

Land Use and Land Cover Change  
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## A note from the LUCC Vice-Chair

by Coleen Vogel  
 Vice-Chair LUCC, University of Witwatersrand,  
 Johannesburg, South Africa

The focus themes of LUCC are now well known to the broader scientific community and are briefly outlined here:

- Focus 1: Land-use dynamics - comparative case study analysis.
- Focus 2: Land-cover dynamics - direct observation and diagnostic models.
- Focus 3: Regional and Global Models - a framework for integrative assessments.

Since my inclusion on the Scientific Steering Committee of the Land-Use and Land-Cover Change Project of IGBP and IHDP, I have been committed to raising the profile of environmental and social science issues associated with land-use and land-cover change. While this activity is not the sole responsibility of LUCC (others, for example, GCTE are involved in similar activities), it is all too easy for the so called 'soft science' issues to become submerged in the larger issues of global change science. The recent GCTE-LUCC open science meeting in Barcelona has, however, proved that social science issues, among a range of others, are critical areas that we in the global change community should be engaging in: "Without the co-operation of social scientists there will be no success in implementing knowledge from the natural sciences. Barcelona was an important step in this direction" (Beierkuhnlein, IGBP Information Brief 31, Potsdam, June 1998).

Research into understanding some of the drivers of global change, both present and past, are essential to understanding the complex nuances of global change science. Issues such as urbanization, migration, food security, land tenure, human health need to be carefully integrated with those studies concerned with land-use change, soil fertility, biodiversity, etc. Similarly, a host of other processes driving land-use change, which are framed by broader policy and institutional arrangements that create the spaces in which land-use changes occur, need to be unpacked, carefully investigated and addressed.

Some of these issues can be identified through carefully selected comparative case studies. Compa-

rative case study research, as suggested in Focus 1, serves as a useful point of reference for research activities that include both social and physical scientists e.g. Miombo. Such studies also help to broaden the debate on issues that may be contested between social and physical scientists, allow for enhancement and improvement of methodological issues, data compilation and for improved targeting of appropriate end-users.

There are, however, a number of other areas that could be more usefully tapped for land-use and land-cover change research and so enable partnerships to be crafted between social and physical scientists. One of these areas, that could be more fruitfully explored, is that of land-use change over time (interaction between PAGES and LUCC as well as others). Several historical sources and repositories of evidence of change exist over time including archived information, diaries, journals, etc. These can be supplemented by oral histories and other forms of participatory research methods which can reveal a number of insights into past land-use and some of the causes thereof. Such sources of information cannot be used in an unobjective manner and would require various forms of corroboration (e.g. palynology, lacustrine data analysis, dendrochronology, etc.).

Despite some of the obvious limitations of such research, a rich picture of land use cover and change can be obtained using such data sources. Using such techniques, researchers from the Institute of Development Studies at the University of Sussex, for example, have managed to provide interesting explanations of land-use changes and their possible drivers in several parts of Africa e.g. West Africa and Southern Africa.

One of the problems of conducting such research is to, however, ensure that the areas being studied do not remain isolated, disparate pieces of research but that they are integrated into a comprehensive body of data so that they can ultimately be integrated into wider research initiatives e.g. transects. Such information can then be used to begin to answer some of the broader global change questions pertaining to regions.

Those of us engaged in global change research should ensure that we encourage, assist and stimulate research in various regions. We should be

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# Monitoring and managing changes in rural marginal areas. A comparative analysis

by N. Lourenço<sup>1</sup>

Project co-ordinator, Universidade Nova de Lisboa, Portugal

In the study, *Monitoring and Managing Changes in Rural Marginal Areas*<sup>2</sup>, a comparative analysis of the processes of change in the rural marginal areas was made. The regions analysed were from northern and western Europe (Jutland in Denmark and Wallonia in Belgium) and from the Mediterranean region (Alentejo and Serra Algarvia in Portugal). The research was based on the present but has maintained an evolutionary perspective by comparisons with previous situations, chiefly in the sixties and seventies. Therefore, the aim has been to provide a global picture of agricultural activity in the last few decades in order to understand the dynamics of change in the areas studied.

