

Aus dem Institut für Ernährungswirtschaft und Verbrauchslehre
der Christian-Albrechts-Universität zu Kiel

Livestock Biodiversity Conservation: The Case of Sheep and Goat Breeds in European Marginal Areas

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SUMMARY

The objective of this Thesis is to enhance our understanding of the conservation dynamics of local sheep and goat breeds and their potential contribution to rural development in European marginal areas. An interdisciplinary, empirical approach is adopted, structured around the following aspects: (1) the analysis of the root causes of livestock biodiversity loss and the impact of agricultural policies, noticeably the CAP; (2) the study of the geographic location with respect to the relative marginality of a region; (3) the analysis of the influence of farm characteristics, including being located in a marginal area, on breeding decisions; and (4) the study of the social determinants of action for the conservation of local breeds.

The CAP is argued to be a major factor contributing to livestock biodiversity loss and abandonment of activities in marginal areas. The ability of recent reforms to reverse the trend is uncertain. The "second pillar" of the CAP, its rural development programme, is allocated 13% of CAP budget and policies for breed conservation are limited to about 0.1% of this.

In lieu of paying direct subsidies, other solutions may be adopted. These include marketing strategies for farm produce. Findings based on econometric analysis of farm breeding decisions highlight the importance of adopting such strategies. Other significant determinants include participation in ad-hoc education programmes, the relative importance of off-farm income, the age of the farmer.

To assess the potential of this type of husbandry in marginal areas, two indices of relative marginality are developed using GIS techniques. The indices combine socio-demographic and economic variables with a concept of marginality based on land use. A significant correlation is found between marginality defined by these indices and the geographic distribution of the breeds. By adding these indices to the econometric model, the location of the farm in a marginal area is found to adversely affect the future development of its breeding stock.

A sociological qualitative case-study provides further insights that help understanding motives and practices driving local breed conservation dynamics. Combining the findings with the results of previous parts of the Thesis highlights the need for an integrated approach to local rural development that takes into account the functioning of networks, the importance of social capital and of capacity building. It is suggested that a participative, multiple-stakeholders problem-solving approach be adopted. Issues to be tackled include the conflict over access to land and the need for the creation of new and niche marketing approaches that may enhance direct contact between breeders and consumers of produce and public goods.

ZUSAMMENFASSUNG

Ziel dieser Arbeit ist es, einen Beitrag zum Verständnis der Dynamik im Erhalt lokaler Schaf- und Ziegenrassen im Kontext der ländlichen Entwicklung auf europäischen Grenzstandorten zu leisten. Die interdisziplinär, empirisch ausgerichtete Arbeit konzentriert sich dabei auf folgende Aspekte: (1) die ursächlichen Gründe für den Verlust landwirtschaftlicher Nutzierrassen und der Einfluss der Gemeinsamen Agrarpolitik (GAP) der EU; (2) die Bestimmung der geographischen Lage im Hinblick auf die Marginalität einer Region; (3) den Einfluss der Eigenschaften landwirtschaftlicher Betriebe auf Entscheidungen bezüglich der Haltung dieser Rassen; und (4) die sozialen Determinanten im Erhalt lokaler Nutzierrassen.

Es zeigt sich, dass die GAP zum Verlust der biologischen Vielfalt bei landwirtschaftlichen Nutzierrassen und zur Aufgabe der Tierhaltung auf Grenzstandorten beigetragen hat. In Anbetracht des geringen Budgetanteils der zweiten Säule der GAP zur Förderung ländlicher Entwicklung und der Maßnahmen zum Erhalt gefährdeter Nutzierrassen ist die Tragweite jüngster Reformen zur Umkehrung dieses Trends ungewiss. Alternative Lösungsansätze anstelle direkter Subventionen bieten sich an. Diese umfassen Marketingstrategien für landwirtschaftliche Erzeugnisse, die nach den Ergebnissen der ökonometrischen Studie bezüglich der Entwicklung der Nutztierhaltung in den Zuchtbetrieben hervorzuheben sind. Andere Determinanten für die Entwicklung in den Betrieben sind die Teilnahme an Fortbildungsmaßnahmen, der Anteil des außerlandwirtschaftlichen Einkommens und das Alter des Züchters.

Das Potential traditioneller Nutzierrassen auf Grenzstandorten wurde durch Indizes zur Messung der relativen Marginalität einer Region erfasst. Diese in einem GIS entwickelten Indizes verbinden demographische und ökonomische Variablen mit einem auf Landnutzung basierenden Marginalitätskonzept. Es ergibt sich eine signifikante Korrelation zwischen den Indizes und der geographischen Verteilung lokaler Rassen. Die Analyse zeigt, dass Betriebe auf Grenzstandorten eher geneigt sind, die Haltung lokaler Rassen einzuschränken.

Eine soziologische, qualitative Fallstudie gibt weitere Einblicke in die Motive und Praktiken des Erhalts lokaler Nutzierrassen. Sie zeigt die Bedeutung eines integrierten Ansatzes lokaler, ländlicher Entwicklung, der Netzwerke, Sozialkapital und Kapazitätsbildung berücksichtigt. Problemlösungsansätze unter Beteiligung unterschiedlicher Interessensträger sollten gewählt werden, wobei mögliche Konflikte über Landnutzung und die Schaffung von neuen Marketingansätzen nicht außer Acht gelassen werden dürfen, um direkte Kontakte zwischen Züchtern und Verbrauchern öffentlicher Güter und landwirtschaftlicher Produkte zu fördern.

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LIST OF ABBREVIATIONS

AEP	Agri-environmental policies
AnGR	Animal genetic resources
CAP	Common Agricultural Policy
CEC	Commission of the European Communities
EAAP	European Association of Animal Production
EAGGF	European Agricultural Guidance and Guarantee Fund
ECC	European Economic Community
ECU	European Currency Unit
EOS	Earth Observing System
ESE	Earth Science Enterprise
EU-15	European Union of 15 Member States
FAO	Food and Agriculture Organisation of the United Nations
GATT	General Agreement on Tariffs and Trade
GIS	Geographic Information System
GLCC	Global Land Cover Characteristics
GPS	Global Positioning Systems
IPCC	Intergovernmental Panel on Climate Change
LEADER	Liaisons Entre Actions de Développement de l'Économie Rurale
LFAs	Less-Favoured Areas
LU	Livestock Units
MAS	Multi-Agent Systems
NASA	United States' National Aeronautics and Space Administration
RD	Rural Development
RDP	Rural Development Plans
SFP	Single Farm Payment
UAA	Utilised Agricultural Area
WGS84	World Geodetic System 1984
WTO	World Trade Organisation

FOREWORD: THE STRUCTURE OF THE THESIS

0.1 Focus of the research

This research focuses on the *in-situ* conservation of sheep and goat biological diversity in European marginal rural areas. This Thesis is part of a broader research, the ECONOGENE project¹ funded by the European Commission "Quality of Life" Fifth Framework Programme.

ECONOGENE is an interdisciplinary project that combines genetics, socio-economics and geostatistics to address the conservation of sheep and goat animal genetic resources (AnGR) for rural development in European marginal areas. It focuses on ten of the 25 EU Member States² and seven non-EU countries³.

The general objective of the project was to assist in the *in-situ* conservation of sheep and goat breeds by assessing the relevant socio-economic factors in a co-ordinated approach in order to define strategies of genetic management and rural development.

The focus on sheep and goat had the objective of extending knowledge of genetic diversity at the molecular level, examining unstudied local breeds. From the point of view of the socio-economic component of the project, one assumption was that sheep and goat species play a major role in most marginal areas. These species are – relatively speaking – more "marginal" than cattle, for instance.

This Thesis is a contribution to the socio-economic part of the ECONOGENE project, in which the Author has been involved since its early stages⁴. In this context, the approach of this Thesis to biodiversity conservation is based on the *in-situ* conservation of breeds. The

¹ See <http://lasig.epfl.ch/projets/econogene/> for further details.

² Austria, France, Germany, Greece, Italy, Hungary, Poland, Portugal, Spain, UK. More details on these countries are given in Chapter 2 (see Table 2.1 and Table 2.2).

³ Albania, Egypt, Jordan, Romania, Saudi Arabia, Switzerland and Turkey.

⁴ The project started officially in September 2001.

focus on breeds may be criticised because it is said that 50% to 70% of diversity is intrabreed (Hammond and Leitch, 1996). However, the perspective adopted here is linked to the role that husbandry of local, traditional sheep and goat breeds may play in rural development in European marginal areas. More precisely, the accent is put on what has been named “community-based conservation” in contrast to “station-based” management (i.e. *in-situ* conservation of biodiversity in parks or zoos).

Thus, conservation of breeds is in actual fact pursued by keeping sheep and goat local, traditional breeds on several farms. By doing so it is argued that *in practice* the diversity within the breed, that is between the separate populations kept on the different farms, is also indirectly and at least partly taken into account.

In this research, the focus is on the "rural development" and farm-based aspects rather than on the genetic ones. As such, conservation of local sheep and goat breeds coincide with the conservation of farm-based sheep and goat husbandry activities that are specifically undertaken with those breeds.

0.2 Objectives

All different parts of this Thesis have the main objective of answering the following basic research questions:

- How can we successfully preserve sheep and goat breeds while also enhancing local sustainable rural livelihoods that are (at least partly) based on this type of animal husbandry?
- What are the factors that contribute most to successful conservation, what are the obstacles?

Articulated around this main objective, several approaches are combined to meet the following corollary objectives:

- to understand the general social and political context that lead to or contribute to livestock biodiversity loss;
- to provide a definition and measurement of marginality for European rural areas;
- to investigate the potential of local sheep and goat breeds to contribute to rural development in marginal areas, also with a geographic focus;
- to analyse the link between the farm and farmers' characteristics and the decision to enhance or reduce husbandry activities based on local, traditional sheep and goat breeds;
- to capture social aspects involved in the conservation of local breeds;
- to provide as output some guidelines for practice and policy.

0.3 Methods

To meet these objectives, this research consists of several parts. All attempt to understand the complex issue of *in-situ* conservation of this type of animal genetic resources (AnGR) and their potential contribution to rural development in marginal areas.

The approach taken is rather interdisciplinary, and is detailed in the following section. The basic idea is that – taken for granted that society does wish to protect livestock biodiversity in general and in sheep and goat breeds in particular – AnGR *in-situ* conservation is a complex, multi-level issue that needs to be tackled in its different aspects adopting as varied a methodology as possible. Different factors have an influence on sheep and goat husbandry: (a) choices and preferences of society as a whole; (b) policy options, including, but not limited to, agricultural and rural development policies; (c) geographic aspects, including land use and farm location; (d) socio-demographic and economic characteristics of

farms rearing these species and particularly local, traditional breeds; and (e) social practices and attitudes, social arrangements and the motives and actions of social actors and networks.

The methodological approach is consequently at least partly cross-disciplinary. Society preferences and policy options are analysed briefly, in a descriptive way to provide the general context of the Thesis. Geographic Information Systems (GIS) tools and methods are used to study the geographic distribution of farms rearing ECONOGENE-selected local sheep and goat breeds and to link them to the "marginality" of their location.

Econometric choice models are used (1) to analyse the correlation existing between the relative degree of marginality of a region and the presence of local sheep and goat breeds in that region and (2) to model farm-level breeding decisions as a function of both farm-level socio-demographic and economic characteristics and the location of the farm in a relatively marginal region.

Finally, qualitative methods in rural sociology are used in Chapter 5 to understand motives and attitudes of farmers rearing two different local goat breeds in Southern France.

In an applied problem-solving approach, integration of methodologies mainly focuses on the integration of results into a coherent whole. Contents and methodology of each chapter as well as the final integration of their results are briefly presented in the following section.

0.4 Content and integration of the different parts of the research

Figure 0.1.1 schematically represents the structure of the Thesis. A principal research question is the starting point of the Thesis. As presented in greater details in section 0.2, the question is "How could the conservation of sheep and goat breeds be enhanced while contributing to rural development in European marginal areas? What are the root causes of livestock biodiversity loss and what factors enhance conservation success?" Four aspects are

considered as essential in understanding the issue. These are (1) policy options and society choices and preferences; (2) the impact of geographic location, including definition, and measurement, of "relative marginality"; (3) farm-level decisions that ultimately affect the actual perspectives of husbandry based on sheep and/or goat breeds in a given area; and (4) socially-grounded and constructed attitudes and practices in relation to the conservation and rearing of local breeds as well as the choice to locate and/or to continue activities in marginal areas and the articulation of the these two aspects within networks and society as a whole.

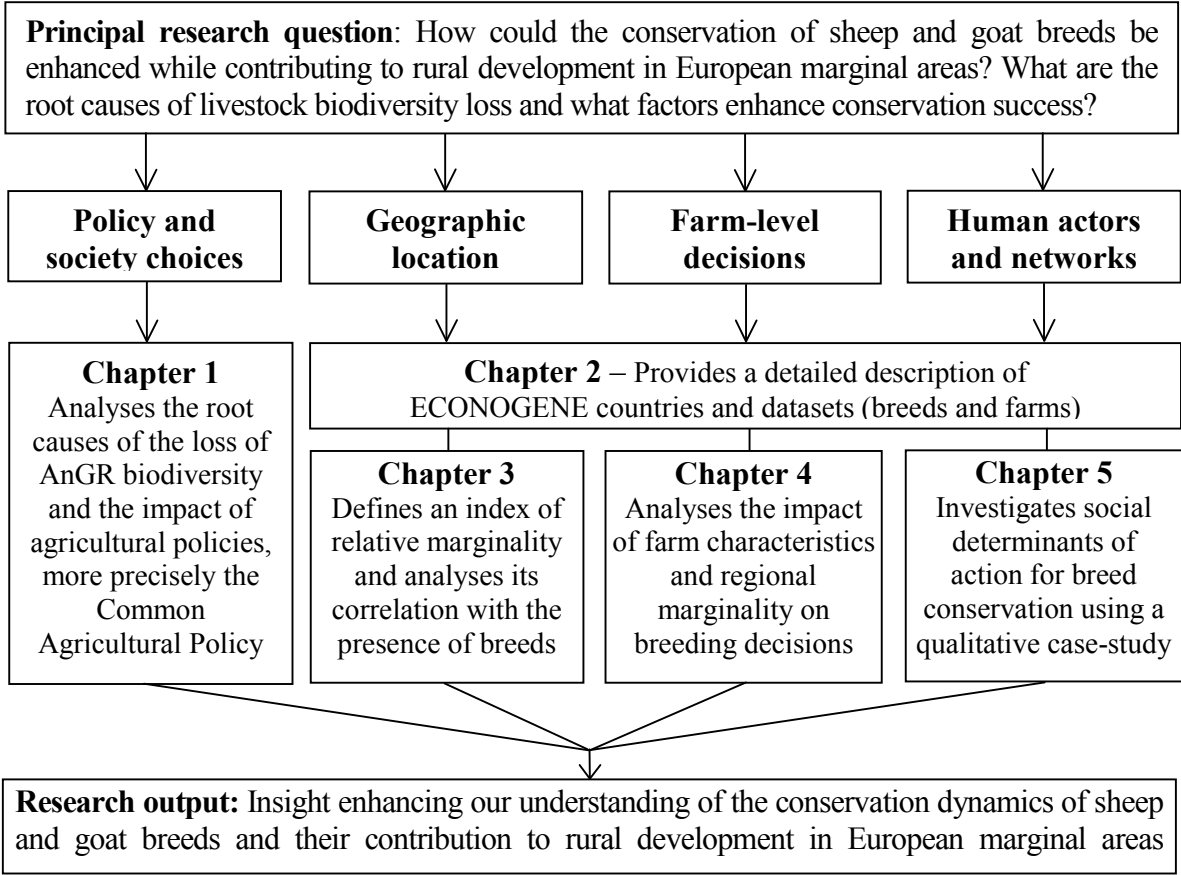


Figure 0.1.1 – Schematic representation of the structure of the Thesis

All these aspects are treated in the corresponding chapters, as shown in the figure. The content and articulation of these chapters are detailed in the following sub-sections.

An introduction to the issue of livestock biodiversity and rural development (Chapter 1)

The first chapter is a general introduction to the issue of livestock biodiversity, and rural development in so far as local, traditional livestock can contribute to it. The focus is on sheep and goat breeds, as stated above, since it is the focus of the ECONOGENE project.

After analysing in some detail the general picture of AnGR biodiversity loss, greater attention is paid to the European context. The present situation of the endangerment level of sheep and goat breeds in Europe is described using data from the database of the European Association of Animal Production (EAAP).

It is argued that the Common Agricultural policy (CAP) of the EU has been a major force shaping the agricultural and rural development of the EU in the last four decades. After a brief historical sketch, the impact of the CAP are discussed in a social welfare approach, comparing trade-offs between production increase and biodiversity loss. Then some aspects of the major reforms of the CAP since 1992 are presented and the current context of subsidies for breed diversity conservation is assessed. The chapter concludes summarising the main insights gained on various causes of, and possible solutions to, the presently ongoing trend of erosion of AnGR biodiversity.

Presenting the project's breeds' and farms' datasets (Chapter 2)

Chapter 2 deals with the description of the object of the research. Firstly, the geographic focus is presented. Two levels are studied in different detail. Some relatively consistent data is available for the EU-25 countries and Romania, most data however is available for EU-15 countries only. In parallel to this fact, most rural development policies of relevance here have been so far applied to the EU-15 only. Therefore, the analysis here focuses mainly on ECONOGENE-selected EU-15 countries, namely Austria, France, Germany, Greece, Italy,

Portugal, Spain and the UK. At the EU-25 level, two countries were part of the ECONOGENE project, Hungary and Poland.

