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International post-graduate course in ecological approaches to resources development, land management and impact assessment in developing countries

Vol. 0

German Democratic Republic

UNEP/UNESCO
INTERNATIONAL POSTGRADUATE COURSE IN ECOLOGICAL APPROACHES TO RESOURCES DEVELOPMENT, LAND MANAGEMENT AND IMPACT ASSESSMENT IN DEVELOPING COUNTRIES (EMA)

held at the Technical University Dresden,
German Democratic Republic

organized by

United Nations Educational, Scientific and Cultural Organization (UNESCO)

and

the United Nations Environment Programme (UNEP)

Centre for Protection and Improvement of Environment (Berlin) of the Ministry of Environmental Protection and Water Management of the German Democratic Republic in cooperation with the Technical University Dresden

Volume 0

Introduction

The objective of the international postgraduate course falls within the overall training objective indicated in the UNEP Medium-Term Plan (MTP), which is:

> "... to catalyze and support the development and implementation of programmes and activities for the orientation and training of policy makers, decision makers and other officials involved in areas which affect the environment, and for the specialized training of professionals, technicians and vocation workers in specific environmental fields".

The course provides a catalyst for incorporating environmental dimensions in development programmes of developing countries through the training of a cadre of environmental specialists. Thus, the results of the course will contribute to UNEP's efforts to assist Governments in environmental assessment and management through appropriate training.

The main purpose of this course is to provide training for officials from developing countries in the ecological aspects of development, resource management and impact assessment for managers and decision makers in the field of environmental protection in developing countries.

The postgraduate course is designed to provide a comprehensive and interdisciplinary understanding of the major ecosystem types in tropical countries, and to impart skills in the use, management and protection of such ecosystems.

The major content of the course is the ecosystem concept and the rational utilization of resources, with the aim of developing strategies for the improved and continuing provision of basic needs to the population in developing countries. Such basic needs include, among others, an adequate

supply of food, and the provision of satisfactory health care, adequate energy, and an appropriate standard of housing. These objectives conform to the major priorities of UNEP.

Proceeding from the trends in the use of natural resources and in environmental degradation, particularly in the developing countries but also world-wide, and based on the results obtained in the active und creative participation of the 10-month training course with its great share in independent activities of case studies, field exercises, laboratory tests, practical courses with studies and calculations on Environmental Impact Assessment, the aim of the course is to enable trainees

- to analyze more profoundly the trends of development of several elements of environment;
- to make complex assessments on the correlations between the perspective complex development in natural-science, technical, technological, economic and social fields and the trends of development derivable from individual components;
- to make well-founded preparations for decision-making, or to specify the major lines of development which may lead to a sound basis for decision-making such as the comparison of variants, computation of scenarios, cost-benefit analysis, etc.

Therefore, the training course is intended to provide the foundations for the management, planning and organization of stable ecosystems in the developing countries of Asia, Africa and Latin America as the starting platform for achieving continuously higher and more yields in crop, food and feed productions for reaching a steadily higher animal stock, thus contributing to resolving such fundamental problems, as hunger and protein deficiency, in developing countries.

Experience has shown that for reaching this aim decisive steps are necessary to acquire more comprehensive knowledge on economic correlations.

In conformity with the stipulations of the U.N. General Assembly on economic development in developing countries as well as in line with the 7th Coordinating Meeting of the Chairmen of National Committees "Man and Biosphere" (MAB) by UNESCO in the 80's to undertake decisive efforts to convert ecology into practice, and mindful of the provisions of the Interstate Environment Education Conference at Tbilissi in 1977 the training course shall contribute to achieving progress in the developing countries in this field. The experience gained during the 10-month-courses on ecosystem management in developing countries has made clear that, given further specialization in the tasks, as in the past training courses and in the new one, attention shall be paid to the fact that the correlations be retained in an attempt to avoid unilateral decisions and, in consequence, to derive the measures for practice. At the same time everybody knows that this would once again make it necessary to acquire the theoretical wealth in full and to renew it steadily together with the abandoning of obsolete knowledge.

For this reason the 10-month training course 'Ecological Approach to Resources, Development, Land Management and Environmental Impact Assessment in Developing Countries' is operated in a way that, apart from the acquisition of concrete knowledge by providing adequate information, the methods and techniques are taught, which show how future environmental problems are solved on a national level by participation in environmental protection even on an international level. Thus the training course is intended to help trainees to acquire a high level for their future activities.