The main objectives of this research were:

- To understand the socio-economic dynamic of the rural areas and particularly the attitudes of the farmers to common policies and the market.
- To understand the relationship between this dynamic and land use/landscape changes.
- To design methodological tools to analyse and anticipate evolution at the regional level. The research aims to build support instruments for decision-making to create conditions for economically sustainable agriculture within the framework of an integrated rural development.

The research was based in the analysis of the changes in land use, which result from the farmers' intervention in the countryside in the regions studied. In the rural areas, the farm managers are the main agents for change in landscape patterns, since they determine the ways the land is occupied for agriculture and forestry. Decisions to intensify or extensify production, to forest or to cultivate, to the options in livestock production or to abandon the land, determine different productive systems which, on the one hand, affect the region's landscape and environment and, on the other hand, have social implications for the population. The aim of this study was to know and understand these decisions and the factors that influence them, taking into account the historical context of the agricultural activity and the political changes of the last few years.

This research "strategy" made possible, for the three teams, to work with a common methodology, satisfying the analytic demands resulting from different socio-economic contexts and introducing a global and comparative analysis in terms of the discussion of the subject.

More than identifying the ways the land is occupied, the features of the landscape and the natural conditions of the regions, the study sought to carry out a comprehensive analysis of the characteristics of farmers as the main agents for agricultural change in these areas.

This analysis is fundamental for understanding the present situation and the factors that cause the processes of land use change in these regions. Nevertheless, the fact that they are regions with different characteristics has caused some problems for comparative analysis.

These differences are due to biophysical, economic, social and even cultural causes. In addition to these characteristics, is the fact that Portugal's accession to the European Union took place long after the other countries, as did the modernisation process of its agriculture which, coming late, forced Portugal to confront more productive and competitive agricultures.

The processes of change in Danish, and even Belgian, agriculture have to deal with the existence of very intensive production systems, which cause the serious deterioration of the

environment and the landscape. While in Portugal the great issues concerning its agriculture lies in its lack of competitiveness and sometimes viability and the less awareness of environmental problems although the production systems are comparatively less aggressive for the environment.

In the last few decades, Europe has attempted to construct a community organisation in a broad sense. The Common Agricultural Policy (CAP) set up the first set of structuring measures for the European Communities within this context of transformation, making it possible to learn how to construct common policies, which are fundamental for the relationship between different countries in the heart of a united Europe.

During this period, the rural landscape of the different countries in the European Union has been substantially transformed as have the agents who have carried out these transformations. In northern and western Europe these transformations are a reflection of processes of agricultural modernisation, intensification and specialisation which have led to a less heterogeneous and biodiverse landscape. On the contrary, in the Mediterranean regions, natural conditions unfavourable to the intensification of agriculture, when considered within the parameters of northern Europe, have contributed to maintaining the systems for traditional land use, which are the basis for very heterogeneous types of land and landscape occupation. Nevertheless, the integration of these countries and regions in the European Union has led to the acceleration of changes, which are a necessary condition for guaranteeing adaptation to the open market. Therefore, land use has been intensified in the more fertile areas, while in the remaining areas agricultural activity has been extended or even abandoned.

The regions of the north and south of the European Union are subject to the application of a Common Agricultural Policy, or rather, to generally restrictive measures for production, which promote the protection of the environment. These measures are a reaction to over-production in northern Europe and to the negative effects of agricultural intensification on natural resources. However, their application also includes regions whose agriculture has lower production and productivity levels, which is less intensive, less polluting and less competitive, as is the case with most Portuguese agriculture. In this way, the application of CAP is not always an efficient instrument for levelling out the inequalities between the different regions.

The problems of the rural areas, where agriculture is a fundamental component of the physical and social space, are increasingly assessed from the perspective of territorial planning and environmental or ecological balance. This is why agriculture is a relevant area of study, as it is still one of the main economic activities of the rural space, and therefore responsible for occupying it, changing it, and making it economically viable.

## Methodology

An interdisciplinary methodology was used in the study, which aimed to articulate a geographic and spatial analysis with a sociological one.

The research methodology followed for the socio-economic areas took into consideration the definition of a strategy and formulates the instruments which might permit the understanding of farmers' behaviour concerning the changes resulting from the introduction of EU policies.

In order to attain this objective, the operational implementation of the research went through four stages:

- understanding the regional, institutional context into which policies were introduced,

## Footnotes:

1. With M. Mormont, E. M. Sorensen, T. P. Correia, M. R. Jorge and C. R. Machado.

2. This study has been carried out within the framework of a research contract financed by the Directorate-General for Agriculture of the European Commission (DG VI FII:3).