Secondly, two datasets are presented. One describes the breeds selected by the ECONOGENE project. The second is a survey of farms raising these breeds. A detailed statistical descriptive analysis of the farm survey is provided. The dataset consists of 604 usable questionnaires of farms in Austria, Germany, Spain, France, Greece, Italy, Hungary, Poland, Romania and the UK. Of these farms, 470 (that is about 78%) are in the EU-15. In depth description of main characteristics of these farms are presented in a series of tables and commented in the text. A conclusive section summarises the salient points.

Charting the potential of local-breed sheep/goat husbandry (Chapter 3)

In Chapter 3 a GIS is implemented in order to define the concept of marginal areas and to quantify and map an index of "relative marginality". The objective of the chapter is (1) to estimate a measure of relative marginality, a concept that is found to be not precisely defined in the literature, and (2) to apply it to study the correlation between the (relative) marginality of a region and the presence of (ECONOGENE-selected) local, traditional sheep and goat breeds.

This is intended as a contribution to one of the objectives of the ECONOGENE project, namely to construct maps of development potential of husbandry based on this type of animal breeding.

The geographic scale is presented. This is the scale of NUTS level 3 regions. NUTS stands for Nomenclature Unit of Territorial Statistics, and correspond to administrative units. These units are used at the EU-15 (and now at the EU-25) level to gather consistently comparable statistics on a broad range of aspects, from economic accounts to agricultural

production and to population densities. These statistical units are presented in detail as well as the used dataset and the geographic boundaries data used in the GIS application.

Relative marginality of NUTS level 3 regions is defined for a set of characteristics such as unemployment rates, change of population density, land use, and so forth. Indices are computed country by country for each of these characteristics and two aggregated indices are computed.

The presence of ECONOGENE breeds in NUTS level 3 regions has also been recorded. This data is used in combination with the one used to build the index, by overlaying the respective layers in a GIS. This allows computation of correlation between relative marginality of a region and presence of traditional sheep and/or goat breeds. This is modelled by using a logit model where the dependent variable is a binary variable indicating the presence or absence of traditional sheep and/or goat breeds and the explanatory variables are the different indices and indicators of marginality.

The results are discussed in a conclusive section and the synthetic indices are also used in the econometric models of Chapter 4, in order to analyse the impact on the breeding decisions of farmers of the geographic location of the farm with respect to the relative marginality of the region.

Econometric analysis of sheep and goat farms' surveys in the EU (Chapter 4)

This chapter presents the results of analyses performed in an ordered logit model to explain the trend in the stock of animals of traditional sheep and goat breeds raised on 604 farms in nine EU-25 countries, plus Romania.

Within the framework of the ECONOGENE Project, a questionnaire allowed gathering data on the socio-economic characteristics of the farm, as well as on marketing of traditional

products, revenues and characteristics of the raised breed and the type of management. Explanatory variables used include the age of the farmer, the presence of a successor and the existence of particular marketing strategies for the most relevant production, etc. Based on the dataset presented in Chapter 2, the impact of these variables on the farmers' breeding decisions is analysed.

After discussing the particularities of the ordered logit model, the variables found to affect production decisions in a significant way are described. Restricting the analysis to EU-15 countries for which data is available, the indices of relative marginality computed in the previous chapter are then added to the model in order to analyse the impact of farm location with respect to marginal areas on the breeding decisions. These findings are discussed to provide insights and suggestions for policies addressing the conservation of sheep and goats in European marginal rural areas.

Qualitative survey: a case study of pastoralism and goat breeders (Chapter 5)

Chapter 5 reports the background, methodology and findings of a sociological qualitative case-study. Qualitative rural sociology provides a different perspective on rural matters and is considered as an enriching contribution to the analysis of complex issues that involve various levels of social, political and economic human action. The case-study focuses on the social and territorial dynamics in which conservation of two local, traditional goat breeds in Southern France is embedded. It is argued that while some of the insights are valuable for the typical situation of the case-study region, some findings can also be applicable in a larger geographic context and some are of interest to most European marginal areas.

In Southern France, in the administrative region of Provence-Alpes-Cote-d'Azur and some portions of contiguous regions that are historically and geographically considered as

situated in Provence, two groups of breeders were surveyed who rear either of two local goat breeds, the Rove and the Common Provençal. Some extension experts were also interviewed.

One of the objectives at the onset of the research was to understand the possible reasons that may explain the fact that the first is not endangered anymore while the second is still at risk of being lost to farming. However, in due course of this research, focus shifted more towards comprehending the attitudes, worldviews, practices and territorial dynamics which are the ground for action aimed at the conservation of local, traditional goat breeds in Southern France.

The importance of key people and of networks is apparent in the discourse of both breeders and extension experts. One important finding reveals the topicality of the conflict over access to land. This is discussed with a view to providing some guidelines for policy.

Conclusive chapter: Integration and discussion of main results (Chapter 6)

In the last chapter of this Thesis, a summary of the main analysis and findings of each chapter is provided. On this basis, an integration synthesising important findings is suggested that is then translated into general guidelines for policy and action. Some of the limitations of the approaches developed here are presented in contrast to their principal advantages. Some suggestions on future research orientation are also discussed.

Chapter 1

INTRODUCTION TO LIVESTOCK BIODIVERSITY AND RURAL DEVELOPMENT

1.1 The issue of biodiversity loss

Depletion of biological diversity of farm animal genetic resources (AnGR) has become a major concern in international research and policy (FAO, 1999; Hammod and Leitch, 1996). A conservative global estimate states that at least 28% of farm animal breeds became extinct, rare or endangered in the past century (World Conservation Monitoring Centre, 1992). In most marginal areas, AnGR-based farm systems are considered to be among the most important land-uses.

In fact, areas currently considered “marginal” have long been the source of several well-adapted local breeds, many of which are presently endangered, either because of substitution by "improved" breeds or because farmers abandon husbandry. However, it is a widely held belief that the existence of traditional, well-adapted breeds is a necessary given for viable, sustainable land use in marginal areas (Rege and Gibson, 2003).

Biodiversity is considered to form the very basis of life on earth. The preamble of the “Convention on Biological Diversity” states that the contracting Parties are “conscious of the intrinsic value of biological diversity” and “conscious also of the importance of biological diversity for evolution and for maintaining life sustaining systems of the biosphere.” They affirm that “the conservation of biological diversity is a common concern of humankind” and that they are “aware that conservation and sustainable use of biological diversity is of critical importance for meeting the food, health and other needs of the growing world population.”

The starting point of this Thesis is thus a desire of society, assumed to be commonly accepted, to preserve AnGR biodiversity. Therefore, the issue of why and whether it is important to preserve livestock biodiversity is not dealt with in further detail. The reader interested in studying the question in further details as compared to the preceding brief account could refer to one of the many existing studies (e.g. Barbier, Burgess and Folke, 1994; Nazarea, 1998; Pearce and Moran, 1994; Perrings, Maler and Holling, 1997; Wilson and Peter, 1989).

1.2 What is specific to livestock biodiversity?

Livestock biodiversity can be conceived as composed of diversity at the species and at the breed levels. At the species level, slightly more than forty animal species are used in agriculture. Only fourteen of these⁵ contribute to approximately 90% of animal produce⁶. The latter species have been diversified by human use and management into an estimated 4000 breeds. The term "breed" is quite difficult to define precisely. It is commonly understood as "a given group of domestic livestock with certain identifiable external characteristics such as size, form of ears, colour, horns, and so forth, that distinguish it from other groups within the same species."

Livestock species are unlikely in danger of extinction themselves. The level of biodiversity conservation which is of concern here is thus that of breeds and even populations within breeds. In fact, intrabreed diversity account for 50 to 70% of total genetic variance (Hammond and Leitch, 1996). This is one of the reason for which the thesis is focused on in-situ conservation at the farm level as what is argued to be the most effective solution to ensure that a maximum of intrabreed genetic diversity is conserved, by keeping a large number of separate populations in different farms.

⁵ Asses, Bees, Buffaloes, Camels, Cattle, Chickens, Ducks, Geese, Goats, Horses, Mules, Pigs, Sheep, Turkeys.

⁶ Source: own calculations on data from <http://faostat.fao.org>, database accessed on 15/07/2004.

In the case of livestock, the anthropogenic impact on biodiversity is often the most important one, through controlled reproduction and selection, as well as introgression and production decisions impacting the demography of livestock populations. Some livestock breeds are ancient, but many are relatively speaking recent. Over this (evolutionarily speaking) short period of time, significant amounts of genetic variation are unlikely to have accumulated as the result of mutations. The rate of phenotypic variation brought about by artificial selection in animal breeding is much greater than the rate of ‘change’ at the genetic level that is measured by DNA markers such as microsatellites (Bruford, 2003). Measures of diversity used in the context of wild species are hence often not suitable as measures of diversity for livestock breeds. It is important to retain that this implies a very high level of uncertainty that society might want to consider when making decisions about livestock biodiversity, possibly pleading a precautionary approach.

Livestock biodiversity is less implied in the functioning of complex food chains and ecosystems than wildlife biodiversity. However, AnGR generally have implications for cultural and landscape diversity and are of great significance for the resilience of many agro-ecosystems (Yarwood and Evans, 2003). Finally, domesticated animals have primarily direct-use values as opposed to wildlife, though this distinction is not as strictly dual as it may appear. In consequence, it is relevant to consider the importance of farm AnGR for production systems, agro-ecosystems and diversity as specific for livestock breeds.

1.3 Causes of livestock biodiversity loss

This section focuses on the factors and processes that have contributed to the loss of livestock genetic diversity. The synthesis presented below is largely based on works by Anderson (2003), Mendelsohn (2003), Rege and Gibson (2003) and Wollny (2003).

Trends in human population demographics, e.g. urbanisation, as well as technological changes in farming systems and marketing can have negative effects upon AnGR. Commercial production systems tend towards uniformity, whilst livelihood-oriented systems thrive on diversity. This points to the fundamental nature of the forces driving diversity decline. Human societies are driven by the desire to meet basic as well as “higher order” needs (Maslow, 1970). Different strategies can be implemented and in this respect choices are primarily influenced by culture (Max-Neef, 1989; Wilk, 2002). In line with a thorough analysis by Proctor (1998), culture here is meant as something encompassing all aspects of human endeavour – be this economic or politic or technological – rather than just one factor amongst others.

Culture-driven economic development the way we have known it so far has derived in part from the substitution of "less productive" assets by the "more productive ones", i.e. from a conversion process. It is important to consider that this productivity comparison has mostly been based on assets' unit productivity in simplified and controlled systems. It is also a unit gross productivity not considering the net benefit. An accurate complete budget taking into account also subsidies (when applicable) including transaction costs and the cost of energy inputs has not been the rule in the past.

Theories that have formed the basis of development policies have oriented actions in the field of agriculture towards great simplification and specialisation (Peemans, 2002). Monoculture for crops and controlled environments for ‘improved’ breeds are much easier to manage centrally. While the output of a production system focusing on a single activity may be larger due to economies of scale, the benefits of diverse farming systems, especially in marginal production regions, have often been neglected. Lack of deeper understanding of agro-ecosystem functioning because of limited knowledge – coupled with a political bias

towards centralisation of services including agricultural extension – may be at the root of misguided policies that have evaluated asset productivity on a simplified basis⁷.

The processes of conversion generate homogenisation and uniformity of inputs, resources, technologies and outputs. These processes have occurred and are still occurring, as well in developed countries as in developing ones, and they generate considerable specialisation. In the case of livestock, the process of conversion is characterised by intensification that is rendered possible by selection, introduction of exotic breeds and/or crossbreeding and by a shift from diversified to homogenous farming systems.

This dissociation between formerly complementary production activities can be understood as a substitution of economies of scope⁸ by economies of scale⁹ in the available technologies. Culture and historical path-dependency have favoured this. The rationality bias and modern age world vision (Huesemann, 2002), noticeably with respect to the mastery of nature, meant that larger, more homogenous farming systems were adopted as a solution to achieve self-sufficiency that were simpler in knowledge and practice. Changes in policies and prices have enhanced and supported changes through technical progress and induced the widespread adoption of new technologies. Schumacher (1973; 1977) spoke about the "law of the disappearance of intermediate stages" to explain the historical trend towards uniform "modern" technologies. According to this interpretation, some areas become (relative to other areas) marginal because of the lack of "intermediate" or adapted technologies (or in this case, analogously, livestock breeds).

⁷ Also, productivity has typically been compared with respect to a single given production factor (for instance labour). The picture changes if another production factor is the standard scale. For instance, Haas, Wetterich and Köpke (2001) found that organic farms in Southern Germany were two times less energy-demanding for the same output level.

⁸ Economies of scope represent the saving in cost that is realized by arranging different production activities into a single production unit. This saving in cost often finds its origin in technological synergies between production activities.

⁹ Whereas economies of scope favour diversification, economies of scale encourage larger production units.

Conversion processes have both accelerated, and been accelerated by, the extension of market systems and the associated process of globalisation. The latter tends to encourage regional economic specialisation and often leads to particular types of livestock production becoming relatively “uneconomic” in a given region, thus resulting in the loss of region-specific breeds.

Moreover, with economic globalisation, it has become less costly to transfer animal produce across international boundaries and this has increased the possibilities for breed substitution (Tisdell, 2003; cf. Figure 1.4, p. 20). This phenomenon can be linked to artificially low energy prices that do not include externalities such as the impacts on climate change. However, according to a broad scientific consensus summarised by the Intergovernmental Panel on Climate Change (IPCC, 2001) the payment of the invoice balance has only been delayed.

Agricultural policy has played a major role in fostering uniform and intensive animal production systems. Financial support for investment in housing and veterinary facilities has led to a change towards “improved” breeds that yield higher returns in controlled environments but lack resistance to difficult environmental conditions. There has been a certain bias towards higher unit productivity, regardless of the common-sense insight that what enhances welfare is global net gain, possibly in the long run. The impact of agricultural policies, with a focus on the EU and thus on the Common Agricultural Policy (CAP) is dealt in greater detail in section 1.5.

Relating to globalisation, one aspect has been emphasised by Tisdell (2003). Import of livestock produce from another region may be less costly than the locally produced supply. If the latter is the output of an endemic breed, the breed is doomed to disappear.

The consequences of these processes are, in short:

- Genetic dilution or eradication through use of non-autochthonous genetic resources;

- Changes in production systems leading to change in breed use or cross-breeding;
- Abandonment of husbandry and/or agricultural activities.

In the context of industrialised countries, the subsidies allocated to agricultural producers contributed to the reduction of grain prices and indirectly encouraged the development of livestock activities. These subsidies have kept grain prices below their free-market level and have made capital-intensive livestock techniques more profitable around the world by rendering both the prices of breeding stock and of feed artificially low. Reducing the subsidies on crops and livestock exports might possibly help reducing the financial pressure on indigenous breeds and production systems.

In the case of developing countries, the strategy which guided livestock development during the four last decades was conceived by international institutions and the authorities of these countries. International institutions have certainly been interested in promoting new methods that they perceived would help developing countries. Nevertheless, they have served the interests of donor countries. In several cases, their strategy has been to promote capital-intensive livestock techniques of donor countries¹⁰.

The value of biodiversity is not, or at least not completely, captured by markets. It is an implicit value that constantly tends to be underestimated because of the absence of well-defined property rights. Despite continuous progress in the evaluation of non-market goods, the empirical literature fails to evaluate the entire range of biodiversity benefits (Nunes and van den Bergh, 2001).

¹⁰ Voting power at the World Bank and International Monetary Fund is determined by the level of a nation's financial contribution. Therefore, the United States have roughly 18% of the vote, with the seven largest industrialized countries (G-7) holding a total of 45% and the G-10 plus Switzerland more than 50% of the total voting power. The eighteen most important decisions require a majority of 85%, thereby giving the United States the power of veto, while some twenty-one other subjects must be decided by a 70% majority, and so may be vetoed by the five countries with the most voting power.

One way biodiversity value may be understood is as an asset for future generations. Consistent with this is a view of biodiversity as insurance in face of uncertainty. Because the value of biodiversity is not completely captured in markets, its conservation is often at loss in comparison to other land-use developments for market goods. Internalising the economic value of natural resources beyond the private value of direct use may hence be useful to fully assess the trade-offs involved in land-use allocations. As some papers have recently outlined (e.g. Costanza et al., 1998; Norton et al., 1998), the natural capital is the very foundation of economics. In this perspective, valuing biodiversity could be one way of helping breed conservation. This approach will neither be developed nor implemented in this Thesis¹¹.

Sudden changes in climatic conditions, the impact of wars and social unrest, and the advent of new or sporadic diseases and epidemics can all further the loss of AnGR. Indeed, when the size of a population falls below a certain level, the genetic diversity is affected in two ways. Firstly, certain genes may be lost from one generation to the next, since a restricted population size limits the sample of the genes available and being passed on. Secondly, because the number of individuals in the population is limited, the probability is increased that the parents of any new individual are related to each other. This means that the probability of the individual receiving the same genes from the maternal and paternal sides of its pedigree is increased. This in turns means that the genetic variability within the individual is reduced. It is a well established and universal fact that this reduction in variability within an individual (particularly a reduction in variability within each locus, or homozygosity) is associated with deterioration in many physical traits, particularly those associated with viability. This impact is known as inbreeding depression (Altukhov, 1990).