The successes achieved have confirmed the correctness of this

method. Hence, Subject I deals in detail with the strategies required for the solution of the decisive problems of natural resources in the developing countries, including the problems of environmental education.

This chapter is intended to refer also to the working methods of U.N. and its organs, notably to those of UNEP and UNESCO, and to explain them at the example of the programmes of this organization, showing how it is possible for each individual participant to grapple in future more effectively with the environmental problems of his own country. International experience gathered in Round Table Discussions, Colloquia are determined to deepen general knowledge.

Proceeding from these deliberations and in agreement with UNEP and UNESCO as well as with the organizers in the GDR a change was made in the new course, with the share of lectures and seminars in the curriculum being considerably reduced in favour of an expansion of practical exercises, field tests, case studies and similar items.

Subject II provides the theoretical foundations for stable ecosystems; the individual parts are dealt with in a concise manner. As to the other Subjects it is believed that the basic knowledge on ecosystems will make it possible to secure a rational acquisition of knowledge. In different exercises and practical courses, starting on the first month, it is envisaged teaching methodical skills required to assess the state of natural resources.

Subject III is primarily intended to make better understandable the correlations between higher and more stable yields in crop production and the further development of animal production in terms of the solution to basic questions in developing countries. Therefore it is necessary to treat technological questions and, above all, the link between the

management of agro-economic systems and land-use planning, including infrastructure and territorial planning, with interdisciplinary exercises in Subject VII.

Six case studies on ecological production processes, selected types of crop and produce from Asia, Africa and Latin America, or in other countries, are an attempt to deal with the principal aspects, the lawful regularities, the generalizable factors, in a given example. Here the methods are manifold. There is a general framework given for the preparation of case studies, or existing ones are discussed with a view to enabling trainees to come to similar conclusions in their own case studies.

Furthermore Subject III comprises field exercises, carried out together with laboratory tests, with the aim of shaping these study programmes in a close-to-practice and close-to-life manner. This will be the more successful, the better the working basis in developing countries is compared with selected placed of the GDR with a view to gaining a wider experience indispensable for the solution of tasks.

Subject IV on animal production again deals with the ecological foundations, which are dealt with in greater detail in Subject VII on Environmental Impact Assessment. At the same time 5 case studies serve for the deepening of knowledge and they demonstrate the evolvement in other countries and serve as the basis for comparative studies in Africa, Asia and Latin America.

In field and laboratory exercises the idea is to reach a complex rational utilization of natural resources (soil, water, air) in connection with the development of modern animal production in developing countries to establish stable agro-ecosystems as a basis for feed production and, accordingly,

for higher capacities in animal production. Another task is to calculate future demands for protein, the consumption by the population in consideration of the up-coming tendencies in the demographic development and in line with the ecological conditions.

Subject V, subdivided into six chapters, deals with the specific questions of forest economy in developing countries in the tropics and subtropics, proceeding from the recommendations of the U.N. system. The questions of agro-forestry and their treatment in the training course make it possible to establish connections with the basic issues of the course.

Four case studies, taken mostly from developing countries, as well as three field and laboratory exercises and five field excursions and studies shall consolidate the knowledge acquired, notably on decision-making in connection with Subject VII.

Subject VI is concerned with the questions of environmental protection and the rational utilization of water, with different aquatic ecosystems being introduced. It is shown how theoretical studies provide the basis for dedicated measures.

In a Round Table Discussion it is planned to demonstrate the issues of 'rehabilitation measures for lakes' with the participation of prominent scientists and organizers of this project. Four case studies shall generalize the experience in water economy and water conservancy; in this context the specific experience gained by trainees from developing countries shall be utilized. Four field and laboratory tests are aimed at acquiring specific skills, knowledge and capabilities required to assess the results of laboratory tests and at evaluating the phenomena and their causes in aquatic ecosystems. Ultimately practical assignments shall contribute to demonstrating a complex system of water economy together

with food and protein production and to taking account of the problems of water within the complex land-use and territorial planning (in connection with Subject VII).