- a global quantitative analysis of the characteristics of the marginalisation process in relation to the regions, farms and their respective head farmers,
- a comprehensive and detailed analysis of the head farmers' behaviour, and
- the integration of the quantitative and qualitative dimensions of the situations.

The integration of the socio-economic and geographic components was attempted by resorting to the use of the Geographic Information System.

### The concept of marginalisation and different scales of analysis

The concept of marginality is commonly applied to certain rural areas which are characterised by less positive indicators in terms of development (Internal Gross Product, employment, revenue, etc.). This concept is, therefore, equivalent to that of a peripheral or deprived region. However, the concept of a deprived region has a more precise meaning within the context of agricultural policy. In effect, it is considered, by the European Union classification, that certain regions (for example mountains) offer less favourable natural conditions for production because of the soils, climate or topography.

In a more dynamic perspective, our concern is not the concept but the process of marginalisation. The processes of the socio-economic decline of certain regions whose production conditions are less favourable, correspond to the concept of deprived regions. The extensification of agricultural production tends to concentrate production in more favourable areas, which produce in great quantity at better prices to the detriment of more traditional production methods that are often found in marginal regions.

The concept of marginalisation has in fact a specific meaning according to the *scale* to which it is applied. Apart from the scale, it is also important to define the *context* in relation to what kind of marginalisation is under consideration.

The first dimension is spatial, and related to different scales where changes can come about and be observed:

- political and economic changes on a European level (agricultural policy and measures),
- demographic or economic changes in the regions,
- the level of the "village territory" is that of the (geographical and sociological) entities where farmers barter amongst themselves (services, land, etc.), and
- farm level where the farmer's decision making and the farming system are present.

The second dimension is related to the different functions which may be attributed to the land (agricultural production, forestry, or functions related to ecology, landscape or other uses). In certain cases, these different functions can be brought about by economic changes. Thus, an agricultural plot (used within a production system) can also have a certain number of functions related to ecology or landscape. However, the landscape function ensured, for example, by the upkeep of hedgerows, is not necessarily relevant only at the level of the isolated plot. It is a group of plots, which constitute a landscape unit, and the management of this landscape that must be considered on a different scale to that of the village territory or municipality.

This scheme of analysis allows for the identification of the problematic character of this concept. The marginalisation of farmland may be considered to be a process which occurs when land use changes towards less intensive agricultural use but which may be replaced by a more intensive use of another type.

### Processes of change in rural areas. Socio-economic constraints in land use dynamics

This study has allowed us to ascertain that the collapse of agriculture forecast and the consequent abandonment of rural areas is to be feared less than expected. 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 produces different effects.

The study carried out allowed us to identify and highlight the fundamental dimensions, which define a systematic articulation that structures the processes of change in rural areas:

#### 1. The changes in farms' structure and land availability

The structure of the farms is relatively stable in Portugal, which is apparently explicable by the lack of flexibility in the real estate market. Several factors contribute to this situation amongst which the low tax rate on land, the hope that it will gain in value for other ends and its symbolic value in account of the fact that the ownership of land is seen as a safe investment to hand on to heirs.

In the regions studied in Alentejo, the CAP measures also seem to have some influence on the upkeep of the structure of property. For example, the subsidies granted per hectare contribute towards owners of large farms not selling or leasing the land and, on the contrary, they even seek to increase the area of the farm. In the future, this situation may contribute to the accentuated concentration of land in large farms, those that offer the greatest opportunity for investment.

In the regions studied in Belgium, policies aiming at the extensification of agricultural production, namely animal farming, would hardly be successful if the land was not relatively available to farmers at a reasonable price. If the price of land (leased or owned) is too high, it dissuades extensification: the farmer will aim to adjust the income he gets from the land he farms to the price of this factor. We have shown that in the Belgian case, alongside the usual competition between farmers, some other elements reinforce the price of land: the pressure of other activities on agricultural space; the fiscal pressure that also aggravates this production factor; the measures themselves aiming at extensification increase the demand for land.

