Integrated Planning for Rural Development and Environmental Management

Organized by

Mediterranean Agronomic Institute of Zaragoza

Integrated Planning for Rural Development and Environmental Management

Jointly organized by: **CIHEAM-IAMZ and University of Lleida (UdL)**
Scientific coordinators: **Prof. Dr. Juan F. Bellot, Guy Engelen**
IAMZ coordinator: **María Teresa Aguinaco**

The Master on Integrated Planning for Rural Development and Environmental Management provides a two-year programme for graduates who wish to specialize in the subject and professionals interested in updating their knowledge.

In the first year participants follow the Postgraduate Specialization Course. Formal lectures are complemented by case studies, practices and field work.

In the second year, students who have successfully completed the first year develop an individual work of initiation to research or to professional activity on a chosen topic of the specialization, leading to a Master of Science Degree.

The programme is held every two years. Next edition starts at the end of September 2008.

Participants must hold a university degree in agronomy, forestry science, biology, geography, environmental sciences, economics, landscape architecture or any related field. Sound knowledge of computers as a user is required, and experience in using geographical information systems (GIS) is taken into consideration when selecting applicants.

The working languages are English, French and Spanish. Lecturers can teach in any of the three languages. Simultaneous translation into Spanish is provided when lecturers speak English or French, therefore participants should prove knowledge of Spanish at the start of the course. From the beginning of July to the end of September IAMZ organizes an intensive course of Spanish for those who require it. Participants can answer the exams in Spanish, French or English. In the selection of candidates, knowledge of English and French is nevertheless valued, as part of the documentation distributed may be written in either of these languages.

This Master is also an official Master of the Spanish University system.

Objectives

The objectives of the first part of the Master programme (Postgraduate Specialisation Course) are to: (i) become acquainted with the bases that govern the behaviour of systems and their corresponding physical, socio-economic, legal and institutional sub-systems; (ii) gain expertise in the methods and techniques that can be applied in the different stages of a rural planning project; (iii) propose alternative land uses under different conditions and assess the viability and appropriateness of their application; (iv) acquire direct experience in the solving of specific problems presented to experts involved in rural development programmes and in the management of the environment in the rural world; and (v) develop the skills to work in a multidisciplinary team.

Through the work carried out in the second part of the programme (Master Thesis), participants complete their training by making a critical application of the knowledge, methods and techniques acquired during the first year of specialization and develop their competence in: (i) analysis of problems; (ii) definition of objectives; (iii) acquisition and treatment of data in compliance to a pre-established research protocol; (iv) analysis of results; and (v) elaboration of conclusions that may contribute to clarify and find a possible solution to problems.

Part 1
Postgraduate specialisation course

Training is organized in 5 sections (60 ECTS)

Section 1 **PLANNING FOR SUSTAINABLE RURAL DEVELOPMENT**

This section introduces planning as the instrument linking human activities and territory. A review of rural evolution and development is made highlighting new trends and driving forces. The system approach is presented as the most appropriate framework to carry out integrated planning, paying special attention to temporal and spatial scales. Different methodologies used in land planning are addressed, finally presenting the work scheme adopted in the Course to elaborate applied planning projects.

Section 2 **INTERPRETATION AND EVALUATION OF NATURAL RESOURCES: MULTISCALE INTERACTION**

The section is devoted to making a general analysis of different aspects related to natural resources and especially to those relevant to the Mediterranean region. The evaluation of natural resources, their processes and interactions are analysed from the perspective of making compatible their use and conservation to guarantee their sustainability. Landscape ecology is presented as a conceptual framework to be applied in rural planning, introducing theories and methods used in the spatial patterning of the dynamics of interacting ecosystems to understand the dynamic functioning of rural systems, their main constraints and the territory resilience. Agricultural production is addressed in a sustainability context, to assure the quality of natural environments and the preservation of rural media. The last part of the section focuses on biodiversity conservation and on the design and management strategies of protected areas.