¹¹ The interested reader is referred to Roosen, Fadlaoui and Bertaglia, 2003.

1.4 The state of European sheep and goat breeds

At the level of the enlarged European Union (EU-25), there are about 100 million sheep and 12 million goats. Comparatively, there are about 90 million cattle and 154 million pigs¹². Compared to World stocks in terms of Livestock Units (LU, using conversion factors from Kouba, 2003 and Seré, Steinfeld and Groenewold, 1995), the EU-25 has 2% of the World's goats and 10% of sheep, as well as 7% of cattle and 16% of pigs. Within the EU-25, sheep and goats account for about 13% of total livestock in LU¹³.

Table 1.1 shows the results of a database query¹⁴ about the number of sheep and goat breeds in EU-25 by present status of endangerment. Data is retrieved from the database of the European Association of Animal Production (EAAP). The total database contains information on 1,939 breeds in all European and some non-European Mediterranean countries¹⁵. Excluding 152 rabbit breeds, whose origin is not defined, 687 breeds are autochthonous (38%) and most of these (564, i.e. 82%) are present in one country only.

The status of endangerment is defined in the EAAP database on the basis of the effective population size (N_e). This is an indicator of (1) the increase in % inbreeding (ΔF) per generation (and decrease of heterozygosity) and (2) the loss of genes due to random drift of gene frequencies per generation. Five classes of endangerment are defined according to the expected total increase of inbreeding, $\Delta F-50$, during 50 years of reproduction, as a function of N_e . The classes are: "Not endangered" ($\Delta F-50 < 5$); "Potentially endangered" ($\Delta F-50 = 5-15$); "Minimally endangered" ($\Delta F-50 = 16-25$); "Endangered" ($\Delta F-50 = 26-40$); and "Critically endangered" ($\Delta F-50 > 40$). Additional factors considered are incrossing, a decreasing number

¹² All data refer to year 2002 and are from <http://faostat.fao.org>, database accessed on 15/07/2004.

¹³ More precisely, sheep account for 12% and goats for 1% of the total of farm animals LU in the EU-25.

¹⁴ Performed on 30/06/2004 via the URL <http://www.tiho-hannover.de/einricht/zucht/eaap/>

¹⁵ Of these breeds, 1,632 (that is, 84% of the total) are in the 25 EU Member States.

of female breeding animals, and the number of breeding herds. The status of endangerment is defined only for autochthon, local or native breeds without any imports (except for rabbits)¹⁶.

Available data shows that 67 sheep and goat breeds in EU-25 are either potentially, minimally, “simply” or critically endangered.

It is interesting to notice that for more than half of all breeds in this dataset the status of endangerment is not defined. These are breeds formed by introgression, or that are composite of other breeds, etc. When considering only breeds for which the status of endangerment is defined¹⁷ in the EAAP database, the percent of endangered breeds is 25% and 35%, for sheep and goat breeds respectively.

Table 1.1 – Sheep and goat breeds by endangerment status in EU-25 countries

Status of endangerment	GOAT breeds, 26%		SHEEP breeds, 74%		TOTAL	
Critically endangered	7	4%	10	2%	17	3%
Potentially endangered	5	3%	27	6%	32	5%
Endangered	1	1%	7	2%	8	1%
Minimally endangered	5	3%	5	1%	10	2%
Not endangered	33	21%	148	33%	181	30%
Missing data	14	9%	22	5%	36	6%
Not defined	93	59%	231	51%	324	53%
TOTAL	158	100%	450	100%	608	100%
Subtotal endangered ¹	18	35%	49	25%	67	27%

Source: EAAP database, accessed 30/06/2004. ¹Percent calculated on autochthonous breeds subtotal.

This research has been conducted within the framework of a vast interdisciplinary endeavour, the ECONOGENE Project, which combines genetics, socio-economics and geostatistics to address the conservation of sheep and goat AnGR for rural development in European marginal areas. This project focuses on ten EU-25 countries¹⁸ and seven non-EU countries¹⁹. The research presented here is limited to EU-25 countries²⁰. The ten countries

¹⁶ For more information, see <http://www.tiho-hannover.de/einricht/zucht/eaap/factors.htm>

¹⁷ That is to say breeds that are considered as autochthonous on the basis of this classification.

¹⁸ Austria, France, Germany, Greece, Italy, Hungary, Poland, Portugal, Spain, UK. More details on these countries are given in Chapter 2 (see Table 2.1 and Table 2.2).

¹⁹ Albania, Switzerland, Egypt, Jordan, Romania, Saudi Arabia and Turkey.

within the project comprise 74% of all EU-25 sheep and goat breeds, that is 457 sheep and goat breeds out of 619²¹. As far as the ten EU-25 countries are concerned, ECONOGENE studied 18% of EAAP-database goat breeds plus four breeds not-included therein, that is 25 goat breeds in total, and 10% of EAAP-database sheep breeds plus eight breeds not-included therein, that is 40 sheep breeds²². Amongst these studied breeds, 52% of goat breeds and 76% of sheep breeds are autochthonous. Further details on the breeds studied in the ECONOGENE project are provided in Chapter 2.

Considering autochthonous breeds only, and excluding missing data, 2 out of 12 ECONOGENE goat breeds (17%) as well as 3 out of 29 ECONOGENE sheep breeds (10%) are endangered²³. This is in contrast with overall figures of respectively 37% and 23% in the ten EU-25 ECONOGENE countries where the research has been carried out. Figures for the eight ECONOGENE EU-15 countries are consistently similar.

Comparatively, in EU-25 countries, considering all farm animal species in the EAAP database, 39% of autochthonous breeds are endangered. These comprise 75 out of 151 autochthonous cattle breeds (50%) and 39 out 60 autochthonous pig breeds (65%). Of these breeds, 9% of cattle and 17% of pig ones are defined as "critically endangered". Remarkably, 218 out of 382 total cattle breeds (57%) and 110 out of 190 total pig breeds (58%) are not considered as autochthonous breeds. This can be interpreted as a consequence of greater intensification in cattle and pig rearing, as compared to sheep and goats. This would suggest that intensification results in greater uniformity and higher loss of AnGR.

²⁰ In some cases, as indicated when applicable, the analysis is limited to EU-15 countries. For instance, this is justified by the fact that agri-environmental policies applied to these countries only.

²¹ 125 out of 161 goat breeds and 332 out of 458 sheep breeds.

²² List of breeds by country: see Appendix 1.

²³ Notice however that data about endangerment status is missing for two goat and two sheep breeds (that is about 8% and 5%, respectively)

1.5 Agricultural policies and livestock biodiversity

Presently, in the EU-15 only about 8% of approximately 141 millions hectares of Utilised Agricultural Area (UAA) are used for permanent crops, while almost 60% is formed of arable land and about one-third are permanent pastures. Agricultural policies have been a major factor that favoured certain types of crops. Equally, certain types of animal husbandry as well as regions with given characteristics have been advantaged²⁴. Conversely, some other areas have been abandoned or have become “marginal”. Some livestock breeds, generally linked to more extensive type of management, have either been lost or become endangered.

There is little doubt that the Common Agricultural Policy (CAP) has been the major force orienting agricultural development in the EU since the early 1960s. An assessment of these policies is necessary to measure their effect on local, traditional sheep and goat husbandry in marginal areas. Some aspects of such an assessment gain further relevance in the recent context of agricultural policy reforms. The effective impact of these reforms have been already questioned (e.g. Gaspart, 2004).

In relation to the agreements of the ‘Uruguay Round’, developed countries committed to a reduction of 20% of subsidies in the period 1995-2000 compared to the base year 1986. Yet, domestic support as a share of farm receipts was still 31% in 2001, down from 38% on average in 1985-1986. Policies hence continue to engender important distortions in markets and the effect of this on local livestock breeds is probably significant though very hard to measure. The latest reform, providing for only partial decoupling, has rather varied impacts, and was met with mitigated approval and uncertainty as to its impacts on marginal areas.

In recent years, the CAP has incorporated interest in the environment and introduced agri-environmental policies (AEP), part of the so-called second pillar of the CAP, including

²⁴ In terms of Livestock Units (LU), in the EU-15 sheep amount to about 13% of LU and goats to just 1% of LU. Comparatively, cattle amount to approximately 58% and pigs to about 25% of LU.

policies providing support for rearing endangered breeds. The latter are but a minor part of the “second pillar”. However, they will be discussed in some detail for their topical interest in this research.

1.5.1 The Common Agricultural Policy: A brief historical introduction

Countries that were part of what was then the European Economic Community (EEC) established the CAP in the 1960s. The six founding members deemed a common policy for agriculture as of foremost importance for a secure food supply. The 1957 Treaty of Rome itself set the general objectives for this policy: (1) increase of agricultural productivity; (2) a comparatively fair standard of living for agricultural work force (farmers, workers, etc.); and (3) affordable prices for consumers. Negotiations to set a CAP commenced straightaway and soon provided a clear view of the three fundamental principles on which the common policy was intended to be based: (1) a common market, i.e. free trade in agricultural products within the EEC (and now the EU); (2) preference for the Community, i.e. control over trade in agricultural products with the outside world in order to maintain price levels within the EEC (and now the EU); (3) common financing, i.e. costs of implementation primarily sustained by the EEC (and now the EU) budget, rather than by the individual countries.

The commodity regimes are financed through the “Guarantee” section of the European Agricultural Guidance and Guarantee Fund (EAGGF) and make up the largest share of the budget now referred to as the “first pillar”. For many years, it has absorbed nearly two-thirds of EEC resources. The EU-25 budget proposal for 2005 plans a total expenditure volume of slightly more than one hundred billion euros. Of this, 46% will be for agriculture, a more or less constant share in recent years. An amount of 6.8 billion euros, i.e. slightly more than 13% of total agricultural policy budget share, is projected for the “second pillar” of rural development (Commission of the European Communities, 2004).

Today, still, the official public statement of the EU concerning the CAP is that "the aim of the CAP is to provide farmers with a reasonable standard of living and consumers with quality food at fair prices"²⁵. With the exception of the present accent on quality, the basic focus has remained the same. The statement announces further that "the key concepts now are food safety, preservation of the rural environment and value for money". However, the "first pillar" of the CAP is still granted the largest share (87%) of total CAP budget.

Until recent reforms, past support used to be based on a coupled price support, i.e. it was linked to production and either paid as a premium (e.g. per head of livestock) or provided in the form of a guaranteed minimum price at which produce would be bought by the EAGGF. One of the first attempts to reform the system of payments consisted in coupling premia to the utilised area, noticeably with livestock premia paid per hectare rather than per head, in an attempt to reduce stocking rates. Presently, an effort is made to achieve at least partial decoupling, as it will be explained further, envisaging a single farm payment that is neither linked to production nor to total utilised area.

One driving force behind the need for reform is linked to international pressures by the World Trade Organisation (WTO), particularly with respect to one of the major objectives at the onset of the CAP, preference for the Community, implying control over trade in agricultural products to maintain price levels in the EEC (now EU). It is argued that this objective cannot be as strongly upheld as before. However, there is conflicting evidence and political conflict over the issue whose analysis is beyond the scopes of our research.

1.5.2 Assessing the impact of the Common Agricultural Policy

Market price structure has a direct influence on every choice a farmer makes. Thus, it is important to assess if, and how, the distortion caused by the CAP influence breeds loss. The

²⁵ Source: http://www.europa.eu.int/pol/agr/index_en.htm

CAP may affect livestock diversity loss in two ways. On the one hand, it may artificially enhance the comparative advantage of more productive breeds, inducing breeds substitution. On the other hand, it may, by artificially enhancing the productivity of some regions, have an effect on the economic viability of activities in marginal areas, inducing abandonment or reduction of livestock breeding activities.

As a direct result of policy support²⁶, production of key commodities such as cereals has more than doubled over the four decades of the CAP. Stocking densities exceed two LU per hectare in some regions of The Netherlands, Germany, France and Northern Italy. The number of farms has fallen over this period and their average size has increased. The farm labour force also shrank steadily, by 10% during the first half of the Nineties for the EU as a whole and more than 20% in Germany and Portugal (Baldock and Bennet, 2002). Intensification is especially evident in data on nitrogenous fertiliser consumption (Figure 1.1). The maximum increase was achieved in 1986, when more than eleven million tons of nitrogenous fertilisers were used in the EU-15, almost three times the amount used in 1962²⁷.

Caraveli (2000) has studied the impact of the CAP on mainly mountainous less-favoured areas (LFAs) of the Mediterranean region. According to her study, there is evidence that "the CAP has been a major factor for the strengthening of [the] process" of abandonment of traditional low-intensity farming systems in LFAs, "reinforcing market forces in this respect". CAP incentives have both favoured intensification, causing an expansion of arable land at the expense of permanent grassland, and extensification, causing the abandonment of many LFAs. This has largely led to a decline in transhumance. Small ruminant production has been

²⁶ While many analysts agree on this, some argue that this process would have occurred anyway. For instance, Cornwallis (1969) spoke of "a new farming in which the emphasis is on arable cropping at the expense of livestock, and with cereals (...) predominating[, (...)] accompanied by a reduction in permanent grassland, the drainage of wet places, and the removal of hedgerows" a few years before the UK joined the then European Economic Community (1974). Cf. section 1.6.1 of this chapter.

²⁷ Source: <http://faostat.fao.org>, database accessed on 22/07/2004.

affected by shifts to more sedentary systems and in some cases farmers have switched from sheep and goat to cattle, and often from livestock to arable crops as maize or wheat.

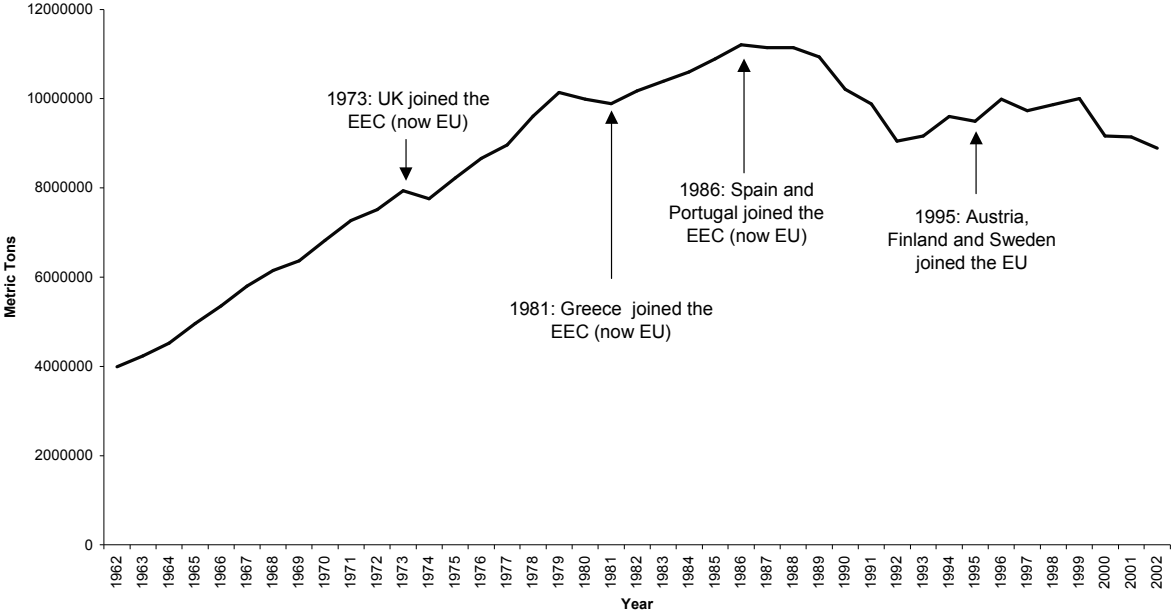


Figure 1.1 – Consumption of nitrogenous fertilisers in the EU-15 between 1962 and 2002

It is important to stress two aspects of the problem. On one level, one might focus the analysis on the loss of one single local breed, driven by either replacement with another breed or abandonment of activities. The latter might be due to either a shift to other agricultural activities (e.g. arable crops) or to complete abandonment of agricultural activities. On another level, one might stress the aggregate effect on total breed diversity as a welfare effect.

It is argued that the CAP has been a major driving force in productivity improvements, in line with the dynamics explained in Figure 1.2 (from Penson, Capps and Rosson, 1996). Under the CAP price support mechanism, a guaranteed price P_G is paid to farmers. At this price, consumers are willing to buy Q_P and the European Agricultural Guidance and Guarantee Fund (EAGGF) buys quantity $Q_G - Q_P$ at price P_G so that farmers react to a

distorted demand curve D that is artificially higher than the market demand curve, and produce more than in the absence of the policy instrument. This also increases the incentives to invest in production technology and development.