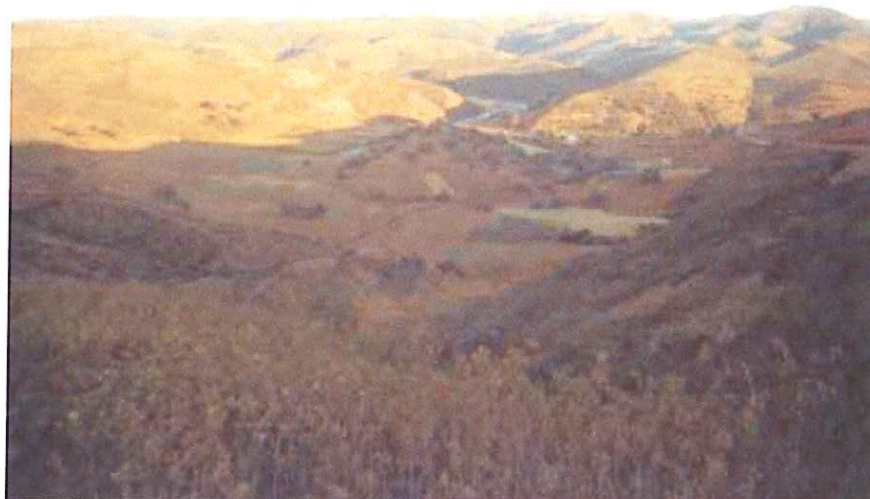
In Denmark, the great issue in regions analysed is the fast development of the structure of large properties. The larger farmers buy or lease more land and are interested in all the land they can acquire. Meanwhile the medium size farms are disappearing and the small farms are bought by part time head farmers or by non-farmers who keep a small stretch of land and lease or sell the rest to the large farmers. Although the price of land is high, supply and demand are balanced.

This situation is certainly partly upheld by the Law on Agricultural Bases which establishes that all agricultural land in Denmark must be used for agricultural purposes. In other words, land cannot be owned without being farmed or without leasing to someone who will farm it. Another factor which results in the great dynamism of the real estate market is the fiscal system applied to land which is reflected in high taxes on agricultural land which can only be borne if that land is profitable. In establishing the system of subsidies per hectare, CAP increased the value of the land with poorer soils in West Jutland, provoking an increase in demand for land.

#### 2. The changes in land use

In the regions studied in Portugal, the abandonment of land is only evident in the region of Alcoutim, in the Serra Algarvia, an inland and clearly peripheric area (plate 1). This abandonment has been progressing since the sixties related to the emigration of young adults. However, in the other regions there are some plots with dense scrub (without *montado*) which, on account of being far away from the centre of the farm and, given the characteristics of the topography and soils, are not worth farming in the present conditions. The plots where the only production is the cork from the cork oak *montado* system are often covered with dense shrub. Nonetheless, they are not abandoned but rather used very extensively, either because they are used for forestry or because this shrub cover is essential to the good development and regeneration of the trees.

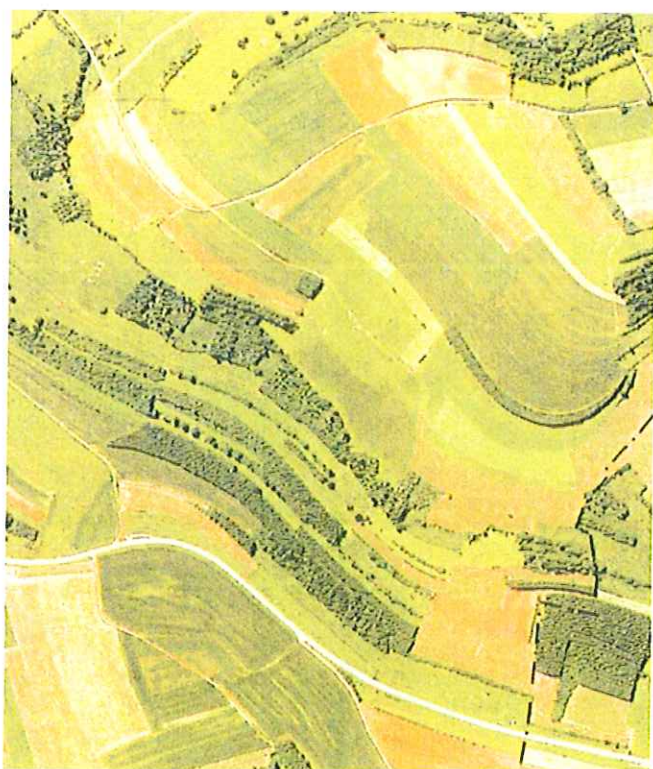
Over the last years in Alentejo, the processes of change in land use have been characterised by extensification. This is increasing an extensive use of available land, which corresponds to the increase in the area of natural pastures, conservation of the



