

UNDERSTANDING THE INTERACTIONS NATURE/SOCIETY FOR LAND USE MANAGEMENT IN RURAL AREAS

Monitoring and Managing Land Use Methodology for rural areas

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Introduction

Today, the Social Sciences still face the absence of an appropriate conceptual framework which could make for the understanding of the complex interactions between society and the environment. In fact, the majority of studies tend to concentrate on the effect and impact of man's actions on the environment, dedicating little attention to the consequences of those changes on human activity.

As mentioned by Mesarovic, McGinnis and West (1996), studies on the role which humanity plays in global change are often carried out within the concept of an *analysis of the human dimension*; thus, they lose the systemic perspective which considers society as a sub-system interacting with the natural sub-system within the far-reaching and integrated framework which is the global change system.

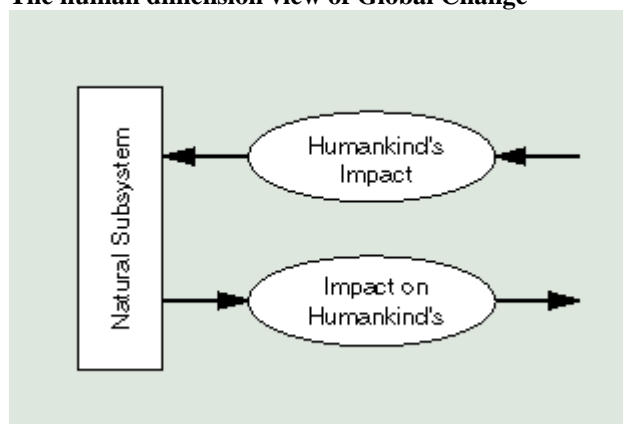
The use of this systemic perspective allows the complexity of the interactions defined by the social systems/natural systems to be incorporated in the analysis and obliges the development of a different view on the relationship of these two systems. This view shows that they interact through a logic of reflexivity, in other words, the social systems are changed at the same time as they modify the natural system, that is to say, the impact of human activity on the environment and the consequences of the latter's deterioration on human activity cannot be considered separately since they are related in real time (these two views are graphically represented in Figs. 1 and 2).

The methodology proposed in this article for the monitoring and management of land use specifically aims to assume an integrated and systemic vision of the social system/biophysical system relationship. Thus, the study of the changes in land use aims at understanding the environmental changes and, further to identifying them, makes for understanding the motivations and strategies of Man's interventions in the environment and his reactions in the light of global change. Thus, the interactions between natural and social factors, political and economic factors should be present in the studies on changes in land use.

Therefore, the land use study "... involves both the manner in which the biophysical attributes of the land are manipulated and the intent underlying that manipulation – the purpose for which the land is used..." (Turner, Skole, Sanderson, Fisher, Fresco and Leemans 1995).

Figure 1.

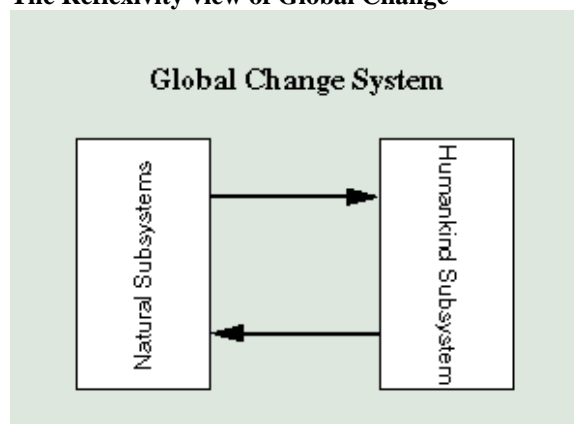
The human dimension view of Global Change



Adapted from: Mesarovic; McGinnis; West, 1996

Figure 2.

The Reflexivity view of Global Change



Adapted from: Mesarovic; McGinnis; West, 1996

Generally speaking, the effects of the change in land use on global change are still little known in much the same way as the factors which are behind those processes are not fully understood. There are, therefore, difficulties in defining methods of intervention in the regions and in obtaining support instruments for decision making which are fundamental to managing, understanding, accompanying and assessing the (environmental and social) changes resulting from modifications in land use.