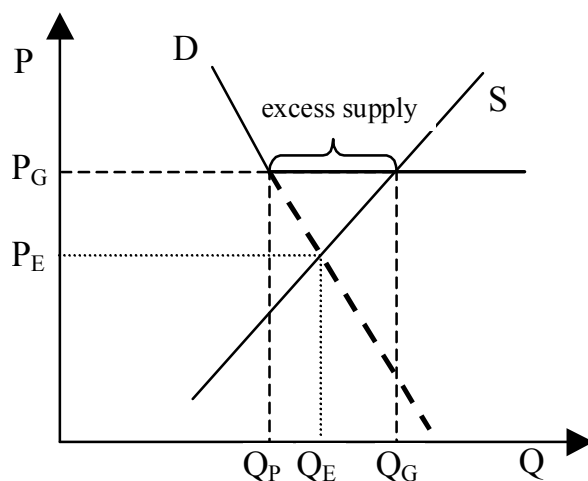


Figure 1.2 – Effect of price support mechanisms on agricultural production

One of the forces that might induce the replacement of one breed with a more productive one may be linked to this artificially enhanced drive to higher productivity. While "improved" breeds might be more productive in certain well controlled environments, they may lose their comparative advantage in difficult ones characterized by rough climate, poor forage conditions or high altitudes. In order to provide the ideal environments for these animals, investments have to be incurred. Those investments are often subject to economies of scale, making them more viable as production expands. The CAP and several national programs also provide investment aids that fund investment projects allowing the introduction of otherwise uninteresting production methods in these regions.

From an overall aggregate social welfare perspective, as more and more farmers replace local breeds with more productive, often exotic ones, total diversity is reduced. Figure 1.3 is a

simplified illustration of this effect, contrasting productivity choices and diversity choices in a single graph.

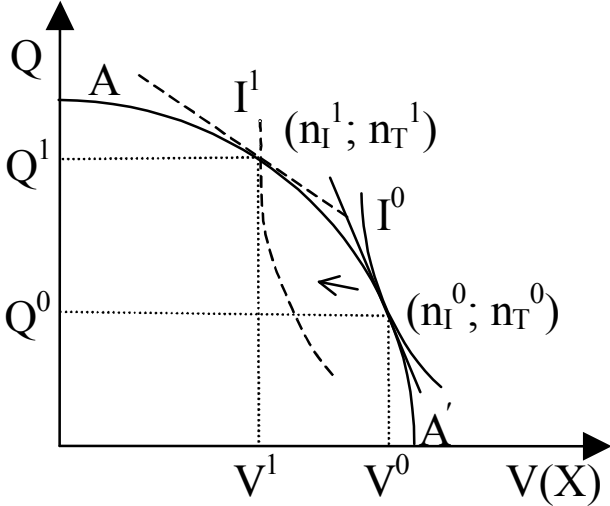


Figure 1.3 – Graph of the partial replacement of breeds in set S_T by breeds in set S_I

For the sake of simplicity, we consider one single output, Q , and only two types of breeds, a set S_I of n_I improved, more productive breeds and set S_T of n_T local, traditional breeds. A certain number of farmers, currently raising animals belonging to set S_T , replace their breeds by breeds in set S_I . Such substitution would lead to more production $Q^1 > Q^0$ and this would be achieved by a lower total number of breeds belonging to set S_T ($n_T^1 < n_T^0$) and a higher total number of breeds belonging to set S_I ($n_I^1 > n_I^0$).

It is important to note that $n_I < n_T$ and that $n_I^1 + n_T^1 < n_I^0 + n_T^0$ so that a measure of diversity²⁸ as $V(X) = V(n_I; n_T; \cdot)$ imply that $V^1 < V^0$ when producing $Q^1 > Q^0$. The set of production possibilities (quantity versus diversity) is drawn as being convex because of decreasing returns to breed substitution in marginal areas. That is, as more and more locally adapted breeds are replaced by “improved” ones, the gain in production falls, as the latter

²⁸ For more details about measures of diversity see Weitzman (1992; 1993; 1998), Simianer et al. (2003), Bertaglia and Roosen (2002) and Roosen, Fadlaoui and Bertaglia (2003).

breeds may not express their full performance potential in more hostile environments. Welfare resulting from production choices is presented by the social indifference curves I^0 and I^1 .

Because relative market prices indicated by the tangents to the production possibilities frontier do not reflect external benefits of livestock biodiversity conservation and because subsidies increase returns to output-oriented systems, social welfare I^1 is lower than the social optimum depicted by I^0 .

We can deduce the impact of a price support for animal products in Figure 1.3. At $(n_T^0; n_D^0)$, the shadow price of diversity conservation, P_D , can be defined by equating the ratio of $-P_D/P_E$ to the slope of the transformation curve AA' . The price P_E is the equilibrium market price of the animal product (cf. Figure 1.2). An increase in the price P_E to P_G would reduce this ratio to $-P_D/P_G$, so that farmers move production to $(Q^1; V^1)$ using breeds $(n_T^1; n_D^1)$. This leads to an increase in supply to Q^1 and a decline in diversity. It is of uttermost importance to notice that the amount of the excess supply $Q_G - Q_P$ is in excess of consumers' needs, so that welfare foregone due to diversity loss measured by the distance of I^1 to I^0 is not compensated by higher food supply.

Another important impact of the CAP on the loss of local breeds is a market effect. It considers changes in production patterns due to the introduction of trade in substitute consumer goods. As Tisdell (2003) has shown (Figure 1.4), low-price supplies of livestock produce from an outside region (S_2) may render supply of produce from local breeds (S_1) non competitive, eventually leading to the abandonment of production from local breeds. To some extent and particularly before the relatively recent shift of consumers' preferences towards local, "quality food" (Allaire, 2002; Ploeg, 2002), cheaper bovine milk and cheese from excedentary countries such as The Netherlands, sold on markets in marginal areas has enacted as replacement good for more expensive local sheep and/or goat milk and cheese.

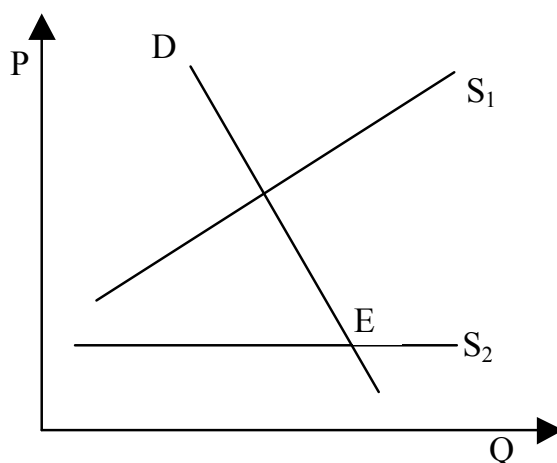


Figure 1.4 – Effects of a lower-price substitute livestock produce supply (S_2) from outside region

1.5.3 CAP reform(s) and agri-environmental schemes

1.5.3.1 The first reforms: 1992 and Agenda2000

In 1992, a major reform to the CAP was adopted. Known as the “MacSharry” reform, by the name of the then Commissioner for Agriculture, one of its main aims was to begin a process of decoupling (breaking the link between production at the farm level and the amount of support received), primarily in order to address the issue of commodity surpluses. One contributing external pressure was exercised at the level of General Agreement on Tariffs and Trade (GATT) negotiations during the Uruguay round (1986 to 1994).

One of MacSharry’s predecessors, Sico Mansholt, had taken a stance against the model of the CAP as early as in 1964. However, it was only in the mid-1980s that the CAP started to integrate one measure that was similar to one of his suggestions, namely arable set-aside. The 1992 reform tried to at least partly shift the support from guaranteed prices to direct payments. However, looking at Figure 1.5, it is evident that EU-15 countries’ per capita

production of cereals has increased steadily over the last four decades, reaching again in 1998 and in 2000 approximately the same peak as in 1984. The success of the 1992 reform can be considered relatively small.

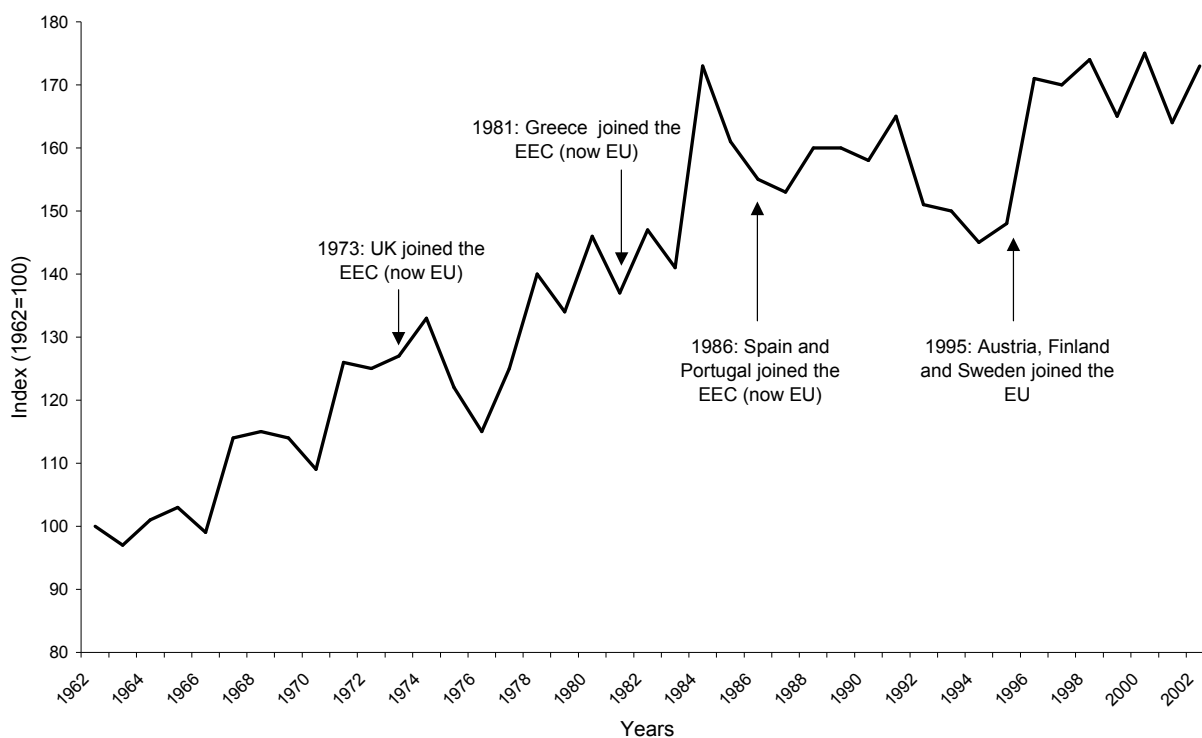


Figure 1.5 – Index of per capita production of cereals in the EU-15 (1962=100)

However, this reform has had the merit of introducing environmental preoccupations inside the CAP. Regulation 2078/1992²⁹ "on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside" was the first step to introduce countryside stewardship principles into the CAP.

Measures adopted as detailed below can be interpreted in the light of this historically-grounded allocation of property rights to farmers. Voluntary agreements, incentive-based

²⁹ Official Journal L 215, 30/07/1992, 85-90.

contracts and the likes would be established as the principal instrument of agri-environmental policies (AEP) across the EU.

In an attempt to favour extensification, quasi-compulsory set-aside, new limits on the number of LU per hectare, and similar measures were adopted. Unfulfilled expectations regarding the decrease in production (and stocks of surpluses) led the EU to engage in another round of reforms between 1997 and 1999. This was part of a broader initiative known as “Agenda 2000”, establishing the EU budget over a seven-year period, 2000-2006. AEP and rural development (RD) achieved the status of “second pillar” of the CAP and many measures of environmental and rural development relevance were grouped into Regulation 1257/1999 “on support for rural development from the EAGGF”³⁰.

The accent of this new Regulation focuses more on the integration of the different measures into Rural Development Plans (RDP) and farm-level contracts based on voluntary schemes for environmental protection. Rural development measures in Regulation 1257/1999 include³¹:

- Investment in agricultural holdings, to reduce production costs, increase quality, preserve and improve the natural environment, hygiene conditions and animal welfare standards, as well as to diversify farm activities;
- Setting-up aids for young farmers;
- Support for vocational training;
- Early retirement;
- Support for less-favoured areas, in order to (1) ensure continued agricultural land use thus contributing to the maintenance of a viable rural community, (2) maintain countryside,

³⁰ Official Journal L 160, 26/06/1999, 80-102.

³¹ This is the official list and official denominations of supported actions, only slightly edited (abridged).

and (3) maintain and promote sustainable farming systems “which in particular take account of environmental protection requirements”, as well as support for areas with environmental restrictions, in order to ensure environmental requirements and safeguard farming in these areas;

- AEP, which shall promote (1) ways of using agricultural land which are compatible with the protection and improvement of the environment, the landscape and its features, natural resources, the soil and genetic diversity, (2) extensification of farming and management of low-intensity pasture systems, (3) the conservation of high nature-value farmed environments that are under threat, (4) the upkeep of the landscape and historical features and (5) the use of environmental planning in farming practice.
- Improvement of processing and marketing of agricultural products;
- Forestry, including afforestation of agricultural land;
- Promotion of the adaptation and development of rural areas, concerning a variety of sub-measures including (1) land improvement, (2) reparaCELLING, (3) setting-up of farm management services, (4) marketing of quality agricultural products, (5) basic services for the rural economy and population, (6) renovation and development of villages and protection and conservation of the rural heritage, (7) diversification of agricultural activities and of activities closely related so that multiple activities and sources of income are available, (8) development of infrastructure, (9) encouragement of tourism, (10) protection of the environment and improvement of animal welfare.

These measures are supported when they are part of RDP, covering a period of seven years from January 2000. Member states are requested to ensure a certain balance between the different support measures. Approximately 100 billion euros are granted to their

implementation by the joint finance of the EU³² and the member states over seven years. As far as the EU common funding is concerned, the overall budget for rural development, including “non agricultural” programmes and LEADER+³³, amount to 52.5 billion euros over the seven-year period.

1.5.3.2 The Agenda 2000 mid-term review and the June 2003 reform agreement

The Agenda 2000 included provisions for a mid-term assessment and review. The European Commission published a proposal for reform in January 2003. On 26th June of the same year, an agreement was reached at the European Council level. Official press-releases have described this step as “a real shift in agricultural policy.” One could admit that the agreement represents a further step to breaking with the past policy framework. Some criticisms however have been pronounced over the actual limited “revolutionary” aspect of this reform. These will be shortly discussed in this section.

Decoupling remains a key component of the reform and has been presented by the EU Agriculture Commissioner as the default position around which members states have the freedom to implement various partial decoupling models. For some critics, member states have so much freedom that this could be interpreted as a renationalisation of agricultural policies and as an element that may reduce the positive impact of the reform much sought-for.

The key aspects of the reforms are as follows:

- Single Farm Payment;

³² Initially, the Community's contribution is set not to exceed 50% of total eligible costs and at least 25% for areas covered by Objective 1 and Objective 2. As far as agri-environmental measures are concerned, the contribution was set to be 75% in Objective 1 areas and 50% in other areas. These limits have been increased to 85% and 60%, respectively, by the mid-term reform of June 2003.

³³ Leader+ is one of four initiatives financed by EU structural funds and is designed to help rural actors consider the long-term potential of their local region. Encouraging the implementation of integrated strategies for sustainable development, it has a strong focus on partnership and networks of exchange of experience. The priority themes laid down by the Commission are: (1) making the best use of natural and cultural resources, including enhancing the value of sites; (2) improving the quality of life in rural areas; (3) adding value to local products, in particular by facilitating access to markets for small production units via collective actions; (4) using new know-how and new technologies to make products and services in rural areas more competitive.

- Cross-compliance;
- Degressivity and modulation;
- Rural Development.

These are detailed in the following subsections.

Single Farm Payment

The central key element of the reform is the single farm payment (SFP). This payment will be decoupled from production levels and linked to the total UAA, with reference to 2000-2002 levels of actual aid received by each farmer. It will be introduced in 2005. However, Member States can delay its implementation until 2007. Member States may choose among the following alternatives to the full decoupling scenario:

- keep up to 25% of current coupled arable aid payments OR up to 40% of current durum wheat payments;
- keep up to 50% of current sheep and goat premia;
- keep the current suckler cow premium at 100% and 40% of the slaughter premium OR the current beef slaughter premium at up to 100% OR 75% of the current beef special premium.

Member states can also make supplementary payments (10% of national aid right) at a national or regional level to address the potential negative impacts of decoupling, encourage environmentally friendly farming systems and improve marketing. Payment levels can be calculated nationally or on a regional basis with separate aid rates in each region for grassland and arable land.

The payments will be tied to land use. The production of potatoes, fruit and vegetables is prohibited on land with a SFP entitlement. The reason for this is the apprehension that formerly unsupported crops would be grown on land with support entitlements³⁴.

There will be no reduction in the intervention price for cereals. The increase in dairy quotas scheduled under Agenda 2000 will be delayed by one year. The dairy quota regime will remain in place until 2014-2015. The new dairy aid payment (to be introduced in 2004) will remain coupled until 2008³⁵.

Cross-compliance

Cross-compliance with EU environmental standards is also an important aspect of the reform. Full payment of the SFP and other payments are to be conditional on compliance with a range of statutory environmental, food safety, animal health and welfare standards. In addition, farmers have to maintain land in "good agricultural and environmental condition."

Digressivity and modulation

Under a new mechanism of "financial discipline", direct payments are reduced when the CAP market support budget ceiling is exceeded. Modulation (reduction in direct payments and recycling of funds to rural development) will begin in 2005. It will operate at 3% in 2005, 4% in 2006 and thereafter will be set at 5%. However, farmers receiving less than five thousand euros will be exempt from any cuts.

³⁴ Some mechanisms are set up to take into account land-related transfers and farmers without proven rights linked to aid support in the reference period. Thus, the transfer by sale of SFP entitlements with or without land is allowed. Transfers by lease must be accompanied by an equivalent amount of eligible hectares. A national reserve of SFP entitlements will be established to provide aid entitlements to those unable to establish their eligibility in the reference period.