**Plate 1.** Land use in the municipality of Alcoutim (south Portugal). This area is almost the only one (in this study) where the land abandonment is very clear. The natural conditions (steep slopes, poor soils and frequent droughts) are very restrictive for the agriculture. Only the plots, which are very small, located on the bottom of the valleys, and near the small villages where the scarce population is very old, are still cultivated. In the slopes the land was abandoned or planted with pine trees and cork and holm oaks.

*montado*, and use with little expenditure of areas which previously were given over to cereal growing. More than a global process, it occasionally results in the increase of production costs through more productive activities such as pig farming, vines, vegetable gardening and the purchase of animals without acquiring land.

In the regions studied in Belgium we can identify three main processes of change in land use: the continuation of the process of intensification of farms which use more intensive methods, the upkeep of small and medium sized less intensive and more traditional farms, and the quite limited abandonment of agricultural use of land. The land that is not very productive is abandoned and becomes more interesting for ecological purposes or in other cases, there is a more regular abandonment for reforestation (plate 2).



**Plate 2.** Land use near the village of Rochecourt (southern Luxembourg, Belgium). The picture shows the small sized plots mostly with permanent pastures. The process of afforestation, which has increased in the recent years, is clear. (Bel4).

In the areas analysed in Denmark, for the period under study, there have been no significant changes in land use or in the structure of the landscape. Only limited forestation can be verified on some small plots adjacent to those where forest already exists. This situation leads to an increasing concentration of the forest areas. Similarly to all the Danish agricultural areas, the land is very intensively used. What has already happened for some years in these areas is the accentuated specialisation in animal farming for meat or milk. This specialisation has been kept up based on a structure of relatively stable land use.

### 3. The regional and local dynamics

Agricultural activity cannot be analysed outside the context of regional and local dynamics and, at this level, there are very different situations to be found in the regions studied.

It is foreseeable that the future of Portuguese agriculture shall take place through the reduction in the number of farmers/farms and paid farm workers, approaching, in fact, in a related movement, the rest of the countries of the European Union. This movement was based on modernisation and on the increase in agricultural production that made it into a competitive sector with the capacity to employ full time labour with salaries equivalent to those in other economic activities. In Portugal, and specifically in the regions studied, the reduction in agricultural employment or the supplies of temporary work are not stable and therefore little sought after by the active population, is contributing to the population exodus. This exodus is also reinforced by the lack of work in other economic activities. However, it should be noted that the real possibilities for promoting work outside agriculture are few on account of structural conditioning factors such as the age, the low education, and professional training level of the labour force in these regions. This situation is aggravated by the peripheral location or remoteness of these regions in relation to the industrial and more economically dynamic centres located in coastal areas of the country.

In the areas studied in Belgium, local dynamics play a primordial role in development. The agriculture-environment relationship is very different according to the local areas. In some cases, the ecological and landscape quality presumes the upkeep of not very intensive farms throughout the whole territory. In other cases, farm plots could be extensified even if the farm remains intensive. Yet, in others, there are areas which need to be protected and that implies land exchanges and new techniques.

The local dynamism of the agricultural environment is also very different. Where it has a strong presence, there is great pressure on the land and the threat of intensification. Where it has a weak presence, there are, on the other hand, the threats of reforestation or deterioration. Competition for land is obviously

strong where there is more dynamism but the real estate legislation has created aggressive competition almost everywhere and that happens as much with intensification as with reforestation.

In Denmark, the rapid development in the structure of the farms, observed in the study areas, correspond to specific dynamics at a local level. The game of supply and demand of agricultural land is defined within the large farmers' group, between the latter and the medium and small owners who are potential traders and also between these last groups and those who buy farms but who sell or lease land. The latter are the so-called new occupants of rural land, inhabitants who want to live in the country but have no interest in the land or who want just a little land. In truth, this new kind of inhabitant plays an important role because due to their presence it was possible to join farms together without leaving empty houses and without which the agricultural area would tend to become deserted. Thus, a certain socio-economic dynamism is maintained in these areas either through intensive and economically profitable farming or through a stable and dynamic population with economic power.