Section 3 **ECONOMY AND SOCIAL STRUCTURES**

The section focuses on land use structural patterns and social organization in rural environments, considering their evolution in the last decades in developed and developing countries. The production model in rural environments is addressed, analysing the economic control of productions in a context of globalization. Tools for the economic evaluation of the environment and of natural resources are studied, introducing related environmental legislation. Finally, main policies affecting rural areas are considered, analysing their incidence in local, regional and international rural development.

Section 4 **CRITERIA AND TECHNIQUES FOR PLANNING DEVELOPMENT**

The section deals with methods and techniques needed to gather, analyse and process information used in planning projects, complementing the content of previously addressed sections from an applied perspective. Cartography analysis, socio-economic analysis, geographic information systems, applications of remote sensing in natural resource management and modelling are included. Special attention is paid to resource conservation and use, providing criteria and presenting methods to propose, assign and evaluate land use alternatives in a given territory, with the aim of contributing to rural development and ameliorating the quality of the environment.

Section 5 INTEGRATED PLANNING PROJECT

Throughout the Course participants form multidisciplinary groups to carry out, under the supervision of a tutor, an integrated planning project on a previously chosen area. The objective of the work is to provide participants with practical experience on how to design and implement a planning project of a particular area, applying knowledge acquired during the Course. Carrying this work out enables participants to: (i) gain practice in information retrieval and its selective treatment; (ii) learn to define and integrate the different components that interact in a system; (iii) apply the principles and methodology presented during the Course in each of the work phases; (iv) acquire experience in the analysis of situations and in decision-making; (v) develop the skills for group work and multidisciplinary collaboration; and (vi) acquire experience in the preparation of oral communications and their presentation in public.

TRAINING SEQUENCE

Section 1 (4 ECTS) Dates: from 29 September to 10 October 2008.	**PLANNING FOR SUSTAINABLE RURAL DEVELOPMENT**
Section 2 (12 ECTS) Dates: from 20 October 2008 to 12 December 2009.	**INTERPRETATION AND EVALUATION OF NATURAL RESOURCES: MULTISCALE INTERACTION** **Unit 1** – Natural resources (5 ECTS), **Unit 2** – Natural and agricultural production systems (7 ECTS).
Section 3 (11 ECTS) Dates: from 8 January to 20 February 2009.	**ECONOMY AND SOCIAL STRUCTURES** **Unit 1** – Environmental economics and policies (6 ECTS), **Unit 2** – Socioeconomics of rural areas and development policies (5 ECTS).
Section 4 (18 ECTS) Dates: Units distributed from 14 October 2008 to 30 April 2009.	**CRITERIA AND TECHNIQUES FOR PLANNING DEVELOPMENT** **Unit 1** – Spatial and socioeconomic analysis (9 ECTS), **Unit 2** – Land use allocation and modelling (9 ECTS).
Section 5 (15 ECTS) Dates: from 29 September 2008 to 5 June 2009.	**INTEGRATED PLANNING PROJECT**

Comprehensive oral or written examination

Participants take 1 written examination for Section 1, which coincides with the written examination of Cartography analysis of Section 4. Participants also present a personal practical exercise on Cartography analysis that complement the written examination of this subject. Each unit is independently graded.

Participants take 2 written examinations during Section 2, equally distributed over time, each unit being independently graded. Participants present personal written practical exercises that complement the written examination.

Participants take 1 written examination during Section 3, which coincides with the written examination of Socioeconomic statistical analysis of Section 4. Each unit is independently graded.

Participants take 2 written examinations during Section 4, equally distributed over time, and present a personal practical exercise to evaluate the GIS part. Participants also present written practical exercises in groups that complement the written examinations on remote sensing and modelling. Each unit of the section is independently graded.

Written exams consist of a set of questions that require a concise answer. Some of the questions are multiple choice. Lengthy questions are avoided.
Participants may retake failed exams once.

To evaluate Section 5, participants must elaborate a written document that is presented and defended orally before a jury for its qualification. As the projects are carried out in groups, each component presents and defends a different part and the jury gives a common grade for the project and an individual grade for each group component. Furthermore, each group component is also graded by the project tutor and the IAMZ coordinator of the Course, on the basis of personal attitude and involvement during the realisation of the project.