The development of a methodology for monitoring and managing land use therefore implies understanding the Nature/Society relationship, in other words, the interaction processes between the natural system and the social system. From this point of view, and

within the framework of global change whose factors are of natural and anthropic origins, it is possible to construct reliable and efficient instruments for supporting technical and political decision making.

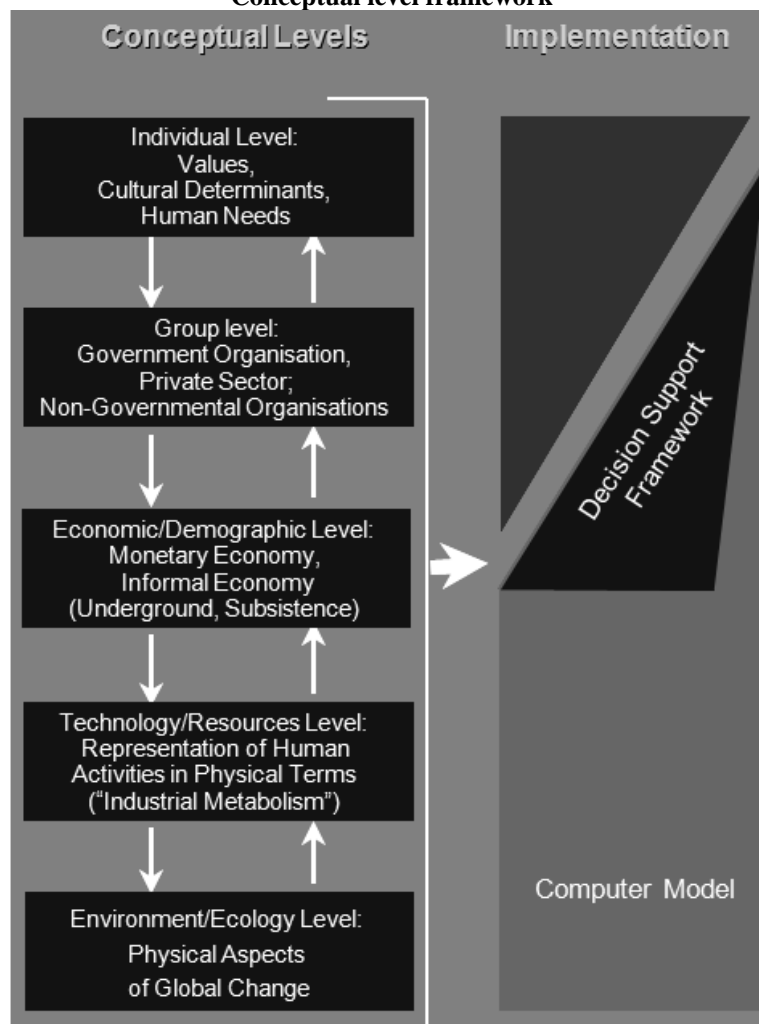
The reflexivity of the relationship of these two systems implies an element of uncertainty given that very complex interactions are involved whose consequences are felt on a global level and for long periods of time. Thus, the uncertainty constitutes a limit to the objective and full understanding of the relationships between the two systems; this makes it difficult to forecast its evolution.

The construction of support instruments for decision making should, therefore, take into consideration the social participants involved at different levels of social reality, the uncertainties, different possibilities for action, different consequences of a decision, situations of conflict or competition, etc.

The conceptual framework presented in Fig. 3 allows these questions to be situated and considered within the framework of the working of complex systems. The higher level shows the individual perspective, in other words the needs, values, socio-cultural conditioning factors of the participants involved in the change in land use such as farmers and their actions at farm level. The next level shows the way in which the participants who intervene directly and indirectly in land use (farmers, farming specialists, official services) are organised. The socio-economic framework expressed by demography and by the different methods of economic organisation is dealt with in the next analysis. For example, at this level, the implications of the population exodus from the regions studied can be analysed in terms of the implications on the decrease in labour force. The different technologies applied in land use and the resources available should also not be forgotten. Lastly, the environmental level should approach the different processes of environmental change which can be seen in the natural system, and which have implications in terms of land use, within a framework of global changes whose factors are of a natural and anthropic nature.