³⁵ However, member states have the choice of opting for a more rapid decoupling.

Rural Development

The new arrangements for modulation will see approximately nine billion euros available for rural development spending up to 2013. In addition, EU co-financing will increase to 85% in Objective 1 areas³⁶ and 60% elsewhere. A range of new optional measures have also been introduced under the amended rural development regulation including incentive payments for improvements in the quality of agricultural products and insurance schemes, financial support to help farmers meet statutory standards not yet included in national legislation, increased support for young farmers and a new animal welfare scheme.

1.5.4 Policies for livestock breed conservation

Summarising the above sections, the CAP reform of 1992 introduced the three "accompanying measures" (agri-environment, aid for early retirement and afforestation of agricultural land) financed by the EAGGF-Guarantee Section. Agenda 2000 brought together all rural development measures under a single regulation forming what has become known as the second pillar of the CAP. The various market-related CAP regimes and direct aids for farmers constitute the first pillar. All rural development measures, including the previously distinct accompanying measures, have been grouped under the second pillar.

Regulation 2078/1992 is the starting point for AnGR conservation at the CAP level. It is thanks to this common legislation that 253 breeds in member countries could benefit of more than 100 ECU (the then European Currency Unit) on average per LU. Subsequently, Regulation 1467/1994 "on the conservation, characterization, collection and utilization of genetic resources in agriculture"³⁷ established the possibility of applying the principle of subsidiarity to joint 50% funding of projects mainly focusing on ex-situ conservation.

³⁶ Objective 1 has been set "to promote the development and structural adjustment of regions whose development is lagging behind". More information: <http://europa.eu.int/scadplus/leg/en/lvb/g24203.htm>

³⁷ Official Journal L 159, 28/06/1994, 1-10.

Twenty-one projects were financed, sixteen concerning plant genetic resources, four related to AnGR and one to forest resources. AnGR projects focused on database development (notably the EAAP and the FAO DAD-IS databases) and on breed description and inventory. These projects concerned bovine, porcine and rabbit species. The latter two species' projects also included cryopreservation of gametes. The whole programme was funded with twenty million euros and the four AnGR projects were allocated a 22% share. An external audit concluded on the importance of a more even balance between projects on animal and vegetal genetic resources and a greater accentuation on in-situ aspects of conservation strategies.

Assessment of these first projects, and of 1992 policies, reveals that they have enhanced the interest for non-market benefits of livestock breeds. As Yarwood and Evans (2003) put it, “there is a distinct geography of livestock breeds and [...] specific breeds of traditional farm animals can contribute to local identity, culture, landscape character and, in particular, environmental management. [...], policy-makers have only just begun to consider the significance of particular breeds, as opposed to species, of livestock in regional and national countryside management. The importance of establishing this breed – environment link cannot be under-estimated.” Another important aspect of this policy is that support for traditional breeds could help maintain farming in marginal areas.

Presently, livestock breed support is part of the AEP of Regulation 1257/1999. These measures include various actions, such as for instance: (1) the application of organic farming production techniques; (2) the maintenance and increase of soil organic matter; (3) set-aside; (4) extensive pasture management; (5) husbandry with local breeds in danger of extinction; etc. The choice of the set of these measures is left to the member states.

Overall, 67 RD programmes have been approved (Commission of the European Communities, 2003b). The planned expenditure of the EAGGF over the entire period 2000-

2006 amounts to approximately 49 billion euros in total³⁸, of which 13.5 billion euros, i.e. 27.5% of RD, are for AEP³⁹.

Table 1.2 – EAGGF planned expenditure for RDP by main measures 2000–2006 (EU-15)

Measures	Million EUR	Share (%)
Investments in farms	4,682	10%
Young farmers	1,824	4%
Vocational training	344	1%
Early retirement	1,423	3%
Less favoured areas and areas with environmental restrictions	6,128	12%
Agri-environment	13,480	27%
Investments in processing/marketing	3,760	8%
Afforestation of agricultural land,	4,807	10%
Adaptation and development of rural areas	12,649	26%
TOTAL	49,097	100%

Source: European Communities, 2003.

Only 53 out of 67 programmes have included AEP measures. These are formed by a set of sub-measures. Those concerning the conservation of breeds in danger of being lost to farming are a (minor) part of these. Considering commitments made for each project approved in 2001, and only the appropriate annual share of expenditure committed for each project approved or ongoing in 2001 for AEP, overall EU-15 expenditures for AnGR conservation amount to only 0.5% of AEP measures' budget⁴⁰. This average hides large differences. Some Member States have not included measures for the conservation of breeds. For others the share is very small and tends to zero, while it is 3.5% for Spain and 4% for Greece.

³⁸ Here, not all programmed expenditure is included, for example evaluation, technical assistance (in the case of Guidance) and certain commitments relating to the previous programming period. The actual foreseen total implying some RD aspects, including LEADER+, amount to 52.5 billion euros.

³⁹ Source: Commission of the European Communities (2003a).

⁴⁰ Source: Commission of the European Communities, 2003b. These figures include all public expenditure. Average EAGGF Guarantee Section share at the EU-15 level is 54% for AEP and 60% for breed conservation.

Overall, there exist 8,442 contracts concerning more than sixty thousand LU (averaging a bare 7 LU per contract). Average premium per LU is 136 euros, varying from a minimum of 53 euros in France to a maximum of 183 in Austria⁴¹. Average financial support amounts to 977 euros per contract related to breed conservation (compared to approximately 1,580 euros per AEP contract related to other actions). In quantitative terms, breed conservation is a very minor aspect of the second pillar of the CAP.

Table 1.3 – Thresholds under which a local breed is considered as being in danger of being lost to farming

Eligible farm animal species	Number of breeding females ¹
Cattle	7,500
Sheep	10,000
Goats	10,000
Equidae	5,000
Pigs	15,000
Avian	25,000

¹Number, calculated for all EU Member States, of breeding females of the same breed available for purebred reproduction, included in a register recognised by the Member State (e.g. herd book or flock book).

Criteria for eligibility of breeds for community support have been set in Regulation 445/2002 "laying down detailed rules for the application of Council Regulation (EC) No. 1257/1999 on support for rural development".⁴² Article 14 of this Regulation states that "(1) support may relate to the following commitments: (a) to rear farm animals of local breeds indigenous to the area and in danger of being lost to farming; (b) to preserve plant genetic resources naturally adapted to the local and regional conditions and under threat of genetic erosion, and (2) the local breeds and plant genetic resources must play a role in maintaining

⁴¹ As far as RDP and AEP are concerned, Austria is an exception in many respects. For instance, 51% of funds for RDP are for AEP and in this country, contrary to what is common in the EU, the EAGGF Guarantee Section contribute overall more for RDP than for all first-pillar support.

⁴² Official Journal L 074, 15/03/2002,1-34.

the environment on the area to which the measure provided for in paragraph 1 applies.” Population thresholds of eligibility for the livestock breeds are given in Table 1.3. It is seen that these thresholds are much higher than those generally considered a genetically-speaking minimum for endangerment. They are also higher than those of Regulation 2078/1992, and they do not include consideration for the trend in the size of the breed. However, the focus is strongly put on in-situ conservation and husbandry. Thresholds are not defined as genetic “endangerment status” but rather as a danger that a breed may be lost to farming, in viable husbandry. However, to my knowledge, this explanation is not given explicitly.

The degree and way of application of this action has been the object of a research by Signorello and Pappalardo (2003). This research has counted 310 breeds benefiting from support in 69 RDP. The analysis focused on six livestock mammalian species (asses, cattle, goats, horses, pigs and sheep). It highlights that many breeds at risk of extinction (according to the FAO DAD-IS database) are not included in the RDP. The main efforts of the RDP are devoted to preserving local cattle and sheep breeds. The Authors note that the payments offered to farmers fail to consider the different breeds’ extinction probabilities in each country. They also observe that payments do not meet all of the relevant criteria stated in EU Regulations and that in many cases they fail to improve profitability of rearing local breeds.

Preliminary results of ongoing research have confirmed the existence of some contradictory tendencies in the drivers of choices of inclusion of given breeds in RDP (Fadlaoui, 2004). While autochthonous breeds clearly have a significantly greater chance to be included in RDP, decision-making does not appear to be linked to risk of extinction. However, breeds having particular, uniquely interesting characteristics are more likely to be included in such programmes. This seems to confirm findings by Simon (1999), who analysed conservation programmes based on regulation 2078/1992. He concluded that EU conservation

programmes seem to be more focused on future potential and cultural reasons than on extinction risk.

1.6 Two final comments

1.6.1 A comment on the specific impact of the CAP on AnGR in marginal areas

It is argued that the CAP has had definite important impacts on the viability of local, traditional AnGR in marginal rural areas. A contradictory argument that might be opposed is that without the CAP agricultural production and rural livelihood would have disappeared from marginal areas because of competition from imports of produce from outside the EU, and possibly because of changes in society as a whole.

This points out to two important aspects of the issue. It is argued that the CAP has been one of many driving forces behind rural change and it is analysed here in this respect. This does not imply that other forces are not present, but rather that the CAP has largely contributed to, and reinforced, these dynamics. In fact, probably no-one could say with scientific certainty what the past forty years would have looked like had the CAP or similarly oriented agricultural policies not existed, at the community or national level.

It is important to make a distinction between two aspects of the CAP. One concerns protection of prices with respect to world markets and preference for the community. The other has more to do with internal price supports, premia and other measures that are deemed as responsible of many of the dynamics of reduction or even abandonment of given crops and livestock breeds, as well as marginal land and/or "marginal" agricultural systems.

The relevance of the issue is linked to the fact that a budget paradox may well be occurring, whence a relatively minor part of total available funds – which is nonetheless

important in absolute terms – would be (is already being?) spent in order to counter-balance given problems (e.g. loss of AnGR) while at the same time spending from other (larger) shares of the budget is actually (contributing to) engendering the problem.

The impact of present reforms is argued to be relatively limited. There is an historical path-dependency and an issue of governance with respect to farming lobbies that shall be discussed in the following.

Environmental regulation has been introduced into agricultural policies since the mid-1980s. These were mainly based on regulatory measures establishing limitations on nitrates and farm wastes. As Latacz-Lohmann and Hodge (2003) have described, early efforts to extend these measures to other emerging issues such as wildlife protection, biodiversity conservation and avoidance of habitat destruction failed. Regulation on these issues were regarded by farmers as an infringement of their property rights. Farmers were successful in obtaining compensation on the basis of profits foregone.

Latacz-Lohmann and Hodge (2003) argue that in the case of the UK nature conservation agencies this approach was criticised because it put on these agencies the burden of payments for agricultural subsidies forgone. At the same time, they say, this provided motivation for them to lobby for agricultural policy reform. It can be claimed that the recently growing accent on cross-compliance is at least partly an outcome of such tendencies. The Authors trace back to this dynamic the emergence of the idea of establishing voluntary contracts which, rather than compensating farmers for restraining from practices considered as damageable for the environment, would pay them to produce environmental amenities. This can be seen as a gradual reallocation of property rights. However, they argue, it is not only unlikely than cross-compliance be used widely, but its use can also be questioned in principle. Its development may be seen as legitimising CAP support and as hindering the search for more cost-effective agri-environmental approaches.

Some authors affirm that the shift in agricultural policies is a relatively major change (Dunne and O'Connell, 2004). However, it could certainly be agreed that the pace of change is slowed by powerful lobbying interests. According to some analysts, change is inevitable and "revolutionary". Suggestions typically plea for a greater link of subsidies to the production of public goods or "environmental amenities" (Gaspart, 2004).

It is uncertain whether policy reforms will become more and more "fundamental" and widespread. As Latacz-Lohmann and Hodge (2003, p. 133) say: "Past experience should not make us too optimistic". Agri-environmental policies' EU expenditure is still limited to a share of 3.5% of CAP budget, with all rural development measures totalling about 13% of it.

It is not clear if the environmental stewardship and rural development approach will continuously be restricted to some "marginal areas" and limited to a minor share of the total agricultural and rural development budget in the future, as it has been documented to be the case in the present chapter. This would relegate some "marginal" farmers to the role of "landscape managers", paid for environmental services rather than agricultural production, while most of the agricultural land would still be used intensively and absorb the largest share of community and member-state support. It is here deemed uncertain that this approach would suffice to reverse the trend of livestock biodiversity erosion.

1.6.2 A comment on livestock breed conservation

The World Conservation Monitoring Centre (1992) states that "a breed can be conserved (a stock maintained which continues to represent the foundation stock without too much genetic drift or inbreeding) for surprisingly small cost compared with possible economic benefits". Smith (1984, cited in Tisdell, 2003) demonstrates that the net economic benefits of conserving livestock breeds can be very great. According to Tisdell (2003), Simianer et al. (2003) and others, it is unlikely to be economical to conserve all breeds. It is argued that this

is an opinion that only seems to have factual value because it is commonly shared by economists and other scholars. However, to my knowledge, no evidence-based demonstration of this is found in the literature. This seems obvious, since no strictly empirical scientific experiment can be straightforwardly designed. The issue is infinitely complex and would require that total public spending in all policies as well as the evolution of preferences (Norton, Costanza and Bishop, 1998) and institutions (Granovetter, 1985; 1990) be considered, too.

The view expressed here is rather the opposite, namely that all breeds can be conserved, and that this can be desirable from many points of view, including the consideration of those non-expressed preferences of future generations that society may wish to take into account to act on the basis of the precautionary principle.

Conservation through allocation of ad hoc policy funds is but one way to preserve breeds. In addition other means could be used, for instance voluntary approaches developing market niches and special marketing channels that have on some occasions proven effective (e.g. Verhaegen and Van Huylbroeck, 2001; Stassart, 2001). The market is here considered as embedded in society, an institution that can be considered to be the base of society and yet remains "a realm of social action" (Biesecker, 1997). Thus, it is argued, within the temporal long-time frame of issues such as biodiversity loss, one appropriate approach would be to set the goal of conserving all breeds as a first step. A second step would then be to research and creatively develop solutions to take the most effective action possible to achieve this goal.

Chapter 2

THE DATASETS: COUNTRIES, BREEDS AND FARMS

2.1 Introduction

As it has been said, this Thesis is part of a larger research project, ECONOGENE, on the conservation of sheep and goat biodiversity and their importance for rural development in European rural marginal areas.

In the present chapter, a descriptive overview of the datasets of primary and secondary data used in the project is provided. There are three datasets in the ECONOGENE project. Two concern the breeds that have been object of the genetic analysis. Of these, one is not discussed here. It contains data generated within the project on genetic distances (based on molecular markers as microsatellites and AFLP). The second one is presented here and has data on breeding animals, phenotype, typical management conditions and some production data and other characteristics of each breed. The geographic distribution of breeds has also been recorded at the EU-15 level.

The third database described here is made up of the results of a broad survey of 779 farms rearing these breeds in ten EU-25 countries and seven non-EU countries⁴³. The EU countries covered in the survey are Austria (AT), Germany (DE), Spain (ES), France (FR), Greece (GR), Hungary (HU), Italy (IT), Poland (PL), Portugal (PT), and the United Kingdom (UK). Of all farms, 75% (i.e. 587 farms) were in EU-25 countries. The reason for this is the fact that one of main the objectives of the research focused on agricultural policies at the EU level.

⁴³ Albania, Switzerland, Egypt, Jordan, Romania, Saudi Arabia and Turkey.

Non-EU countries were mainly introduced in order to study linkages and geographic (and historical) patterns of sheep and goat breed genetic diversity.

The rest of this chapter is formed of three sections. In section 2.2, a brief overview of EU-15 ECONOGENE countries is given. In section 2.3, the breeds studied under the framework of the ECONOGENE project are described. In section 2.4, a thorough descriptive analysis of farms' characteristics based upon the usable dataset is given. Section 2.5 gives a short conclusion and a brief overview of further analysis in following chapters.

2.2 The countries

This section is limited to EU-15 countries, a major focus of the research, with especial emphasis on common agricultural policies and rural development programmes that have been applied so far to them alone. Besides, consistent data for comparison was directly and reliably available from EUROSTAT⁴⁴. In the rapidly changing agricultural context of Hungary and Poland, the two newcomers among the EU-25 ECONOGENE countries, hardly any data is available.⁴⁵ We hence focus on the countries Austria, Germany, Spain, France, Greece, Italy, Portugal and the United Kingdom.

From Table 2.1 it appears clearly that there exist large differences between countries in the use of land and stocking densities. Grassland area as a proportion of total area varies from just 10% for Portugal to over 40% in the UK. Grassland as a proportion of UAA varies from 24% in Spain and Portugal to 60% of UAA in the UK.

Stocking densities can be expressed per hectare of UAA and per hectare of grassland. Typically, both are used and convey an idea of the degree of intensification of animal rearing. A high stoking density per hectare of grassland imply a greater need for external sources of

⁴⁴ All data cited here is from version 2 of database "Regio" (2002), <http://europa.eu.int/comm/eurostat/>

⁴⁵ The most recent but still incomplete data would be six years old and more and is not suitable for this analysis.

animal feed and is commonly held to be an appropriate indicator of level of intensification in husbandry. Of course country level comparability is limited by the fact that the different productivity of land in different regions is not taken into account. However, this indicator can provide a useful general picture of land use in agricultural systems.

