

# Natural Resources Management

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Growing population densities lead to land scarcity and widespread changes in land use. Human activities result in environmental problems such as deforestation, overgrazing, and the depletion and contamination of land and water resources. To solve these problems and ensure that future generations can enjoy the benefits of the earth's resources, improved management of these resources is needed. Planners, managers, policy makers and researchers alike need to understand the complexity of factors involved. They must collect and interpret the required data and work together with professionals from other disciplinary fields. Geo-information technology, and particularly remote sensing, plays an important role in these tasks.

#### What will be achieved?

Two types of degree course, the PM course and the MSc course, are offered. These courses aim to strengthen the institutional capacity of organisations that support natural resources management. Such organisations may be either specialist institutes or multidisciplinary agencies. These courses provide participants with the theoretical knowledge and practical skills needed for collecting, interpreting and managing geographical information to support the planning and decision-making processes.

#### Course content and structure

The courses are composed of a series of three-week modules. There are four types of module: core modules, programme modules, specialisation modules and elective modules.

#### Core modules

The core modules deal with the theory, tools and techniques of GIS and remote sensing that are common to all ITC programmes. Knowledge of the principal concepts of spatial data acquisition through remote sensing and spatial data handling with GIS is supplemented by developing the practical skills required to apply these tools. Throughout other modules GIS and remote sensing tools are applied regularly. This provides the opportunity to develop a full understanding of their relevance to the management of natural resources, and the ability to extract maximum utility from their use.

#### Programme modules

The programme modules prepare participants for a role as natural resource geo-information specialists working at the interface of natural resources management, natural resource data acquisition and analysis, and geo-information technology. Participants master the principles of GIS, remote sensing and information technology applied to natural resources management.

#### **Specialisation modules**

Specialisation modules are offered in six directions:

### Planning and Coordination in Natural Resources Management

Decision makers in natural resources management seek solutions that satisfy the varied interests of the different parties involved. This specialisation addresses the coordination and reconciliation of the diverse interests of the various stakeholders, problem structuring and analysis, scenario development, and multicriteria evaluation approaches and techniques, while emphasising the application of geo-information in planning and decision-making processes for sustainable natural resources management.

#### Sustainable Agriculture

Materials to meet basic human needs such as food, fuel, fibre and shelter are obtained through agricultural land use. Land uses change continually, and their impacts on the resource base are adjusted in response to the changing demands of the growing population. Management of natural resources is the essence of land use, protecting not only future production possibilities but also biodiversity and habitats.

The survey and study of agricultural land uses, their sustainability and their impacts on the environment are the core subjects of this specialisation. Using GIS and modern remote sensing techniques, georeferenced information is collected and mapped to support (multisectoral) land use planning.

#### Rural Land Ecology

This specialisation studies the earth's "green cover" - the agricultural crops and natural vegetation that provide materials to satisfy basic human needs. Changing human demands result in changes in land use and hence in vegetation. Direct and indirect impacts (desired and undesired) such as erosion, climatic change and the loss of natural habitats and biodiversity may be the outcome.

Spatial information on land use and its effect on vegetation is essential for the sustainable development and management of natural ecosystems, and for biological conservation. This specialisation focuses on the survey, study and use of vegetation, as well as on the conservation of areas with high conservation value. The spatial information is generated for purposes of managing natural resources such as rangelands, woodlands, forests and wetlands.

#### Forestry for Sustainable Development

Forests and trees outside forests provide a wide range of ecological, economic and social benefits, thus playing a crucial role in rural land use systems and rural livelihoods



throughout the humid and dry tropics. In many countries, however, growing populations, with their increasing demands for agricultural land and tree products, are leading to deforestation and resource degradation. Consequently, sound utilisation and management practices are called for in order to safeguard the existence of these resources and their continued productivity.

This specialisation emphasises that forests and trees outside forests, rather than being separate entities, complement each other. It focuses on the contribution forests and trees outside forests make to sustainable development and on the current approaches to forest and tree resources management. It addresses both well-established and relatively new forestry application domains, such as biodiversity conservation, carbon sequestration, and criteria and indicators for sustainable forest and tree resources management.

## Soil Information Systems for Sustainable Land Management

Reliable and appropriate information on soil resources plays an important role in multidisciplinary studies in support of land use planning and decision making for natural resources and environmental management. Information on soil resources varies widely in quality, quantity and form, and often information on the nature and properties of soils and on their spatial distribution is unavailable or difficult to access. Yet soil information is increasingly required in order to answer questions about the nature and causes of land degradation and the consequences of land management alternatives. Changing demands for soil information reflect the changing role of soil information specialists. They are becoming client-oriented providers of soil geo-information and related land resource data to aid natural resource managers in decision making.

This specialisation addresses the need to improve user access to geo-information on soils and related land resources. It is intended to develop expert knowledge and skills in soil geography and the use of modern techniques for land resource assessment and modelling.

*Environmental System Analysis and Management* Environmental management aims to use renewable



resources sustainably, while preserving the quality of life and the environment. It identifies problems arising from the interaction between people and their environment. This specialisation deals with the application of GIS and remote sensing techniques for environmental management in terrestrial ecosystems.

Ecosystems are complex systems,



with feedback mechanisms and the ability for self-organisation. Modelling techniques and scenario analysis are one way to simplify and structure such complex and dynamic systems. Ecosystem models attempt to capture the effects of land use changes on the biotic and abiotic environment; natural ecosystem models describe the development of vegetation and animals in relation to environmental conditions and management; agro-ecosystem models illustrate the effects of natural and human influences on agricultural and pastoral systems.

#### Inter-specialisation Geo-information Management

Participants may elect to follow the Geo-information Management interdisciplinary specialisation spanning modules 9 to 12.

Participants should have an interest in working with geodata and geo-information technology to improve the quality and performance of organisational processes. These processes can range from data capture, via planning and analysis, to monitoring and decision support information provision. Participants will study:

- · the geo-information flow within an organisation,
- implementation of GIS capacity within an organisation (including third party support)
- information system development and appropriate ways of introducing geo-ICT into the organisation (including aspects of technical, financial and human resource development).

#### Elective modules

All ITC participants may choose from a variety of elective modules offered simultaneously by all ITC's scientific departments. For the PM course, two such electives are scheduled; for the MSc course three. Examples of modules on offer include Environmental Impact Assessment using GIS, Multiple Criteria Evaluation and Visualisation; Introduction to Spatial Analysis and Geostatistics; Project Planning, Formulation and Funding; Natural Resource Degradation Analysis and Modelling.



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