Because farmers are the main users of the land (in fact they make the decision as to how to use the land) it is assumed that their reactions will largely determine the impact of agricultural policies in terms of constraints and opportunities for development. Thus, this conceptual approach should take into consideration the external driving forces, in other words, the general framework of measures which direct and rule society's intervention in nature. An example of these kinds of forces is, in the European case, the European Union's Common Agricultural Policy. In this case, it is not possible to forget the restrictive measures on production (which in some regions can lead to extensification or even the abandonment of the land for agricultural purposes) and environmental conservation which were established due to the existence of very intensive agricultural practices (which had far-reaching consequences in deterioration of the environment) implemented in the countries of Central and Northern Europe over the last decades.

Figure 3.
Conceptual level framework



Adapted from: Mesarovic; McGinnis; West, 1996

Thus, the change in land use results from the implementation of political measures which aim to reduce environmental damage and agricultural excesses. In the meantime, these guidelines often contradict the farmers' interests because they entail a drop in income. Therefore, the success of this type of intervention is dependent on the implementation measures complementary to agricultural incomes.

Methodology

The methodology presented below was developed and implemented within the scope of the study *Monitoring and Managing Changes in Rural Marginal Areas: a comparative research*.

The research was based on the study of the head farmers' activity, in other words, is activity as an agricultural farmer and agent for change in the rural landscape. Thus, on one hand, it is important to analyse what their options are with regard to the kind of product and production quantity and, on the other hand, to understand the farming trends which may be diversification, maintenance, extensification or intensification.

The aim was to understand the changes in land use through the analysis of the impact of the human and biophysical dynamics. The articulation between the human and biophysical factors which is at the root of land use contributes to the understanding of the complexity of the regional dynamics through the comparative analysis of local case studies.

In fact, the analysis of the processes of change in the rural areas and their articulation with external driving forces, such as the Common Agricultural Policy, stressed that in face of different contexts the same cause provokes different effects (Jorge 1997; Lourenço *et al* 1997). The study carried out allowed us to identify and highlight four fundamental dimensions which define a systemic articulation that structures the processes of change in rural areas: the change in farms' structure and land availability; the change in soil use; the process of innovation and modernisation; and the regional and local dynamics.

The first step of this study led to the identification of Territorial Units where a characterisation of the farmers and of the natural framework in which they are involved was carried out. Thus, a detailed survey was effected on current land use, by land use plot, of the farms studied as well as on the landscape's elements which give most structure to the farming activities (hedges, fencing, lines of trees, etc.). The analysis of the farmers' strategies resulted in the carrying out of a detailed survey which allowed for the development of their socio-economic characterisation and for the assessment of the main changes they introduced in land use on their farms.

The presence of different biophysical and socio-economic contexts, head farmers with different socio-cultural characteristics and diverse land uses results in very different situations which, in order to be duly analysed, had to be grouped into a typology of farms and head farmers.

In this study it was more relevant to be able to characterise the farmers and the conditioning factors in their choice of soil use and the environmental pressure on the agricultural land. It was necessary, therefore, to create a typology which was dynamic, useful for forecasting and directed at choice in terms of soil use and the environment.

On account of this, it needed to incorporate some conditioning factors (namely non-economic factors such as the age of the farmer, his heirs, etc.) related to decision making, restrictions and specific objectives.

The typology proposed combines a characterisation of the farms linked to structural aspects of production (type of production, kind of techniques employed, buildings) and a characterisation of the farmer's dynamism (investments, changes in production of animal or vegetal kind, search for land).

Finally, the typologies were formulated step by step, articulating quantitative and qualitative information, aiming to function as a comprehensive analysis tool for the dynamics of agriculture and the farmers' behaviour. Thus, the aim was obviously not to generalise the typologies but to consolidate an approach for the formulation of typologies considered as auxiliary instruments to the understanding of the dynamics of change.

The process of constructing the typology implied the use of the Factorial Analysis of Correspondences and made for the initial identification of a typology of production systems. The Factorial Analysis of Correspondences is the technique which can best ensure the simultaneous analysis of all the variables, given that their inter-relationship and weight are dependent on the group. The concept of farming system is understood as an operational concept, in other words, it is an idea which allows for the description of the group of products of a plant or animal kind which are present on the farm and contribute, directly or indirectly, to the creation of income.