Stocking densities of sheep, goats, cattle and pig are at the lowest in Greece, just above one livestock unit (LU) per hectare of grassland, being more than three LU per hectare of grassland in Germany.

Table 2.1 – Land use and stocking densities in ECONOGENE EU-15 countries

Country	UAA (1000 ha)	Arable land (% of UAA)	Grassland (% of UAA)	Total area (1000 ha)	Farm animals* 1000 LU	LU/ha UAA	LU/ha grassland
AT	3,411.3	41%	57%	8,385.8	2,469.9	0.72	1.27
DE	17,373.1	68%	30%	35,702.8 ²	17,025.1	0.98	3.23
ES	25,728.6	57%	24%	50,488.7	11,399.9	0.44	1.83
FR	29,921.1	61%	35%	54,908.7	20,848.6	0.70	2.00
GR	5,109.2	44%	35%	13,195.7	2,049.6	0.40	1.15
IT	15,364.6	54%	28%	30,133.7	8,832.9	0.57	2.03
PT	3,770.6	55%	24%	9,191.0	1,873.2	0.50	2.07
UK	16,491.6	40%	60%	24,382.0	13,457.5	0.82	1.36
EU-15	133,258.6	57%	35%	323,999.8	100,932.3	0.76	2.18

Source: EUROSTAT, 2002, data 1998; ¹1996; ²1997. UAA utilised agricultural area; LU livestock units.

* Farm animals here include sheep, goats, cattle and pigs.

Table 2.2 – Numbers and relative importance of farm animals in ECONOGENE EU-15 countries

Country	Within country %		sheep		goats		cattle		Dairy cows		pigs	
	sheep	Goat	1000 LU EU-15	% of EU-15	1000 LU EU-15	% of EU-15	1000 LU EU-15	% of EU-15	1000 LU EU-15	% of EU-15	1000 LU EU-15	% of EU-15
AT	1%	0.2%	36.1	0%	5.4	0%	1715.1	3%	728.7	3%	713.3	3%
DE	2%	0.1%	287	3%	12.5	1%	11638	18%	4833	22%	5087.5	21%
ES	21%	2.0%	2419	24%	259.7	22%	4446.5	7%	1308.4	6%	4274.7	18%
FR	5%	1.0%	955.3	10%	108.7	9%	16768	25%	4432	21%	3017.1	13%
GR	43%	26.0%	882.3	9%	537.7	46%	449.4	1%	172	1%	180.2	1%
IT	12%	2.0%	1,089.4	11%	133.1	11%	5742.6	9%	2116.2	10%	1867.8	8%
PT	19%	4.0%	352.0	4%	79.6	7%	1001	2%	355	2%	440.6	2%
UK	23%	0.1%	3,108.0	31%	8	1%	8901.4	13%	2474.6	12%	1440.1	6%
EU-15	10%	1.0%	9,905.7	100%	1161.9	100%	66086	100%	21496	100%	23779	100%

Source: EUROSTAT, 2002, data 1998; LU livestock units. Second and third column, relative importance of sheep and goats within each country

Similarly, large differences exist with respect to the relative importance and the abundance of sheep and goats in each country (Table 2.2). Relative importance of sheep and goats for each country has been assessed on a partial total, due to lack of data. Thus, total of farm animals in both Table 2.1 and Table 2.2 is to be understood as the sum of the four major species in animal husbandry, namely sheep, goats, cattle and pigs, in terms of livestock units. Relative to the total of these four species, the percentage of sheep varies in a range from 1% for Austria to 43% for Greece. The latter country also has the largest EU-15 share of goats, 46%, while this species is virtually absent from Austria, Germany and the UK. Goats also account for 26% of the total of the four species in Greece. Conversely, cattle are largely the most important of the four species in Austria (69%), Germany (68%), France (80%), Italy (65%) and the UK 65%. In the latter country, though, sheep account for 23% of the four species' contribution to animal husbandry. In fact, the UK has the largest EU-15 share of sheep, 31%.

2.3 The breeds

The ECONOGENE Project studied 45 goat and 56 sheep breeds in seventeen countries. These are so diverse as the UK and Jordan, Portugal and Poland. The same outstanding diversity is found in the characteristics of the breed, their average production potentialities, their numbers, and so forth. For instance the number of breeding females ranges from just about 120 for one Austrian goat breed, the Pinzgauer, to well over six million for the Greek goat. Data availability also varied, and for instance the figure cited for the Pinzgauer refers to the year 1999 while for the Greek goat it goes back to 1986.

Table 2.3 and Table 2.4 show the number of breeds in all EU countries, as well as in the nine EU-25 ECONOGENE countries, by status of endangerment.

Table 2.3 – Sheep and goat breeds in ECONOGENE EU-25 countries and in the whole EU-25, by endangerment status

Endangerment status	Number of goat breeds				Number of sheep breeds			
	ECONOGENE COUNTRIES		EU-25		ECONOGENE COUNTRIES		EU-25	
	N	%	N	%	N	%	N	%
Critically endangered	6	5%	7	4%	7	2%	10	2%
Potentially endangered	4	3%	5	3%	20	6%	27	6%
Endangered	1	1%	1	1%	6	2%	7	2%
Minimally endangered	4	3%	5	3%	4	1%	5	1%
Not endangered	26	21%	33	21%	125	39%	148	33%
Missing data	14	11%	14	9%	18	6%	22	5%
Not defined	67	55%	93	59%	144	44%	231	51%
TOTAL	122	100%	158	100%	324	100%	450	100%
Subtotal endangered	15	37%	18	35%	37	23%	49	25%

Source: EAAP database, accessed 15/07/2004

Table 2.4 – ECONOGENE breeds in EU-25 and EU-15 countries, by endangerment status

ECONOGENE breeds Endangerment status	Number of goat breeds				Number of sheep breeds			
	EU-25		EU-15		EU-25		EU-15	
	N	%	N	%	N	%	N	%
Critically endangered	1	4%	1	4%	0	0%	0	0%
Potentially endangered	1	4%	1	4%	0	0%	0	0%
Endangered	0	0%	0	0%	1	3%	1	3%
Minimally endangered	0	0%	0	0%	2	5%	1	3%
Not endangered	10	40%	10	40%	26	65%	19	59%
Missing data	2	8%	2	8%	2	5%	5	16%
Not defined	11	44%	11	44%	9	23%	6	19%
TOTAL	25	100%	25	100%	40	100%	32	100%
Subtotal endangered	2	17%	2	17%	3	10%	2	10%

Source: EAAP database, accessed 15/07/2004, and ECONOGENE Consortium, 2002-2003

Breeds in Table 2.4 include four goat and two sheep breeds that are national "variants" of the Alpine goat and the Merino sheep cosmopolitan breeds: the French, German, Italian and Polish Alpine goat breeds and the German and Hungarian Merino sheep breeds. These breeds are considered non autochthonous (the Spanish Merino sheep breed is considered as autochthonous in Spain). However, the endangerment status of the German and the Italian

Alpine are also defined (as not endangered) in the EAAP database⁴⁶, as opposed to non autochthonous breeds in general, for which the status is not defined. Taking this in consideration, the figure for endangered goat breeds excluding the Alpine and Merino breeds from the data in Table 2.4 is 20% rather than 17%. In comparison, 10% of ECONOGENE autochthonous sheep breeds are endangered.

Table 2.5 – ECONOGENE sample of sheep and goat breeds, selected breeds as percent of total number of breeds in selected EU-25 countries

Endangerment status	Number of breeds in the selected countries (A)	Selected breeds as % of (A)		
		Both species	Goats	Sheep
Endangered (potentially to critically)	52	8%	13%	5%
Not endangered	151	19%	35%	16%
Subtotal autochthonous breeds	203	16%	27%	14%
Total including missing data on status	446	12%	18%	10%

Source: EAAP database, accessed 15/07/2004, and ECONOGENE Consortium, 2002-2003

Table 2.5 shows the percent of breeds covered by the ECONOGENE sample in the countries of the EU-25 where the project has been carried on. It is to be noticed that numbers in this table differ slightly from those in the other tables. This is because, in order to assess the sampling coverage of the project, only those breeds that are in the EAAP database are included here, and not those studied in the project that are not in the database. It is maintained that showing data in both ways allows presenting a more detailed picture of the sample.

As it appears from the data, the sampling in the project is asymmetric with respect to the endangerment status. This is explained by the fact that breeds were selected trying to balance different objectives of the analysis of their genetic diversity as well as their geographic dispersion, their relationship to the environment and a series of other parameters and not exclusively for issues of biodiversity loss.

⁴⁶ Online at <http://www.tiho-hannover.de/einricht/zucht/eaap/> accessed 30/06/2004 (cf. Chapter 1)

Table 2.6 – Number of ECONOGENE sheep and goat breeds, by country

Country	Goat breeds		Sheep breeds	
	EU-25	Non EU-25	EU-25	Non EU-25
Albania		6		3
Austria	2		0	
Egypt		1		1
France	4		1	
Germany	2		4	
Greece	2		10	
Hungary	0		4	
Italy	8		5	
Jordan		1		1
Poland	1		6	
Portugal	1		1	
Romania		1		4
Saudi Arabia		2		3
Spain	5		5	
Switzerland		5		0
Turkey		4		4
UK	0		4	
Subtotal	25	20	40	16
TOTAL	101 breeds	45 goat breeds	56 sheep breeds	

Table 2.6 shows the number of sheep and goat ECONOGENE breeds by country. The complete list of breeds is found in Appendix 1.

2.4 The farms

The total dataset of surveyed farms consisted of 779 farms in seventeen countries, 587 farms in ten EU-25 ones and 192 farms in seven non-EU ones. The original idea in the project was to interview 11 farms per selected breed. Because of non-responses, we deviated from that rule so that on average 9.7 farms were interview per breed. The analysis of the farm dataset focuses on EU-25 countries, plus one non-EU country which is near accession into the EU, Romania. The usable dataset consists of 604 farms (53 of which are in Romania), that is 94% of the total collected data for these countries. Surveyed farms are not evenly distributed across all countries. A greater focus was on Mediterranean countries. Greece alone, with 130

farms accounted for 20% of all farms in the dataset, with Greece, Italy and Spain together accounting for 50% of it (Table 2.7).

Table 2.7 – Number and proportion of farms in the dataset, by country

Country (ISO codes)	EU-25 + Romania	Country as % of total	Usable dataset	Country as % of total usable dataset
Austria (AT)	17	3%	16	3%
Germany (DE)	59	9%	55	9%
Spain (ES)	90	14%	90	15%
France (FR)	41	6%	38	6%
Greece (GR)	130	20%	130	22%
Hungary (HU)	21	3%	16	3%
Italy (IT)	97	15%	97	16%
Poland (PL)	69	11%	65	11%
Portugal (PT)	19	3%		0%
Romania (RO)	53	8%	53	9%
United Kingdom (UK)	44	7%	44	7%
Total	640	100%	604	100%

This Southern bias can be explained by three main factors. Firstly, these Southern countries are home to a larger number of sheep and goat breeds and even more so, to a larger number of farms whose main agricultural activity is sheep and/or goat husbandry. As seen above (Table 2.2), Greece has the largest EU-15 share of goats (46%). Greece, Italy and Spain together have a share of 48% of the two small ruminant species combined.

A quantitative representative sample, though, was not the main objective of the project. The other two factors are linked to the project’s main objectives. On the one hand, a major focus of the project was on genetic diversity, and its geographic dispersal, with the intent to study its dynamics. One hypothesis is the common southern origin of sheep and goats. This was the overall major drive for the choice of breeds in the project, as discussed earlier. On the other hand, another important aim of the research was to analyse the relevance of husbandry based on local, traditional sheep and/or goat breeds as a (possibly major) contribution to rural

development in marginal areas. Although it is surely arguable that all EU countries, including Northern ones, have areas that are marginal, there is a general EU policy focus on peripheral marginal areas of Europe, and more particularly on the Southern periphery.

The questionnaire was translated in the national languages and submitted to farmers in face-to-face interviews. These were held at the same time as sampling animals for molecular genetics analysis, between the first half of 2002 and the second half of 2003.

The questionnaire was divided into three parts. The first aimed at collecting data on the location of the farm using global positioning system (GPS) data, the practice and location of transhumance (if applicable), and similar data. The second part consisted of questions on the farm and family structure, employment, work force, presence of a successor, revenues, subsidies, etc. It collected data on size, ownership of land, tractor and other capital endowments, structure of land use and production. Data gathered also included the type of sheep and/or goat breeding activities, marketing strategies for the products, as well as participation in farmers' associations, education programmes, and so forth.

The third part of the questionnaire concerned the sheep or goat breed found on the farm. In some (rare) cases, husbandry based on the breed on which the research focused was not the most important activity of the farm or the breed/species reared was not the most important animal species or breed.

Data collected in this part of the survey, though, only concerned the breeds studied in the project. This part of the questionnaire was mainly of relevance for the animal husbandry component of the larger ECONOGENE project and is not analysed in detail here, with the exception of a few variables, such as importance of type of production (milk, meat, wool, etc.), the trend in the stock of animal of the breed, the number of years since the breed was present on the farm, as well as the total number of animals present on the farm at the time of the interview. The entire questionnaire is provided in Appendix 2.

Table 2.8 provides a list of the breeds found on these farms, by country, indicating the number of farms in the dataset which raise each breed.

Table 2.8 – List of breeds on the farms in the dataset, number of farms by country

Country	Goat Breed	N	Country	Sheep Breed	N	Country	Sheep Breed	N
AT	Pinzgauer	8	FR	Thones et Marthod	11	PL	Kamieniec	10
AT	Tauernschecken	8	DE	German Grey Heath	9	PL	Polish Heat	11
FR	Corsican	9	DE	German Merino	9	PL	Polish Merino	11
FR	Pyrenean	9	DE	Rhoensheep	7	PL	Polish Mountain	11
FR	Rove	9	DE	White/Brown Mountain Sheep	11	PL	Pomeranian	11
DE	German Alpine	11	GR	Skopelos	11	PL	Zelazna	1
DE	Thuringian Forest Goat	8	GR	Anogeiano	11	RO	Tsigaia	10
GR	Greek Goat	11	GR	Kalarritiko	11	RO	Black Karakul	10
GR	Skopelos	11	GR	Karagouniko	11	RO	Transylvanian Merino	11
IT	Argentata dell'Etna	11	GR	Kefalleneas	9	RO	Turcana	11
IT	Bionda dell'Adamello	11	GR	Kymi	11	ES	Colmenareña	10
IT	Camosciata delle Alpi	10	GR	Lesvos	11	ES	Manchega	10
IT	Girgentana	8	GR	Orino	11	ES	Rubia del Molar	4
IT	Grigia molisana	6	GR	Pilioritiko	11	ES	Segureña	10
IT	Orobica	11	GR	Sfakia	11	ES	Spanish Merino	10
IT	Valdostana	11	HU	Cikta	1	UK	Exmoor Horn	11
PL	Polish Fawn Coloured Goat	10	HU	Hungarian Merino	11	UK	Scottish Blackface	11
RO	Carpathian	11	HU	Magyar Racka	2	UK	Swaledale	11
ES	Cabra del Guadarrama	10	HU	Tsigaia	2	UK	Welsh Mountain	11
ES	Florida	6	IT	Altamura	1			
ES	Malagueña	10	IT	Gentile di Puglia	4			
ES	Payoya	10	IT	Laticauda	3			
ES	Verata	10	IT	Pecora Bergamasca	10			
			IT	Pecora delle Langhe	11			

2.4.1 General aspects

Overall, 84% of farms rear an autochthonous breed. In 65% of cases, these concern breeds with less than ten thousand breeding females. This is relevant, as it is one of the EU

criteria for a breed to be eligible for conservation premia within rural development agri-environmental measures (see Chapter 1). On average, more farms in our sample rear sheep compared to goat breeds (Figure 2.1). This is consistent with the fact that there are more sheep than goats in Europe (100 million sheep and 12 million goats in the 25 EU countries⁴⁷) and that the project covers more sheep breeds (43) than goat breeds (23) in the relevant countries. Approximately a quarter of farms in the dataset rear both species, while 29% also have cattle. However, this conceals quite large differences between countries. Data for each country is shown in Table 2.9 and Table 2.11 (p. 49).