Analytical syllabus

Section 1 **PLANNING FOR SUSTAINABLE RURAL DEVELOPMENT**

Section 2 **INTERPRETATION AND EVALUATION OF NATURAL RESOURCES: MULTISCALE INTERACTION**

Unit 1 – Natural resources

The unit considers natural capital (land, soil, water and climate) at a landscape scale. The first part of the unit is devoted to the description, analysis and valuation of climate, water, soil and vegetation, and their interrelationships, focusing on factors controlling primary production, soil development and conservation, main biogeochemical sections and biodiversity conservation. Emphasis is placed on the scale with which elements are studied. The second part of the unit introduces the system hierarchy concept, how inputs and outputs link systems and the established interconnections. Actual case studies on systems functioning are presented, where the element connections are analysed and guidelines for management are provided.

Unit 2 – Natural and agricultural production systems

The first part of the unit deals with landscape dynamics. A general overview of landscape ecology, considering its principles as the conceptual framework to be applied in land planning and management is provided. The causes and consequences of spatial heterogeneity at different scales are considered, explaining the interaction between spatial patterns and ecological processes. Special attention is paid to quantitative methods used to analyse landscape dynamics. A case study on how to increase interconnection between systems setting up corridors in the landscape is presented.

The second part of the unit studies the functioning of different natural and agricultural systems, focusing on factors involved in the ecosystem production rates. Methodological proposals for controlling these factors are addressed, and applied examples for system and resource management are presented. Special attention is paid to water, as the element regulating the functioning and production of the systems, and to the importance of planning its use to improve efficiency. Systems recovery is also highlighted, presenting the application of ecological engineering to aquatic and land systems recovery. Agricultural production is reviewed in the context of sustainability, and alternative production systems are also considered. Case studies on forest and agricultural systems are presented and analysed to illustrate the theoretical concepts. Computer work for system management simulation is carried out.

The third part of the unit first studies biodiversity, its structure and assessment, introducing concepts of rarity and fragility. Then, functional networks of protected areas are addressed, as a tool to preserve species and habitats, discussing main criteria and methods for their selection and management and considering legal tools that guarantee their protection. Guidelines for zoning protected areas and the assignment of uses in each zone are given, taking into account the compatibility of uses and preservation. Case studies on the management of different National Parks and other protected areas are analysed.

Section 3 **ECONOMY AND SOCIAL STRUCTURES**

Unit 1 – Environmental economics and policies

After an introduction to macroeconomic concepts and its interpretation to economically characterize a territory, the unit deals with the economic bases of market functioning, the concept of welfare economics and the cost-benefit analysis methodology. The economics of natural resources is then addressed providing the criteria that must guide the economic management of renewable and depletable natural resources. Finally, the unit deals with environmental economics, presenting methodologies used to estimate and assign the economic value of environmental resources and analysing environmental policies as instruments to reduce externalities.

Unit 2 – Socioeconomics of rural areas and development policies

The first part of the unit deals with the socioeconomic analysis of rural areas and its importance in rural planning, reviewing census and other data sources, indicators, surveys and demographic processes. The humanisation of rural areas and the social and legal system of the territory are analysed, considering their effects on agrarian structures and rural development. Rural and agricultural transformation are considered in the context of globalization, analysing processes in developed and developing countries. The role of social participation in local development is highlighted. A case study on demographic processes is analysed.

The second part of the unit deals with rural economics and policies for integrated rural development. The importance of rural areas is first analysed, considering its role in European regional dynamics. Different European policies and policies in other Mediterranean non-European countries affecting rural areas are reviewed, as well as their evolution in recent years. Special attention is paid to initiatives related to European Leader programmes, as driving forces of rural development. The possibilities offered by rural tourism for rural development are analysed. Case studies on rural development programmes currently carried out in diverse Spanish areas are presented.

