investigation, followed by 2-1/2 months data analysis and writing up. Projects will be selected in collaboration with faculty members during the third semester. The concerned faculty member will act as guide throughout the study.

Once his/her topic has been selected the student should acquaint him or herself with existing literature on the subject so as to provide a context for his own particular investigation. After surveying the literature assessing the problem, a time-bound format for the data collection phase should be prepared and necessary equipment procured under guidance. Detailed project proposals will be prepared during the third semester, before the student starts field work.

The guides should be frequently consulted at every stage, including data analysis and thesis writing, which should give the student experience in the preparation and presentation of scientific results.

Students are strongly advised to start the process of data analysis during their field work period. Draft chapter writing on methods and study site descriptions should commence in the field, both to give the student initial confidence in writing and allow the guide to assist in improving writing capabilities at an initial stage, but also to ensure all site information is collected before the student leaves the field.

Dissertations will typically be 50-100 pages in length and follow a standard Introduction - Methods - Results - Discussion pattern. Examiners will want to check that the student has the ability to identify and discuss an ecological problem, pose a hypothesis about the problem, devise methodology to prove/disprove the hypothesis, collect and analyse results in a way free from bias, and to draw conclusions and interpret the results in relation to the hypothesis and original problem. Details on the preparation of the dissertation will be given during the course itself.

APPENDIX - I

Rationale for Syllabus Changes to the M.Sc. in
Wildlife Science at the Wildlife Institute of India.

1. Experience in teaching one complete M.Sc. course 1988-89 and half of another course 1989-90 has shown some weaknesses in the present syllabus. This was expected to happen, the first course was to be experimental and would be used to strengthen and improve the initial syllabus.
2. There was a need to modify nine aspects of the original syllabus, these are :
 - (i) Strengthening the theoretical ecology component of the syllabus. Today ecology is a fast developing science incorporating much evolution, physiology and mathematics in its basic theory. There is need to give more attention to such concepts.
 - (ii) There is increased awareness of the essential role that people play in the whole conservation process in India. Wildlife ecology thus cannot ignore the disciplines of human ecology and the way in which economic and political forces shape human ecology. The syllabus is adjusted accordingly.
 - (iii) The past courses were of greatly unequal length, varying from 1 to 8 course units (10 to 80 lectures). The syllabus content is readjusted into courses of more equal size (2,3 units) to facilitate timetabling and examining procedures.
 - (iv) Computer applications and statistics are increasingly essential tools in wildlife science. The syllabus is strengthened to reflect this. There are two courses, an elementary course in mathematics and statistics, and an advanced course in computer applications and complex statistical analysis. In addition there is a non examinable but compulsory vacation course in BASIC programming.
 - (v) The optional courses are modified to reflect specialisations in the WII and student requirements.
 - (vi) The initial syllabus had an over ambitious field-tour component. This is reduced to ten weeks.
 - (vii) The syllabus should contains more details of the dissertation component.
 - (viii) Some of the syllabus content details are revised to fill lacunae and avoid ambiguity.
 - (ix) One course on practical management techniques has been deleted and contents built into field tours and practical classes of regular courses.

THE WILDLIFE INSTITUTE OF INDIA

The Institute

Ever since official attempts at preservation of living natural resources began in India, the need had been felt for institutions that could undertake training, education, and research in the rapidly emerging science of conservation. In particular, the vast field of wildlife conservation, research, and protected-area management remained largely unattended for over three decades after independence. It was in response to this need that the Wildlife Institute of India was set up in 1982, under the Ministry of Environment & Forests of the Government of India. To aid it in its academic and research pursuits, the Institute was granted autonomy in April 1986. It now functions under a 14-member Governing Body chaired by the Secretary in the Ministry of Environment, Forests, and Wildlife.

The Objectives

The major objectives of the Institute are:

- i) Training managers and biologists for protected area management and wildlife research.
- ii) Training education and extension specialists for protected areas to gain public support for wildlife conservation.
- iii) Providing orientation courses for those involved in land-use management.
- iv) Conducting and coordinating applied wildlife research and evolving relevant techniques suited to Indian conditions.
- v) Creating a database for building up a wildlife information system employing modern analytical techniques and computer equipment.
- vi) Providing advisory and consultancy services to Central and State governments, universities, research institutions, and other official and non-official agencies.

The Activities

The primary aim of the Institute is to develop a cadre of trained wildlife managers, and a pool of scientific personnel including researchers and wildlife biologists. Its attempt is to provide training and research inputs for better management of wildlife and wild habitats in the country, so as to make our efforts at the conservation of our natural heritage compatible with the

human dimension and other present day field realities. It is hoped that the personnel and researchers trained by the Institute will fulfill the requirements of the state forest departments, academic and research institutions including universities, and various other agencies; a few of them may also be absorbed by the Institute itself. Towards these objectives, WII carries out training, teaching, research, and consultancy.

National Structure

WII is organized into three scientific faculty divisions, viz. Wildlife Biology, Wildlife Management, and Wildlife Extension. Each of the faculties is headed by a Scientist-SE, and the administration division by a Registrar. There are, at present 22 faculty members in the Scientists category, including the Director, and 25 Research Fellows. Of the remaining 101 posts 21 are technical, 48 administrative, and 32 maintenance.

The Campus and Facilities

The Institute is currently functioning from the campus of Forest Research Institute and hired accommodation in Vasant Vihar, Dehra Dun. The new campus of the Institute is coming up on a scenic wooded site in the foothills of the Siwalik at Chandrabani, Dehra Dun. This will be a residential campus on 80 hectares of land. The first phase of the construction work, which is now in progress, will have the academic administration, and residential blocks. The academic complex will comprise classrooms, laboratories, library, seminar facilities, computer cell, and herbarium. The residential block will have quarters for the faculty and the staff. There will also be a 96-room hostel with dining and kitchen areas for students. The campus should be ready by early 1991.

The Institute currently provides hostel facilities at the FRI campus and in Vasant Vihar to its trainees, students, and research fellows.

Saurashtra University

Saurashtra University at Rajkot, Gujarat was established in 1965, and has been recognised as a seat of learning under the University Grants Commission. It has nine faculty divisions. The Department of Biosciences is a full-fledged department within the Faculty of Science.

The Wildlife Institute of India is affiliated to Saurashtra University for the award of the Master's degree in Wildlife Science. The degree will be awarded by the University, but the centre of study will be Wildlife Institute of India in Dehra Dun.

Students possessing 55% marks and above in an approved B.Sc. subject of any university, and of an age below 30 years (40 years in case of inservice candidates) are eligible to apply for entrance to the course.

The Board of Studies constituted by the Saurashtra University controls the M.Sc. programme, and determines the eligibility for the course and reviews the scheduling of course activities.

The two year course is split into 4 semesters. The grand total of the marks of all the four semesters determines the class of degree as follows:

Ist Class	-	60% and above
2nd Class	-	48% and above
3rd Class	-	36% and above

A distinction is awarded if the aggregate mark is above 75%.

Financial Assistance to Students

The Wildlife Institute of India offers financial assistance in the form of fellowships to five general category students and one to a SC/ST category student. For the first batch (1988-1989), the Bombay Natural History Society offered additional support by awarding the top candidate the Dr. Salim Ali Memorial Fellowship. The International Union for Conservation of Nature and Natural Resources has also agreed to offer assistance for two fellowships for every batch.

Each fellowship includes a monthly stipend of Rs.800/-, equipment and contingency allowance of Rs.5500/- for the research project and Rs.6000/- for the travel. All tuition costs are covered by the fellow.