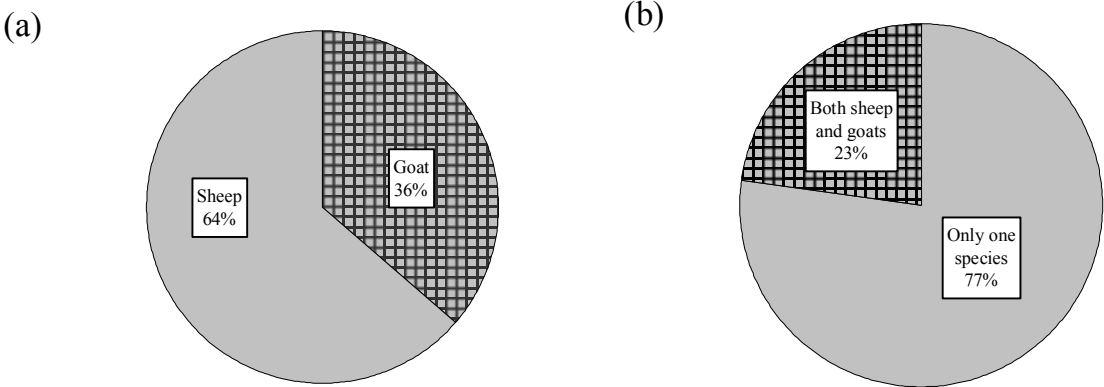


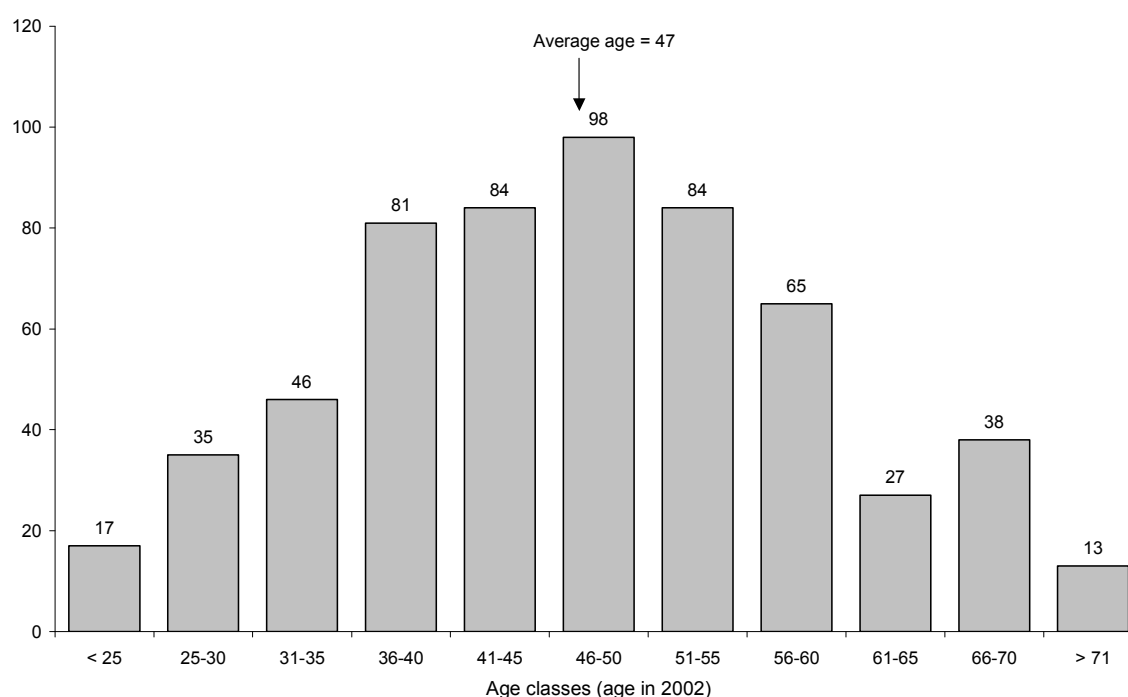
Figure 2.1 – Percent of farms (a) by focus breed and (b) rearing one or both species

It is apparent from these figures that almost all breeders also breed other animals besides sheep and/or goats, with the exception of the absence of pigs in France and the UK, and the relatively small number of farms having pigs in Greece or other farm animals in Spain. Also interesting to notice, in the latter category a large variety of "other animals" are kept, from chicken to geese and from horses to bees, rabbits, etc.

⁴⁷ Data of year 2002 from <http://faostat.fao.org>, database accessed on 15/07/2004.

Table 2.9 – Number and percent of farms rearing different animal species, by country

Country	Sheep		Goat		Country	Sheep		Goat	
	N	%	N	%		N	%	N	%
AT			16	100%	IT	29	30%	68	70%
FR	11	29%	27	71%	PL	55	85%	10	15%
DE	36	65%	19	35%	RO	42	79%	11	21%
GR	108	83%	22	17%	ES	44	49%	46	51%
HU	16	100%			UK	44	100%		

**Figure 2.2 – Distribution of the age of the farmer**

The average age of the farmer is 47 years old (age in 2002). Excluding the extreme case of a 97-year-old person still (officially, at least) being the owner of one Italian farm, the range from the youngest to the oldest farmer was comprised between 18 and 81 years old. Table 2.10 shows the age structure of farmers in each country, as well as the proportion of farmers older than 45 and older than 60. For the latter, data was gathered to know if they had a successor for the farm.

Table 2.10 – Age of farmers (years) and percent of farmers older than sixty having a successor

Country	Youngest	Average	Oldest	% of farmers > 45 y. o.	% of farmers > 60 y. o.	
					On total	With successor
AT	24	43	70	38%	13%	50%
DE	29	46	69	55%	13%	29%
ES	24	47	81	62%	17%	60%
FR	19	45	69	53%	8%	0%
GR	24	49	79	65%	25%	44%
HU	27	48	66	69%	8%	100%
IT	19	46	97	52%	19%	56%
PL	21	48	71	71%	12%	86%
RO	18	46	73	55%	19%	60%
UK	33	52	70	82%	18%	100%
All countries	18	47	97	61%	17%	55%

Table 2.11 – Percent of farms rearing different animal species, by country

Country (ISO codes)	Sheep	Goats	Both sheep and goats	Cattle	Pigs	Other animals
AT	38%	100%	38%	50%	25%	69%
DE	76%	47%	24%	22%	25%	31%
ES	53%	55%	8%	9%	8%	1%
FR	61%	76%	37%	8%	0%	16%
GR	90%	42%	32%	4%	1%	2%
HU	100%	13%	13%	31%	13%	25%
IT	68%	81%	49%	37%	30%	45%
PL	86%	20%	6%	52%	40%	20%
RO	83%	21%	4%	49%	62%	58%
UK	100%	0%	0%	82%	0%	9%
Total	76%	46%	23%	29%	19%	22%

Overall, 17% of farmers were older than 60. Of these, on average, 45% did not have a successor for the farm. This is a figure that varies considerably between countries, with no farmers who are older than 60 in France having a successor, while 100% of them had one in Hungary and the UK.

2.4.2 Revenues, size and other production data

As Table 2.12 shows, 38% of farmers have some other income-generating activities outside the farm. Half of these part-time farmers have more than 50% of their income from

these outside sources, and 30% of them get at least three quarters of their income from off-farm activities. Again, this picture is varied across Europe, and the percent of part-time farmers getting half or more of their income outside the farm ranges between 9% (UK) and 83% (Italy).

Table 2.12 – Off-the-farm income generating activities and part of revenues thereof

Country	Percent having off-farm activities	N of farms w/out off-farm activity	N of farms by class of revenues originating off-farm			
			< 25%	25-50%	50-75%	75-100%
AT	93%	1	7	1	2	4
DE	78%	12	7	10	6	20
ES	25%	63	4	5	6	6
FR	45%	21	4	2	2	9
GR	31%	90	20	14	5	1
HU	31%	11	1	3	0	1
IT	30%	68	2	3	6	18
PL	20%	52	5	2	4	2
RO	62%	20	9	3	16	5
UK	25%	33	9	1	0	1
ALL	38%	371	68	44	47	67

Off-farm activities include commerce, agriculture (on other farms), off the farm tourism-related activities or contracts as employee. The category "other" covers more than one third of non-missing data. The latter, however, account for 59% of this variable. Given that, any definitive conclusion on the branch attracting most off-farm activity is hindered. Tentatively, it might be said that the relative abundance of "other" and "employee" responses may signify that farmers either look for varied, irregular activities, possibly in seasons that are less demanding relative to on-farm work, or they may seek the (perceived) stability and feeling of safety provided by a contract as employee.

The proportion of farmers having other sources of income outside the farm varies largely, between a minimum 20% in Poland to an impressive 93% in Austria. The high proportion of

off-farm income-generating activities in this country and in Germany is partly due to the relative abundance of hobby breeders (Germany).

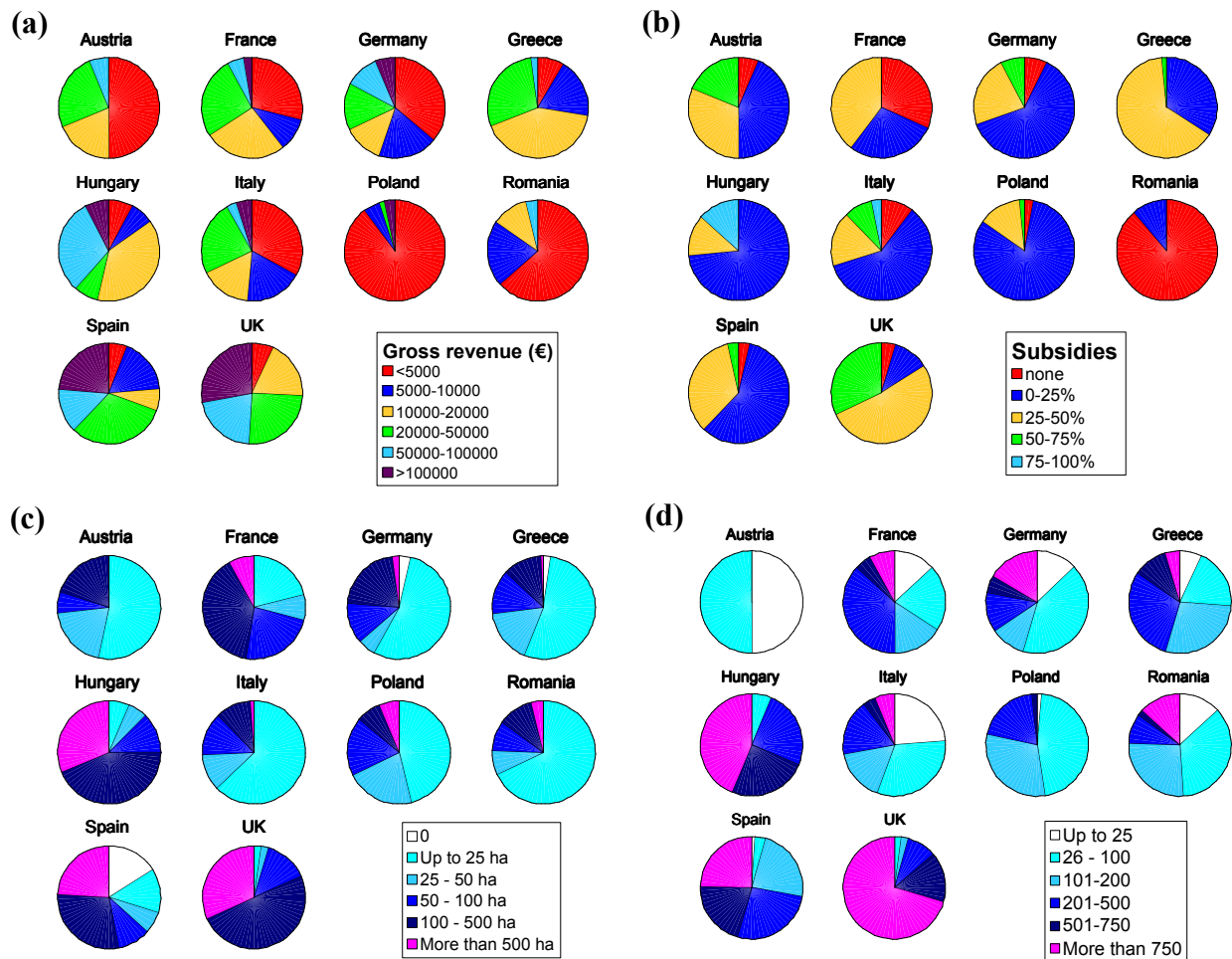


Figure 2.3 - Pie charts of classes of (a) gross revenues, (b) percent revenues from subsidies, (c) Utilised Agricultural Areas and (d) number of animals of sheep and goat breeds, by country

In some countries, the studied breeds are relatively marginal even within those farms raising them (e.g. Austria). In fact, 13 Austrian farms out of 16 derive their major source of revenues from "other animal products" (cf. Table 2.14 p. 53). This is confirmed by data in

Table 2.11. In Austria, 50% of farms also raise cattle, 25% pigs and 69% of farms also breed other animal species.

Figure 2.3 (a) shows the proportion of farms by classes of declared total revenues. The comparison between the different countries is somewhat restricted by the need for the same questionnaire to be submitted in each of them. Thus, it is evident that farms in Poland and Romania have a much smaller revenue and at the same time much smaller costs (including farm operating costs as well as the cost of living) than Germany, for instance.

Table 2.13 – Number of farms and percent income originating from the major source of income

Source of income (A)	Number and %of farms for which (A) is the major source of income		Average % of income
Goat milk	122	21%	69
Goat meat	27	5%	70
Sheep milk	127	21%	58
Sheep meat	168	28%	78
Sheep wool	2	0.3%	75
Crops	49	8%	58
Other animal products	82	14%	70
Other products	15	3%	59
TOTAL	592	100%	68*

* This is to be interpreted as the average percent of revenues originating from the major source of revenues, with respect to all the other sources of revenues for the "average farm" across all countries.

Two thirds of farmers in Austria, France, Germany, Greece and Italy declared a total revenue smaller than 20,000 EUR per year. Spain, Hungary and the UK show a different picture, consistent with data shown in pie charts of Figure 2.3 (c) and (d). In fact, very large farms are present in these three countries. Looking at the correlation between revenue and size as measured by area or number of sheep and goat animals on the farm, a chi-squared test of independence has shown a very significant link between these variable, with p-values much smaller than 0.0001 for all crosstabulations.

Larger farms also apparently get a larger share of their total revenues from subsidies, as it can be seen in Figure 2.3. In the UK, for instance, about one third of farmers obtain from subsidies about 50 to 75% of their revenues from subsidies.

From Table 2.13 it can be noticed that a quarter of all farms in the dataset have other products, animal or else, as their major source of revenues. In average, when these sources are the largest share of their income, they can get from 58% to 70% of their revenue from other sources than sheep and/or goats.

Table 2.14 – Number of farms by major source of income, by country

Country	<i>N farms, total</i>	Crops	Goat milk	Goat meat	Sheep milk	Sheep meat	Sheep wool	Other animal products	Other products
AT	16	0	1	2	0	0	0	13	0
DE	55	3	11	0	0	21	0	8	6
ES	90	3	39	1	16	24	0	5	1
FR	38	0	14	5	3	11	0	2	1
GR	130	11	21	2	84	10	0	0	0
HU	16	1	0	0	1	8	1	4	1
IT	97	6	17	17	11	21	0	22	2
PL	65	12	9	0	0	37	0	6	1
RO	53	13	10	0	12	12	0	4	2
UK	44	0	0	0	0	24	1	18	1

For instance, in Austria and the UK 81% and 43% of farms, respectively, have as their most important source of revenues other activities and products than sheep and/or goat (Table 2.14). This may suggest that these marginal, "minor" breeds are also "marginal" within the structure of production of those farms which do actually rear them. Conversely, this may also account for the fact that these farms operating in marginal regions diversify much more their production in order to be viable. Finally, farmers may assess the relative importance of their revenues from, e.g., maize crops by including subsidies. This may well be the case for the UK, when one compares with the data in Figure 2.3. On average, though, 75% of farms have

sheep and/or goat products as their major source of revenues (on 592 farms with non missing data for these variables). Overall, 50% of farms have sheep and/or goat products as the unique source of revenues.

2.4.3 *Farmers' associations, marketing strategies, development of activities*

Different strategies can be adopted to enhance the viability or the ability to find solutions to the particular problems of this type of animal breeding. These strategies include farmers' associations, marketing strategies, education and training, etc. 80% of all farmers belong to some sort of farmers' association. Their typical activities are shown in Table 2.15. Not surprisingly, most of them either focus on animal production, or are farmers' unions, or both.

Many farmers also implement some kind of marketing strategies for at least some of their products (Table 2.16). They also may participate in information or education programmes on this type of animal breeding (sheep/goat/traditional breeds). Contrary to all other variables, here some difference is found between farmers rearing autochthonous and those rearing non-autochthonous breeds, with the latter showing a larger participation in education programmes (with the exception of Hungary) and especially adopting relatively more marketing strategies.

Table 2.15 – Number and percent of farms by type of farmers' association

Type of association	N	%
Plant production	7	1.5%
Animal production	174	36.6%
Farmers' union	193	40.6%
Animal production and farmers' union	80	16.8%
Plant production and farmers' union	1	0.2%
Plant production and animal production	17	3.6%
Plant production, animal production and farmers' union	3	0.6%

Using the data on the relative importance of various animal productions, such as sheep milk, meat or wool, and/or goat milk or meat, a derivate variable was constructed, showing that 44% of breeders of autochthonous breeds and 83% of breeders of non-autochthonous breeds have ad hoc marketing strategies for the most relevant production of their breed.

Table 2.16 – Percent of farms using some kind of marketing strategies and participating in ad hoc education programmes, by country and breed origin

Country	Use of at least one type of marketing strategies for:				Participation in ad hoc education programmes	
	at least one product		the main type of product		A	N_A
	A	N-A	A	N-A		
AT	94%		69%		38%	
DE	61%	81%	38%	74%	25%	52%
ES	18%	90%	16%	60%	84%	90%
FR	61%		50%		45%	
GR	18%		16%		53%	
HU	60%	100%	40%	100%	60%	45%
IT	78%	100%	74%	100%	53%	90%
PL	79%	82%	79%	82%	77%	86%
RO	98%	100%	79%	100%	33%	45%
UK	52%		43%		36%	
All countries	51%	88%	44%	83%	54%	67%

A: autochthonous breeds; N-A: non autochthonous breeds

Farmers were also asked the following question: "How do you see your agricultural activity developing in the next 10 years?" Table 2.17 show results concerning the breeding of traditional goat/sheep breeds present on the farm. Most farmers (58%) foresee that they will continue the activities as presently, while 9% would reduce and 2% abandon. Of the latter 13 farmers, four are older than sixty and without a successor. Of these four, two are in Greece and two in Italy. The latter two raise the Girgentana goat breed, an endangered breed. However, no significant correlation exists between the future of activities with traditional breeds and a given breed or set of farm characteristics. Not surprisingly, no farmer who is

older than sixty and has no successor for the farm considers expanding activities. However, while 13 of them either reduce or abandon, mostly because they abandon farming, 17 declare they will continue as in the present situation for the next 10 years.