Section 4 CRITERIA AND TECHNIQUES FOR PLANNING DEVELOPMENT

Unit 1 – Spatial and socioeconomic analysis

The first part of the unit deals with cartography analysis for rural planning introducing the basic principles of the cartographic representation of spatial variables, going on to a review of types of maps and map symbols. Then it deals with the elaboration of maps, the interpretation of their information and their application to environmental and rural management. Topographic, geomorphological and geological maps are studied, including the creation of further information that can be derived from them. Tools for the elaboration of soil and vegetation maps are presented. The elaboration of other kinds of maps from the ones previously described to complete territory characterization is also addressed, such as risk maps, capacity maps and aptitude maps. Practical work on cartography is carried out, applying the knowledge acquired to the elaboration and interpretation of study zones of the projects developed in Section 5.

The second part of the unit deals with Geographic Information Systems (GIS) and digital database management. The bases of GIS, the characteristics of spatial data (raster and vectorial) and GIS functions and applications are presented. Then, the use of GIS IDRISI32 and CARTALINX software to scan and georeference information is addressed, carrying out computer practices. Finally, access to different useful digital data bases and their applications are dealt with.

The third part of the unit is an introduction to remote sensing and its application to natural resource management. RS concepts and satellite characteristics and uses according to the information desired on weather or land resources are presented. Characterization of different sensors and satellite images is then addressed. The possibilities offered by RS to obtain valuable information for rural planning are reviewed, dealing with image processing and presenting different applied examples. Practical work is carried out on the use of CHIPS software.

The fourth part of the unit deals with socioeconomic statistical analysis, developing the use of statistical procedures to obtain the socio-economic patterns and trends of rural areas. Statistical bases are addressed, followed by applied work using statistical packages.

Practical work is also carried out on the use of spatial data, geographic information systems and computer simulation modelling to examine the causes and consequences of spatial patterning. This work develops skills in the application of quantitative tools used in landscape ecology and allows participants to learn how to apply these tools and concepts to the projects developed in Section 5.

Unit 2 – Land use allocation and modelling

The first part of the unit deals with land use allocation and environmental impact assessment, developing methods and techniques currently used for decision-making on use allocation and resolution of land use conflicts. It is studied how to calculate land capacity to support possible different uses and their impact, and then, methods to select use alternatives in a given territory are presented. The concepts, general methodology and legal framework for the environmental impact assessment of projects are presented, followed by a review of preventive, corrective and compensatory environmental measures. Practical work is carried out on land use allocation, impact assessment and choice of alternatives.

The second part of the unit deals with qualitative modelling, scenarios and system dynamics modelling. The concepts and bases of the systems approach needed to model systems functioning in planning projects are provided. Then, qualitative models, scenario building and dynamic models are addressed, as tools for the analysis of complex systems. Practical work is carried out on system diagramming and on the elaboration of simple models using Stella software, to understand their functioning and value their possibilities and limits. Practical work is also carried out on the development of system dynamic models.

The third part of the unit is conceived to show how decision support systems can be used in spatial planning and policy making. Simulation model building is presented in order to understand their functioning and assess their capabilities and limitations. The use of models for integrated assessment of socio-environmental systems is addressed and practical work on modelling for the vulnerability assessment to climate change and dynamic land use in Europe is provided.

Section 5 INTEGRATED PLANNING PROJECT

Part 2
The Master of Science thesis

Project (10 month duration, 60 ECTS)

This part of the programme is carried out in well-recognized institutions (universities, research centres or firms), generally throughout Spain or in the participant's country of origin, under the scientific supervision of a thesis director that must be a doctor of renowned prestige. Participants choose the topic according to their interest of training, which is approved by a Committee. If the participant so requires, IAMZ and UdL advise on the choice of the most appropriate thesis director and institution to carry out the desired project, and likewise proposes topics related to activities of cooperative research coordinated by IAMZ or UdL, or other topics of interest previously accorded with other institutions.