The objective of Subject VII is to make a thorough study of the methods of Environmental Impact Assessment and to make the experience gained in the use of EIA in various countries as the basis for seminars and colloquia. Every participant acquires the most recent knowledge in this field as a basis for the acquisition and derivation of questions and the formulation of tasks on EIA. 34 lessons are provided for the problems of systems analysis, especially simulation engineering as the centrepiece for the patterning of ecological processes. Trainees are offered the possibility of getting acquainted with ecological tasks of land management and long-term ecosystem management on the basis of a dialogue with color slide display.

At the same time it is required to deepen knowledge on economic valuation. For this purpose, a great amount of material was gathered to be able to carry out the evaluation of damage and cost-benefit analysis. In an exercise of several days with the organs of territorial planning it is intended to show the rational land utilization and the introduction of ecology into practice with the use of modern machines, such as remote sensing and automatic cartography. Finally in seminars the social and legal aspects and the specific measures for the organization of EIA shall be treated.

Three case studies and three laboratory tests shall complement the knowledge acquired in terms of the complex application of previous findings. At the same time the other Subjects, especially III, IV, V, and VI, shall be used within the framework of exercises of this field in an effort to accentuate the interdisciplinary nature of work in environ-

mental protection and to demonstrate the character of team-work.

Subsequent compilation gives a survey on the different subjects and the number of lessons. (See next page.)

Teaching material was prepared and worked out for all classes and lectures, as indicated in the syllabus, which encompasses primarily the conditions of the developing countries. Most recent international findings, decisions and recommendations of U.N. organs were included in the teaching material available.

Internationally known scientists who have gained year-long experience in the practice of designing and constructing plants for environmental protection, or in plant and animal production provide for the classes and lectures, including field exercises, fieldwork, laboratory tests and the carrying out of case studies. They can look back on the experience essential to meet the ecological requirements of developing countries, as is proved by the survey below:

S y l l a b u s

	Time (hours)	Subjects						
		I	II	III	IV	V	VI	VII
1. Ecological fundamentals of ecosystem management, with reference to major disciplines involved and the need for interdisciplinary approaches (lectures and seminars)	490	20	100	60	40	70	50	150
2. Elaboration of case studies, projects	175	-	-	50	35	40	20	30
3. Fieldwork, laboratory exercises	210	-	70	35	15	25	15	50
4. Field exercises, in combination with study tours/excursions (7 weeks)	245	-	75	-	-	75	25	70
5. Consultations and discussions with experts and managers in the major specialized fields	70	-	-	15	10	15	10	20
6. Compiling and defending the final paper (6 weeks)	210							
Total:	1,400	20	245	160	100	225	120	320

2. List of authors

Internationally known scientists and scholars who took part and read lectures in the past training course, were, among others:

Prof. Dr. Francis, Canada, chief rapporteur of UNEP and UNESCO on problems of training and education and on water ecology

Prof. Dr. Volker (Netherlands) on problem of estuaries and deltas;

Prof. Dr. Belsare (India) on protein problems and protection of nature and developing countries;

Prof. Dr. Lemeshev (USSR) on problems of damage evaluation

Prof. Dr. Saakov (USSR) on the ecology of tropical plants;

Prof. Dr. Le Thac Can (Soc. Rep. of Vietnam) on modern rice technology and complex environmental questions of developing countries

Dr. Lötzsch and Dr. Weish (Austria) on energy, settlement and environment;

Dr. Clark (U.K.) on the use of EIA

Dr. Stoklasa (CSSR) on the basis of EIA

In addition, graduates from previous training courses will take part in lecturing and courses. The leading officials of UNEP and UNESCO deserve special recognition with their lectures, they contributed essentially to imparting the experience of international organizations to the training course.

The following list gives a survey on the authors who contributed to the study material, elaborated case studies and prepared fieldwork/laboratory exercises and field exercises and study tours.

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Some parts of the study material are based on extracts from important international publications. Detailled references are given for every chapter.

3. Editorial staff:

The editing of the entire teaching material was carried out by a group of editors, among them the following members:

Prof. Dr. E. Seidel, coordinator of the entire project, head of the editorial group, coordinator of Subject I.

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Prof. Dr. D. Uhlmann, coordinator of Subject VI.

Dr. E. Schuster, coordinator of Subject VII.

Dipl. phil. B. Uebelmann, Secretary.