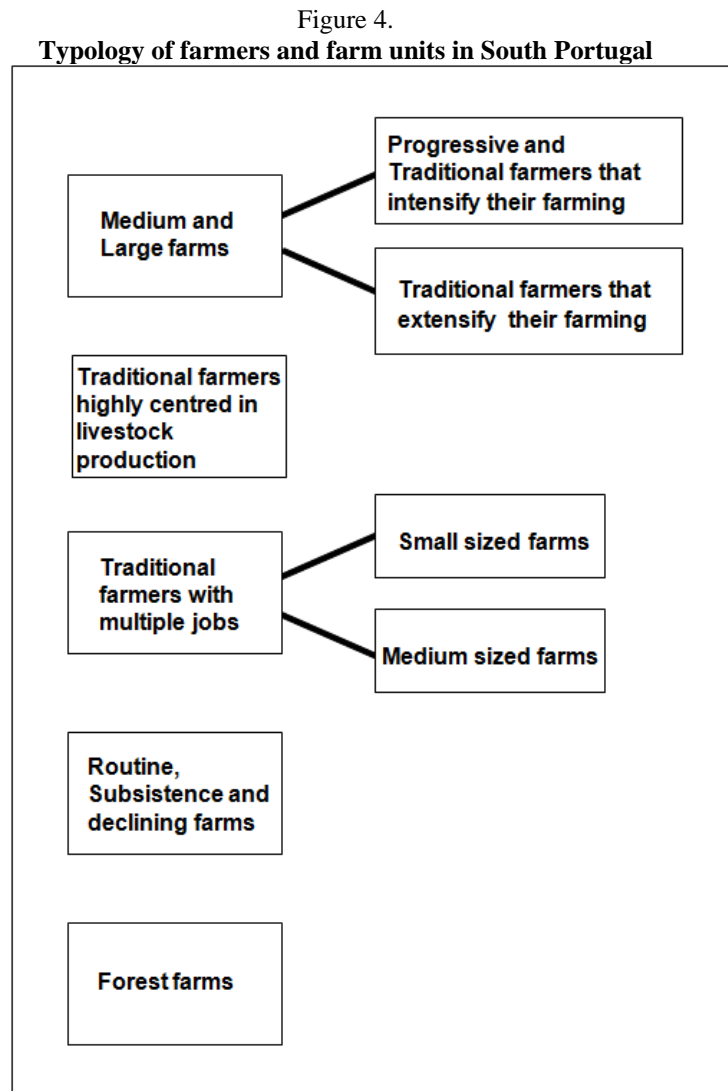
The second step of the statistical treatment consisted of another Factorial Analysis of Correspondences which gave rise to the farms' and head farmers' typology. These kinds of tools permit an analysis of the categories most associated with change and most associated with the different farming systems and which are, simultaneously most important for the farming systems and trends for change.

The aim of this comprehensive typology of change was to make a synthesis which answers the initial question: how do the individual characteristics and the farms' characteristics condition the head farmers' different practices in terms of inverting or reinforcing the trends of the process of change in rural areas.

Although the changes in land use were considered in the Factorial Analysis, the resulting typology is not a typology of changes in land use. In truth, the great diversity of land uses present in each farm doesn't allow for a characterisation according to a differentiated type of land use. However, it is possible to define the main trends of change: intensification, extensification, diversification or abandonment of land use. These are the main trends which were identified through the dynamics expressed in the typology presented.

The importance attributed to the study of the dynamics of the farm lies in the fact that it is there that the interaction of the socio-economic and biophysical aspects is most intense, allowing for the analysis and understanding of the change trends in land use.

For example, Fig. 4 shows the typology of the farms and head farmers obtained for the regions studied in the South of Portugal. On account of the great diversity of biophysical and socio-economic contexts, the aim was not to obtain a common typology for all the regions studied in the three countries. However, the construction of the typologies in the three countries followed the same methodology which aimed, in essence, to obtain instruments adapted to the each situation studied in order to construct support instruments for the decision making process. Thus, the resulting groups show the conjugation of the socio-economic factors, practices and attitudes of the farmers with regard to intervention in the land.



Source: Lourenço *et al*, 1997

As previously mentioned, this methodology was developed for the study of the dynamics of the farms in regions of Portugal, Belgium and Denmark, countries with different biophysical, social, economic and legal contexts, with farmers who are different in terms of type, level of development and integration in the market (Lourenço *et al* 1997; Pinto Correia 1993). Typologies of the farms and head farmers in the regions studied were realised in these three countries.