As a consequence of the previous facts and because of the multidisciplinary approach of the programme, there is a wide range of research topics available for Master of Science theses. Many of the theses focus on the application of different methods and techniques to rural planning and environmental management; others even go beyond presenting integrated or partial planning proposals for particular natural and rural areas. Other theses deal with agricultural production and its interaction with the natural or social environment in rural areas. Others study the physical media, the interrelationship between its components and its effects on determinate aspects such as water management and desertification processes. Forestry studies are also frequent, especially those on forest fire impact and regeneration of affected areas. Other common subjects for theses are socio-economic studies on the use of natural resources or on the repercussion of particular activities in sustainable production and rural development.

The participant, with the support of the thesis director, should inform IAMZ and UdL periodically on the development and progress of the research work. This part concludes with the writing of a thesis to be defended in public before an examining board convened by IAMZ and UdL. The jury is composed of a representative of the organizing institutions and at least three external members selected in each case for their expertise and prestige in the field of the thesis.

INDICATIVE MASTER THESES REALIZED WITHIN THE AREA

Title: Time series of soil cover and use. Indexes of change, change-landscape structure relationship and series coherence (2007)
Author: Rachid Hamaina, Topographer, Morocco
Place of realization: Estación Experimental de Zonas Aridas, Consejo Superior de Investigaciones Científicas, Almería, Spain
Thesis director: Gabriel del Barrio

Title: Valuation of high-mountain landscapes. Assessment of landscape alternatives in the Pyrenees of Aragón (2007)
Author: Fernando Afonso Vieira de Figueiredo, Biologist, Portugal
Place of realization: Unidad de Economía Agroalimentaria, Centro de Investigación y Tecnología Agroalimentaria, Diputación General de Aragón, Zaragoza, Spain
Thesis director: Begoña ALVAREZ FARIZO

Title: Agricultural vulnerability to drought: a comparative study in Morocco and Spain (2005)
Author: Marta Moneo, Environmental Scientist, Spain
Place of realization: Departamento de Economía y Ciencias Sociales Agrarias, Escuela Técnica Superior de Ingenieros Agrónomos, Universidad Politécnica de Madrid, Spain
Thesis director: Ana Iglesias

Title: Application of a multicriteria methodology to evaluate the socio-economic and environmental impact of the new CAP. Repercussions on the agriculture of the region of Cinco Villas (2004)
Aplicación de una metodología multicriterio para la evaluación del impacto socioeconómico y ambiental de la nueva PAC. Repercusiones sobre la agricultura en la comarca de las Cinco Villas
Author: Saida Elfkih, Agronomist, Tunisia
Place of realization: Departamento de Análisis Económico, Facultad de Ciencias Económicas y Empresariales, Universidad de Zaragoza, Spain
Thesis director: María Luisa Feijoo

Title: Contribution to the sustainable development of the rural community of Ait M'zal, south-western Morocco. A rural planning proposal (2003)
Author: Abdelkrim Azenfar, Forestry Engineer, Morocco
Place of realization: Service d'Aménagement des Forêts et des Bassins Versants, Direction Régionale des Eaux et Forêts du Sud-Ouest, Agadir, Morocco
Thesis director: Faiçal Benchekroun

Title: Effect of topographic landforms on vegetation cover density of arid landscape of the southeast of Spain (2003)
Author: Ashraf Afana, Agronomist, Palestina
Place of realization: Estación Experimental de Zonas Aridas, Consejo Superior de Investigaciones Científicas, Almería, Spain
Thesis directors: Juan Puigdefabregas and Gabriel del Barrio

Title: A study of forest fires in the Province of Valencia (1978-2001) in relation to the environment using GIS (2003)
Author: Dania Abdelmalak, Agronomist, Lebanon
Place of realization: Fundación Centro de Estudios Ambientales del Mediterráneo (CEAM), Valencia, Spain
Thesis director: Jordi García Pausas

Title: Tourism in Alto Ésera: compatibility and competition with the primary sector (2001)
Author: María Laguna, Geographer, Spain
Place of realization: Instituto Pirenaico de Ecología, Consejo Superior de Investigaciones Científicas, Zaragoza, Spain
Thesis director: Teodoro Lasanta