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We feel obliged to express our thanks especially to all those executives of UNEP and UNESCO who had been instrumental in publishing the material with a new content. Thanks to UNEP and UNESCO support it was possible to provide new teaching aids and to make information accessible and available in a special library to all trainees of this course.

Our gratitude shall also be expressed to the government of the GDR for the generous and continuous support and assistance given to the course in providing the conditions necessary for a successful study.

We also feel indebted to the heads of a great number of enterprises of the industries for coal and energy, chemistry, foodstuffs, but even agricultural enterprises of plant and animal production, meat, milk and grain processing. Finally we would like to thank the great number of scholars and scientists who by way of their thorough preparations have contributed essentially to providing the latest knowledge, especially from the Technical University of Dresden, Karl-Marx-University Leipzig, Martin-Luther-University of Halle, Humboldt-University Berlin, Wilhelm-Pieck-University Rostock, but also scientists from the Academy of Sciences, of the GDR such as the Central Institute of Cybernetics and Information Processes, the Institute of Geography and Geo-ecology.

Many thanks also for the provision of a great number of teaching materials and aids required for holding the workshops and colloquia by scholars from other colleges and universities, such as Prof. Dr. Francis, Prof. Belsare, Prof. Volker, a.o.

Ultimately we express our gratitude to enterprises and institutions where it was possible to demonstrate modern

facilities and sets of aggregates, to be used effectively also in developing countries in the sphere of information engineering and processing, automatic mapping and the processing of remote sensing data etc.

To bring this vast amount of material to the press in time would have been impossible without the industrious activities of the translators of INTERTEXT, Fremdsprachendienst of the GDR, as well as the translators Herr Liebscher (Leipzig), Frau Ney (Berlin), Herr Reise (Berlin), Dr Römer (Berlin), Frau Ziegenrücker (Berlin) and the staff typing the manuscripts ready for print, such as Frau Becker (Berlin) and Herr Herz (Berlin) and the many members of staff of INTERTEXT.

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Subject I: International strategies for the solution of basic natural resource problems of developing countries

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elaborated by a team of authors under E. Seidel

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Subject I (continued)

guard for national economic production processes) and to improved living and working conditions; social aspects, sanitation and housing in developing countries

I.5.3.1. The contribution to increased efficiency in national economies

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I.5.3.2. The contribution to improved working and living conditions

Colloquium

Round-table discussion

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Subject II: Ecological fundamentals of production systems

STUDY MATERIAL
elaborated by a team of authors under W. BASSUS

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II.1.	Biological fundamentals or production
II.1.1.	Basic problems of the ecology of terrestrial ecosystems
II.1.2.	Basic problems of ecology of aquatic systems
II.1.3.	Fundamentals of primary production
II.1.4.	Production of usable biomass and strategies for its utilization
II.1.5.	Influencing the productivity of ecosystems

Volume Two

II.2.	Soil as production factor
II.2.1.	Soil genesis
II.2.2.	Soil types and soil classification
II.2.3.	Site characteristics
II.2.4.	Soil fertility

Volume Three

II.3.	Water as production factor
II.3.1.	Climate and hydrological cycle
II.3.2.	Groundwater
II.3.3.	Surface water
II.3.4.	Interrelations soil - water - plant
II.3.5.	Irrigation and drainage
II.3.6.	Water quality, water treatment, drinking water supply

Volume Four

II.4.	Stability and protection of ecosystems
II.4.1.	Economic, social and hygienic influences
II.4.2.	Conditions for the regeneration and stability of ecosystems

Subject II (continued)

II.4.3.	Measures for the maintenance of stability
II.4.4.	Management of nature and landscape protection, biosphere reserves and rational utilization and protection of natural resources

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Subject III: Agro-ecosystems: Land-use planning with special reference to infrastructure and regional planning

STUDY MATERIAL
elaborated by a team of authors under G. Franke and A. Pfeiffer

Volume One

III. 1. General characterisation of arid and humid systems: irrigated and rainfed technologies

Volume Two

III. 2. Ecology and cultivation of important crops
2.1. Special problems of fertility and degradation of tropical soils

Volume Three

III. 2.2. Cultivation of important crops

Volume Four

III. 3. Cultivation technologies, including site demands, energy demand, irrigation, crop protection, fertilisation, harvesting, processing, marketing