#### Tools for monitoring and managing rural areas

The formulation of monitoring and management instruments for the analysis of change presents some complications mainly because of the diversity of situations, absence or lack of available information as well as the scale of the analysis used.

Understanding the main trends of change is only possible when the spatial context is placed on a regional scale. However, on this spatial scale the main references for the analysis of the farmer/farm interactions, which allow for the understanding of the decision making processes and are reflected in the land use changes, are lost. The use of the GIS constitutes an essential tool for the formulation of this kind of instruments and for their constant updating. Consequently, there is an urgent need to promote the production of digitalised data supports and to facilitate the availability of information in a digital format, which may allow for the rapid formulation of these instruments.

One of the project's contributions was precisely to formulate a methodology which was capable of articulating demographic, economic and social information with information of a physical nature (soils and land use). These two groups of data were introduced into the GIS making for a spatial reading of the information. 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 databases, at intervals to be defined in the future, 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 databases 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, remote sensing) and 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 land use viable.

The data from the surveys and the spatial data make for the composition of a photograph of land use, relevant aspects from the ecological and landscape point of view and the sociological and structural situation of the farms at a given moment in time. Two kinds of tools, which this study tried to develop, are highlighted:

#### a) *A typology of the farms directed at the decision processes in terms of land use*

In this study, it was more relevant to be able to characterise

the farmers and the conditioning factors in their choice of land use and the environmental pressure on the agricultural land. It was necessary to create a typology that was dynamic, useful for forecasting and directed at choice in terms of land use and the environment.

Because 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 and vegetal kind, search for land). Another classification was attempted on a sample of farmers, based mostly on their objectives and strategies and, more precisely, concerning land attribution.

This typology is provisory and experimental: they should be fine-tuned and validated. In the meantime, they allowed certain connections between the farmer type and land use to be identified. Some methodological questions could be asked:

- Is it more interesting to use a typology formulated "by hand" based on the creation of a relatively intuitive hierarchy of discriminatory characteristics? Or would it be better to use a typology created in a methodical fashion by data processing means which is less subjective but more difficult to interpret?
- Are typologies of this kind able to be generalised (in other words, is it possible to have the same typology for Denmark, Belgium and Portugal)? Is it possible to develop the same typology for the farmers, e.g.: young farmers, those close to retirement, bold or cautious, "technocrats" or "ecological"? In addition, how is it possible to compare the agriculture of a large farm employing temporary staff with the agriculture of a family run farm? Whatever the case, the translation in terms of the land about choice of production and environment is specific to each region.

These 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.

#### b) *Tools for the spatial analysis of the rural areas*

These tools were used in the cartographic study of land use more than in the analysis of the environmental and landscape quality of the territories.

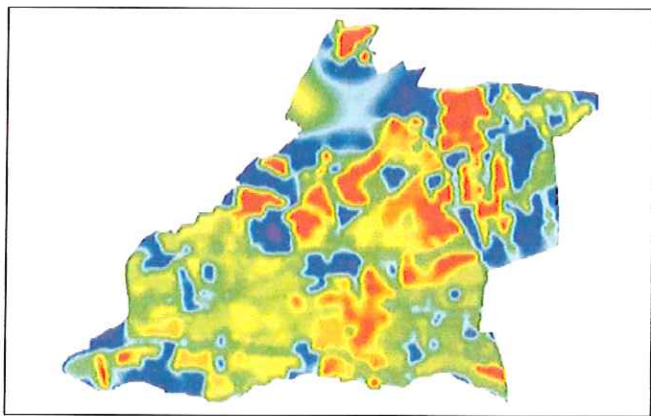
Land use was analysed in a relatively static way although the translation of the previous situation into numbers made the representation and calculation of the developments possible within the pastures/crops and forest/agriculture relationships. A more detailed analysis of these past developments is not possible due to lack of data. On the other hand, it would be interesting to assess the situation of the territories studied in a few years time.