Title: Economic evaluation of the effects of climatic change on Tunisian and Spanish agriculture (2001)
Author: Mohamed Nabil Balti, Agronomist, Tunisia
Place of realization: Departamento de Ciencias Sociales Agrarias, Escuela Técnica Superior de Ingenieros Agrónomos, Universidad Politécnica de Madrid, Spain, and Département de Gestion du Développement et d'Analyse de Données, Ecole Supérieure d'Agriculture de Mograne, Tunisia
Thesis directors: Alberto Garrido and Slim Zekri

Title: Rural exodus as an environmental degradation factor. The case of Haiti (2000)
Author: Pierre Jeune, Agronomist, Haiti
Place of realization: Departamento de Geografía y Ordenación del Territorio, Facultad de Filosofía y Letras, Universidad de Zaragoza, Spain
Thesis director: José Luis Calvo

REFERENCES OF THE MAIN ACADEMIC STAFF TEACHING WITHIN THE M.SC. PROGRAMME

Some 55 invited lecturers from about 10 countries participate in each edition of the M.Sc. programme of which, 67% come from Higher Education Institutions, 13% from Research Centres, 14% from Private Companies, 4% from the Administrations and 2% from International Centres. Considering their implication in the programme, the following academic staff is taken as reference:

- Juan **F. BELLOT** Scientific coordinator, Univ. de Alicante, Departamento de Ecología, Alicante (Spain)
- Guy **ENGELEN** Scientific coordinator, Flemish Institute for Technological Research (VITO NV), Mol (Belgium)
- Antonio **ALEDO**, Univ. de Alicante, Departamento de Sociología 1, Alicante (Spain)
- Fernando **ARBUÉS**, Univ. de Zaragoza, Departamento de Economía Aplicada, Zaragoza (Spain)
- Theo **ARENTZE**, Technical Univ. of Eindhoven, Department of Architecture, Building and Planning, Eindhoven (the Netherlands)
- Eladio **ARNALTE**, Univ. Politécnica de Valencia (UPV), Departamento de Economía y Ciencias Sociales, Valencia (Spain)
- Paulo **M. BARBOSA**, EC Joint Research Centre, Institute for Environment and Sustainability, Ispra (Italy)
- Carlos **CANTERO**, Univ. de Lleida (UdL), Departamento de Producción Vegetal y Ciencia Forestal, Lleida (Spain)
- Edward **DWYER**, University College Cork (UCC), Coastal and Marine Resources Centre, Cork (Ireland)
- M. Teresa **ECHEVERRÍA**, Univ. de Zaragoza, Departamento de Geografía y Ordenación del Territorio, Zaragoza (Spain)
- Almo **FARINA**, Univ. of Urbino, Institute of Biomathematics, Urbino (Italy)
- Luisa **M. FRUTOS**, Univ. de Zaragoza, Departamento de Geografía y Ordenación del Territorio, Zaragoza (Spain)
- Germán **GLARÍA**, Univ. Politécnica de Madrid, Departamento de Proyectos y Planificación Rural, Madrid (Spain)
- Carlos A. **GRACIA**, Univ. de Barcelona (UB), Departamento de Ecología, Barcelona (Spain)
- Joao **GUERREIRO**, Univ. do Algarve, Department of Regional Economics, Faro (Portugal)
- Elías **GUTIÉRREZ**, Univ. Puerto Rico, Escuela Graduada de Planificación, San Juan (Puerto Rico)
- Dionisio **ORTIZ**, Univ. Politécnica de Valencia (UPV), Departamento de Economía y Ciencias Sociales, Valencia (Spain)
- Fausto **SARMIENTO**, Univ. of Georgia, Office of International Education, Athens (United States)
- John **THORNES**, King's College, Department of Geography, London (United Kingdom)
- V. Ramón **VALLEJO**, Centro de Estudios Ambientales del Mediterráneo (CEAM), Programa Investigación Forestal, Paterna (Spain)
- Hedwig **VAN DELDEN**, Research Institute for Knowledge Systems (RIKS bv), Maastricht (the Netherlands)
- Willem **VAN DEURSEN**, PCRaster, Rotterdam (the Netherlands)