Volume Five

III. 4. Crop rotation, plantations

III. 5. Ecological and economy-based cultivation strategies

III. 6. Environmental impacts of major agricultural systems and practices, and possible countermeasures

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III. 1. General characterisation of arid and humid systems; irrigated and rainfed technologies
by W. Hain

Volume Two

Volume Four

Volume Four (continued)

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[1] See III.2.1

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Subject IV: Animal husbandry

STUDY MATERIAL
elaborated by a team of authors under G. Fenske

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Introduction

IV.1. Range management

Volume Two

IV.2. Ecology and production technology of selected animals (cattle, sheep and goats, poultry, pigs)

Volume Three

IV.3. Processing and marketing (milk and meat)

IV.4. Unconventional sources of protein
Game management (management of reserve areas and other game habitats)

IV.5. Environmental impact of animal husbandry

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Subject V: Forestry resources management and agroforestry

STUDY MATERIAL

elaborated by a team of authors under M. Loeschau

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V. 1. Formations of natural woody vegetation of tropical regions

V. 2. Assessment of tropical forest resources

V. 3. The use of the forest resources potential

Volume Two

V. 4. Uses of forests and their environmental implications

V. 5. Inventory and planning of forest land use

Volume Three

V. 6. Strategies in forest resources management

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V. 6.6. Impact of agroforestry on the environment and rural community development

V. 7. Arid zones forestry

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The contributions to complex exercises
Environmental impact assessment
and
Planning and organization of land reclamation and recultivation in former strip-mining areas
are printed under separate cover in Subject VII.

Subject VI: Management of aquatic ecosystems

STUDY MATERIAL
elaborated by a team of authors under D. Uhlmann

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VI. 1. Structure of lake ecosystems (temperature and oxygen stratification, light energy and nutrients)

VI. 2. Structure and dynamics of marine ecosystems (nutrient balance in the sea, regional differences, upwelling areas), off-shore and coastal fisheries

VI. 3. Controlled productivity as a principal management goal (control of eutrophication; combating aquatic weeds; international control measures and food-web manipulation)

Volume Two

VI. 4. Service ecosystems for secondary and advanced waste treatment (stabilization ponds, pre-dams)

VI. 5. Management of river ecosystems (biotic structure, pollution and self-purification)

Volume Three

VI. 6. High productivity as a principal management goal (fisheries management of lakes, rivers and ponds)

VI. 7. Control of human impacts on coastal ecosystems (pollution problems in shelf regions, estuaries, mangrove swamps, coral reefs)

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Subject VII: Fundamentals of environmental impact assessment and project implementation

STUDY MATERIAL
elaborated by a team of authors under E. SCHUSTER and E. SEIDEL

Volume One

VII. 1. General problems of environmental impact assessment (EIA) and project implementation in developing countries

VII. 2. Environmental impact assessment
VII. 2.1. Baseline information, information systems

Volume Two

VII. 2.2. Environmental monitoring and analysis, global and national, including remote sensing

Volume Three

VII. 2.3. Importance and history of EIA
VII. 2.4. Methods, preparation and implementation of EIA (critical review)
VII. 2.5. Determination and forecast of environmental impacts
VII. 2.6. Application of EIA in various countries

Volume Four

VII. 3. Modelling
VII. 3.1. Applied systems analysis
VII. 3.2. Modelling (including mathematical fundamentals)
VII. 3.3. World models (comparison of contents and methods)

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VII. 4. Economic evaluation
VII. 4.1. Evaluation of natural resources
VII. 4.2. Evaluation of environmental damage and measures of environmental protection, secondary and non-monetary values
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VII. 5. Planning and project design
VII. 5.1. Options for environmental protection and planning in developing countries
VII. 5.2. Fundamentals of planning in environmental protection
VII. 5.3. Territorial and land-use planning
VII. 5.4. Utilization of development projects
VII. 5.5. Methods of project design; integration of development in agriculture, industry, forestry, water management under consideration of territorial requirement
VII. 5.6. Utilization of mapping techniques

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VII. 6. Social, organizational and legal aspects
VII. 6.1. Social aspects (living and working conditions, social impacts, public involvement)
VII. 6.2. Organization and management of EIA and of project implementation
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VII. C. 3. Exercise: Remote sensing (complex treatment of image acquisition, processing and interpretation)

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