Above all the GIS allowed for the quick adaptation of the analysis to the questions that were raised during the course of the research. Apart from this, it allowed very different information to be inter-associated. In Denmark, through a GRID analysis, an attempt was made to combine various factors in order to identify the variation of pressure on the land and, thus, an opening was made for more varied socio-economic analyses of the land (figure 1).

#### c) *The combination of these two kinds of tools*

The farm typology based on the surveys was re-introduced into the alphanumeric database as well as the relevant indicators relating to the farmer. Thus, it was possible to associate each plot with the characteristics of the farm to which it belonged. The distribution maps of the types in the area allowed:

- To establish the "village effects". Certain villages seemed to be clearly more dynamic because the surrounding plots are mostly



**Figure 1.** Combined pressure on the land in the parish of Horstrup (Denmark). This map is an attempt to construct a tool that results from the aggregation of five socio-ecological dimensions: work input; investment; land use; livestock and the farmers' perspective about their future. The areas in red are those that show the highest pressure on the land. On the contrary the areas in blue are those where the pressure on the land is the lowest.

farmed by this or that type of farmer. The pressure of the real estate market is most likely to be strong; other villages have many old farmers that involve great risks of agricultural decline in the future. However, there are other regions where the dynamism of the urban centres does not occur as a result of agricultural activities. This is the case on the Coast of the Alentejo in Portugal where the dynamism of the settlements is generated by industrial growth. This fact shows the incapacity of agriculture to generate dynamism in these areas and highlights the complexity of the marginalisation processes of the regions and of agriculture.

- To compare, in the regions studied in Belgium and Denmark, the distribution of these types with the pressure on the environment. Maps of distribution types could be compared to documents (maps, surveys, and aerial photographs) presenting the most interesting areas in terms of ecology and landscape: hedgerow networks, woodland, the bottoms of damp valleys.

Other analytical possibilities were established such as the particular susceptibility of certain plots to decline (distant, closed in plots, located outside the leased land, in the hands of an old farmer without heirs).

#### The regional analysis approach: a tool for the monitoring and managing of rural areas

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 dynamics which would explain tendencies for change in larger areas.

It would appear to be 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.

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 evolutionary analysis of the main changes in land use. On this level, official statistics can also be analysed to collect socio-economic information that 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, in the European

context, due to the growth of other economic activities in rural areas (such as tourism, services, industries, etc.), these main participants are dwindling rapidly in number. Their importance is being made secondary by the intervention of other agents (new residents, farming experts, 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 who will represent 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 permit the construction of instruments for monitoring, managing and for the support of decision-making, this type of approach makes possible to work with larger areas. It also permits drawing out information from the more detailed analysis, although more specific and localised, facilitating, possibly, its extrapolation to regions where less information is available.

The monitoring and managing of rural areas should be sustained by the realisation of scenarios that make for the understanding of change trends for the future. This knowledge is essential for the support of decision making processes, in other words, the decision makers could depend on an analysis of the bio-physical and socio-economic situation whose development can be modelled according to the different possibilities for intervention.

The possibility of effecting development scenarios is affected by the limitation in formulating homogenous temporal and sufficiently long series. But two types of scenarios were built in this study: the situation scenario and the trend scenario. The first makes it possible to define images, in terms of configurations, of the future of the regions and of the head farmers, who live in them, the second suggests the possible, or even probable, future paths for marginal areas.

The information available in the three countries presents different degrees of detail and accessibility in terms of ease of consultation and data processing treatment such as has been mentioned before. Thus, and mainly in Portugal and Belgium, investment should be made in the gathering, treatment and availability of information with a high degree of detail.

As mentioned before, the decision making process, even if it is based on global guidelines, should consider the specific characteristics of the different regions. Thus, the formulation of data bases, which should be cornerstones of decisions, on the one hand, should impose respect for harmonisation standards in relation to the kind of information gathered and access supports. On the other hand, they should oblige the characteristics of the different regions to be taken into consideration.

The importance of digital supports for information lies in the possibility of incorporating geographical, socio-economic or other data in Geographical Information Systems in order to construct monitoring and management models. The construction of these models, based on a multi-disciplinary approach, should consider the different levels of intervention (individual, society or organisational, economic, social and natural/environmental global factors) in order to incorporate the complexity of the interactions of the human system with the natural system. The objective of the existence of this kind of instruments should not only be to service the technical control of the measures applied, but also to service research, facilitating its important role in supporting decision making in this way.