Given the need to characterise and group head farmers, it was necessary to carry out detailed surveys of the farmers as the only way of obtaining the necessary information.

This need for information obtained at a local level is one of the main points of this methodology since it is this information, articulated with that obtained at a regional level from official statistics, which shall allow for its generalisation to wider areas thus making it possible to formulate change scenarios which are an important support instrument for the decision making process.

The incorporation of this typology of the farms and of the information related to the current land use passed through a Geographical Information System allows for the identification of the main trends of change in land use and of landscape patterns. Given the characteristics of these kinds of data processing tools, which allow for the rapid and frequent update of the data, it is possible to keep the change scenarios updated.

Application of the Methodology to the Regional Analysis

The application of this methodology to the monitoring and managing of changes in rural areas has made it possible to understand the main dynamics and processes of the farmers' intervention on the land at local level. This type of analysis is very difficult to extrapolate to more extensive areas, given that the scale used does not make it possible to include the regional dynamic which would explain tendencies for change in larger areas.

It's possible, nevertheless, to apply this methodology on a regional scale. To do this, it is necessary to adapt the approach of this type of study in some ways.

One of the project's contributions was precisely to formulate a methodology which is capable of articulating demographic, economic and social information with information of a physical nature (soils and soil use). These two groups of data were introduced into the Geographic Information System making for a spatial reading of the information. The GIS software made other analysis possible, for example the sensitivity factors of the land to abandonment, but above all the GIS allowed very different information to be inter-associated as well the quick adaptation of the analysis to the questions which were raised during the course of the research.

Although it is important that the reach of the information contained is restricted to the areas studied, this data base is set up as an instrument for supporting decision making, monitoring and management of the area and its dynamics. The constant update of these data bases and its expansion to other areas shall permit the construction of precious support instruments for decision making and the definition of regional policies.

Obviously, the generalisation of the data bases to large regions with the detail used in this study shall give rise to financial and operational problems. However, it is thought that it is possible to conceive the construction of data bases with different levels of detail, inter-articulated, based on GIS supports, serving the same objectives as those incorporated in this study at a local level. In the last instance it is a question of making the analysis of the dynamics at the level of the involvement of the local social participants compatible with the dynamics at a regional level. This procedure would require the characterisation of the region based on indicators of a secondary nature (censuses, annual statistics, instruments for remote sensing) with the realisation of case studies which are representative of the regional situation, making the study of the dynamics of social changes and their effects on soil use viable.

At regional level the analysis should, therefore, be based on information obtained with instruments for remote detection (satellite pictures and aerial photographs) which permit the collection of information on land use in this region in relatively extensive areas. These instruments also make it possible to obtain data for different periods and to carry out an evaluative analysis of the main changes in land use. On this level, official statistics can also be analysed to collect socio-economic information which is fundamental for describing the region's general framework. These two types of information are complementary and fundamental for the identification of the main problems which affect the region studied.

It is necessary, nevertheless, to study the main agents of the rural world, or rather, the main participants in the land's use at local level. It should be emphasised, however, that, due to the growth of other economic activities in rural areas (such as tourism, services, industries, etc.), in the European context the traditional participants, i.e. the farmers, are dwindling rapidly in number, their importance being made secondary by the intervention of other agents (new residents, farming experts, local planners, local associations, etc.). This level is, therefore, fundamental for understanding the motivation of these agents when they use the land. A group of farmers should be chosen which represents the questions identified at regional level and which makes it possible to understand them. A typology will be constructed based on this group of farmers, following the methodology referred to above, which will make it possible to understand the main factors for changes in land use.

The articulation of these two levels of analysis will be used for constructing support instruments for decision-making processes, which are mainly based on the construction of scenarios of change which will indicate the main tendencies for changes in land use.

In this way, the study is carried out on two levels of analysis. On a regional scale, it is possible to describe the region, and use official statistics and remote detection to identify the main problems to be dealt with and the main changes in land use. At local level, a study is made of the farmers, and of the factors for change identified at regional level.

In addition to permitting the construction of instruments for monitoring, managing and the support of decision-making, this type of approach makes it possible to work with larger areas, drawing out information from the analysis which is more detailed, but is more specific and localised, possibly facilitating its extrapolation to regions where less information is available.

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