Again, there are some differences between countries, with 16%, 17% and 14% of farmers in Spain, Greece and Italy, respectively, either reducing or abandoning traditional-breed related activities, while this figure is less than 5% in France, Hungary and Poland, and no farmer reduces or abandons local sheep/goats in Austria. It is interesting to notice that Spain, Greece and Italy are also the three countries having the largest proportion of farmers with no off-the-farm income generating activities (more than 65% of farmers, Table 2.12).

Table 2.17 – Future of breeding of traditional breeds on the farm, by country

Country	Abandon	Reduce	Continue as now	Expand
AT	0	0	12	4
DE	1	3	39	11
ES	2	12	38	38
FR	1	1	19	17
GR	6	15	73	32
HU	0	1	11	4
IT	3	11	51	32
PL	0	2	55	8
RO	0	2	18	33
UK	0	6	32	6
ALL	13	53	348	185

The questionnaire also collected data on farmers' opinion about the importance of alternative policy measures that a rural development policy trying to assure the continued use of traditional goat/sheep breeds should address. This was assessed on the typical 1 – 5 scale (with 1 signifying "not important at all" and 5 "very important").

Farmers were asked to express opinion on the following policies:

- Extension service on breeding and animal husbandry (information and consultancy);

- More (higher) subsidies for breeding traditional breeds;
- Specialized marketing/Support for regional products;
- Alternative development/employment options in the region;
- Investment aids.

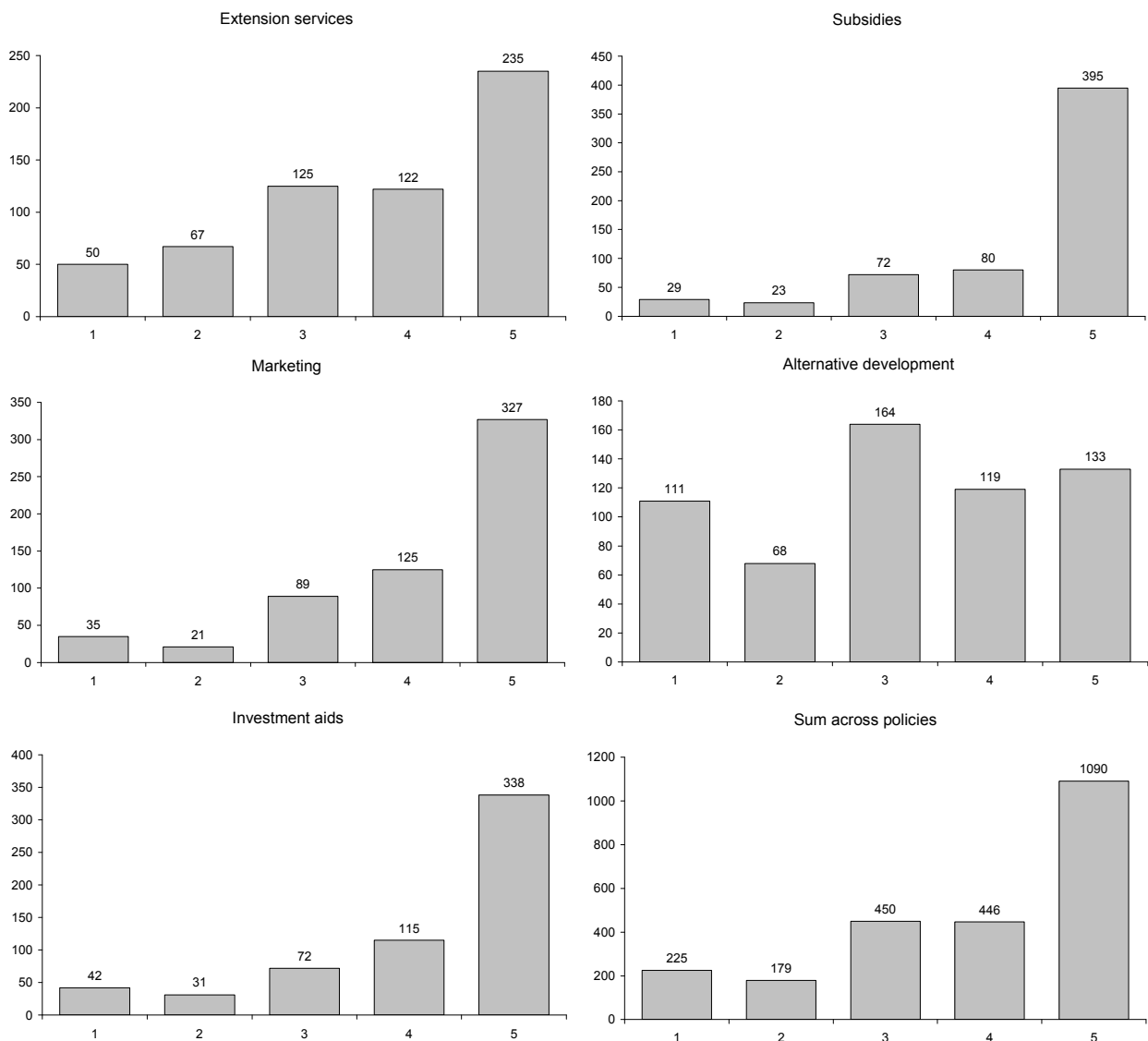


Figure 2.4 - Farmers' opinion about the relative importance of alternative policies

Results are shown in Figure 2.4. All policies are considered as "very important" for developing the activity of traditional sheep and goat breeding by a large majority, except

policies supporting alternative developments in the region. The picture for this was also the most varied throughout Europe, with a large share of interviewed French breeders, for instance, being strictly against these policies. Most farmers of traditional breeds, especially in Southern France and Mediterranean countries, traditionally rear local breeds extensively in marginal, less productive pastures. They necessitate letting the animals graze relatively vast grassland areas. Thus, they explained, alternative development like for instance tourism bring an increased pressure on land use and may restrict the availability of grassland. Thus this kind of policies is seen as a problem rather than a solution.

2.5 Conclusion

Many factors appear to influence the evolution of traditional sheep and goat breeding in European rural marginal areas. These are certainly linked to the socio-economic and agricultural structure typical of each country. Some results may also depend on the chosen breeds, though comparison with breeds not studied under the framework of the ECONOGENE project was not possible for lack of data.

Finally, farms characteristics seem to play a major role, and probably an important part of farmers' decisions is based on endogenous factors (at the farm level).

The following aspects appear to be the most relevant and demand more detailed analysis:

- the age of the farmer, as well as the presence of a successor for farmers older than 60;
- the presence and relative importance of other, off-the-farm income generating activities;
- the participation in ad hoc education programmes;
- the implementation of marketing strategies;
- the influence of raising breeds that are autochthonous versus non autochthonous;

- the differences between countries.

All these and other variables are analysed in an econometric model in Chapter 4.

It is also interesting to analyse the impact and relevance of being in a "marginal" area, including definition of what this means. This is the object of Chapter 3 and that will also subsequently be analysed in Chapter 4.

Chapter 3

CHARTING THE POTENTIAL OF TRADITIONAL SHEEP/GOAT HUSBANDRY IN EUROPEAN MARGINAL AREAS

3.1 Introduction

It is often argued that sheep and goat extensive husbandry is one of the best adapted land uses in rural marginal areas. Put the other way round, it may be said that marginal areas are especially (or in some extreme cases even only) suitable for agricultural systems based on extensive husbandry of locally adapted livestock breeds (Neofitidis and Tawfik, 2002; Dmitriev and Ernst, 1989).

However broadly the term "marginal areas" is used, there is to my knowledge no clear definition of it in the literature. In the present chapter, the analysis is restricted to the former 15-Member-State European Union (EU-15) covered by the ECONOGENE project: Austria (AT), Germany (DE), Spain (ES), France (FR), Greece (GR), Hungary (HU), Italy (IT), Poland (PL), Portugal (PT) and the United Kingdom (UK).

Given this geographic focus and in line with Wright (1997), marginal areas are defined here correspondingly to the EU Commission definition of "less-favoured areas" (Commission of the European Communities, 1975; 1999). These are areas where possible land uses are considered relatively limited because of higher altitude, shorter growing season, steeper slopes, less fertile soils or broadly speaking with generally lower soil productivity.

Marginal areas thus defined imply (in some cases severe) restrictions even to extensive livestock utilisation. Wright (1997) has summarised these limitations as constraints on the level of nutrition of livestock, with impacts on the physiological processes of reproduction,

lactation and growth. To overcome, at least partly, these limitations, the choice of the species and breed is often of foremost importance.

In fact, sheep are better able to graze selectively and more efficiently than cattle, obtaining a better quality diet where the overall quality of pasture is generally low (Gordon and Illius, 1988). Small ruminants utilise more shrubs and less grass than larger ruminants, and goats generally utilise more shrubs and woody plants than sheep (Brand, 2000).

Goats are also versatile in harvesting forage and are able to survive under adverse foraging conditions, and this sets them apart from other species of livestock (Lu, 1988). Goats have also greater efficiency in chewing. They prefer to consume forage of lower digestibility and higher fibre content (Hadjigeorgiou, Gordon and Milne, 2003).

Diet selection and grazing behaviour also differ between breeds, with some breeds being more selective than others (Brand, 2000). Smaller and/or less productive breeds are more adapted to harsher conditions (Wright, 1997). Thus, it is interesting to analyse the possible link between traditional, locally-adapted sheep and goat breeds and marginal areas.

Given all this, the definition of marginality adopted can have a rather agronomic and environmental emphasis. The accent is here put on production systems and thus variables such as rainfall, soil pH and similar data could help define a level of marginality. All these and similar variables influence land use and thus data on land cover can profitably be used. In fact, data on land cover could be considered an aggregate of all these variables.

However, it is also important to capture other, more general socio-demographic and economic aspects of "marginality". Typically, it might be argued that marginal areas have known some abandonment and depopulation, that they provide less work opportunities and that they are endowed with relatively less infrastructure and fewer urban areas/infrastructure.

In this chapter, a tentative combination of the two aspects is investigated, focusing on the computation of a synthetic index of relative marginality integrating agri-environmental and socio-economic data. A Geographic Information System (GIS) is implemented at the regional level, to combine socio-economic, land-use and breed presence data.

The following section presents the objectives of this chapter. Utilised data and methods are described in section 3.3. Results are discussed in section 3.4 and finally some conclusions are given in section 3.5.

3.2 Objectives

The main objective of this chapter is to provide a spatial analysis of sheep and goat husbandry systems based on local, traditional breeds. Of primary interest is the question in (1) how far the (present-day) marginality of regions is linked to the traditional presence of sheep and/or goat breeds and (2) how far it contributes to the survival and development of these husbandry systems. The analysis is divided into two parts. In a first instance (this chapter), the focus is on the general distribution of local, traditional sheep and goat breeds. To achieve this main objective the following corollary objectives are of relevance:

- to define a synthetic index of "marginality" that captures both agri-environmental variables and socio-demographic and economic ones;
- to analyse the spatial relationship between the distribution of ECONOGENE breeds and marginality as defined above.

In a second step, the analysis will focus on the impact of the "degree of marginality" measured by the index on farm decisions. This second analysis is based on a different data set, the farm questionnaire, and will be presented in a separate chapter, chapter 4.

3.3 Data and Methods

The geographic scale of analysis was largely determined by the availability of consistently comparable and validated data at the EU level. The scale chosen was that of the NUTS level 3. "NUTS" stands for Nomenclature Units of Territorial Statistics, a classification of statistical regions used by EUROSTAT, the European Commission Directorate-General responsible for EU-level statistical methodologies, tools and statistics⁴⁸.

Table 3.1 – List and number of NUTS regions for ECONOGENE EU-15 countries

Country	NUTS 1		NUTS 2		NUTS 3	
AT	Gruppen von Bundesländern	3	Bundesländer	9	Gruppen von Politischen Bezirken	35
DE	Länder	16	Regierungsbezirke	41	Kreise	439
ES	Agrupación de comunidades autónomas	7	Comunidades y ciudades autónomas	19	Provincias + Ceuta y Melilla	50 2
FR	Z.E.A.T + DOM	8 1	Régions + DOM	22 4	Départements + DOM	96 4
GR	Groups of development regions	4	Periferies	13	Nomoi	51
IT	Gruppi di regioni	5	Regioni	21	Provincia	103
PT	Continente	3	Comissões de coordenação regional + Regiões autónomas	5 2	Grupos de Concelhos	30
UK:		12		37		133
England	Government Office Regions	9	Counties (some grouped); Inner and Outer London	30	Upper tier authorities or groups of lower tier authorities (unitary authorities or districts)	93
Wales	Country	1	Groups of unitary authorities	2	Groups of unitary authorities	12
Scotland	Country	1	Groups of unitary authorities or LECs	4	Groups of unitary authorities or LECs (or parts thereof)	23
N.Ireland	Country	1	Country	1	Groups of districts	5
EU-15		72		213		1091

Source: EUROSTAT, http://europa.eu.int/comm/eurostat/ramon/nuts/introannex_regions_en.html (12/08/2004)

⁴⁸ EUROSTAT manage statistics in a variety of fields, including economic and monetary, employment and social, agricultural and environment, as well as external relations statistics. It insures EU-level comparability.

The NUTS classification has been used in Community legislation since 1988. However, only in 2003 was a Regulation on NUTS adopted by the European Parliament and the Council⁴⁹.

The NUTS is a three-level hierarchical classification. The unit of reference at each level can be quite different in administrative unity and geographic size depending on the country. Table 3.1 shows a list of NUTS and the number of units at each level, up to the level 3, for EU-15 ECONOGENE countries. Furthermore, at the local level, two levels of Local Administrative Units (LAU) have been defined. The upper LAU level (LAU level 1, formerly NUTS level 4) is defined only for the some countries⁵⁰. The second LAU level (formerly NUTS level 5) consists of 95,152 municipalities or equivalent units in the EU-15 Member States.

The NUTS nomenclature serves as a reference:

1. for the collection, development and harmonisation of Community regional statistics;
2. for the socio-economic analyses of the regions;
3. for the framing of Community regional policies⁵¹.

The new NUTS classification following Regulation 1059/2003 replaces the previous EUROSTAT NUTS publication, issued in May 1999, and includes the administrative changes which have taken place since then. However, this research, which started in 2001, uses the old classification. It is argued that changes are minor with respect to the needs of this research and that they do not influence the validity of our results⁵².

The following primary and secondary sources of data have been used:

⁴⁹ Regulation 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS) (Official Journal, L 154, 21/06/2003, 1-41)

⁵⁰ These are Finland, Germany, Greece, Ireland, Luxembourg, Portugal and the United Kingdom.

⁵¹ http://europa.eu.int/comm/eurostat/ramon/nuts/application_regions_en.html

⁵² At the level 3 used here, what happened is that some administrative units were combined in larger ones. In the version of 1999 used, there were 1,093 level-3 regions, compared to 1,091 in the new version. It is in Germany that there are now two NUTS level 3 regions less. Changes mainly affected some countries' NUTS level 2.

- primary data on the distribution of ECONOGENE sheep and goat breeds collected from experts (Figure 3.1);
- geographic coordinates of each ECONOGENE sampled farm, obtained by GPS;
- secondary NUTS level 3 socio-demographic and economic data, from the EUROSTAT database New Cronos, more precisely the Theme "Regio";
- cartographic data with NUTS level 3 regional boundaries and code table;
- CORINE⁵³ Land Cover database for data on land use and land cover.
- some data from the Global Land Cover Characteristics (GLCC) database of the the United States' National Aeronautics and Space Administration (NASA).

These data are described in the following sub-sections (3.3.1 to 3.3.3), except farm-level data which have been described in detail in chapter 2. Section 3.3.4 explains how indices are computed and a synthetic index joining the different types of data is built.

3.3.1 A GIS of sheep and goat traditional breeds and sampled farms

Two of the layers of the GIS that has been built consist of: (1) the geographic distribution of traditional sheep and goat breeds that have been studied in the ECONOGENE project and (2) the geographic location of farms rearing these breeds and which have been sampled.

Throughout EU-15, the ECONOGENE Consortium helped with collecting data on the traditional geographic distribution of breeding localities of sheep and goat breeds covered by this project. This has been done for all autochthonous breeds. When the breed had spread outside its original area, only the latter was generally considered. However, in some cases areas were also retained (1) which are geographically close to those deemed to be the original locations where the breed was traditionally reared, (2) which have overall similar characteristics to these areas and (3) where the breed is presently reared with a similar

⁵³ CORINE is the acronym for Coordination of Information on the Environment of the Commission of the European Communities Directorate-General on Environment (DG XI)

significant economic importance as in the "original" areas. The assessment was made by the respective ECONOGENE Consortium Partners in each EU-15 country covered by the project.

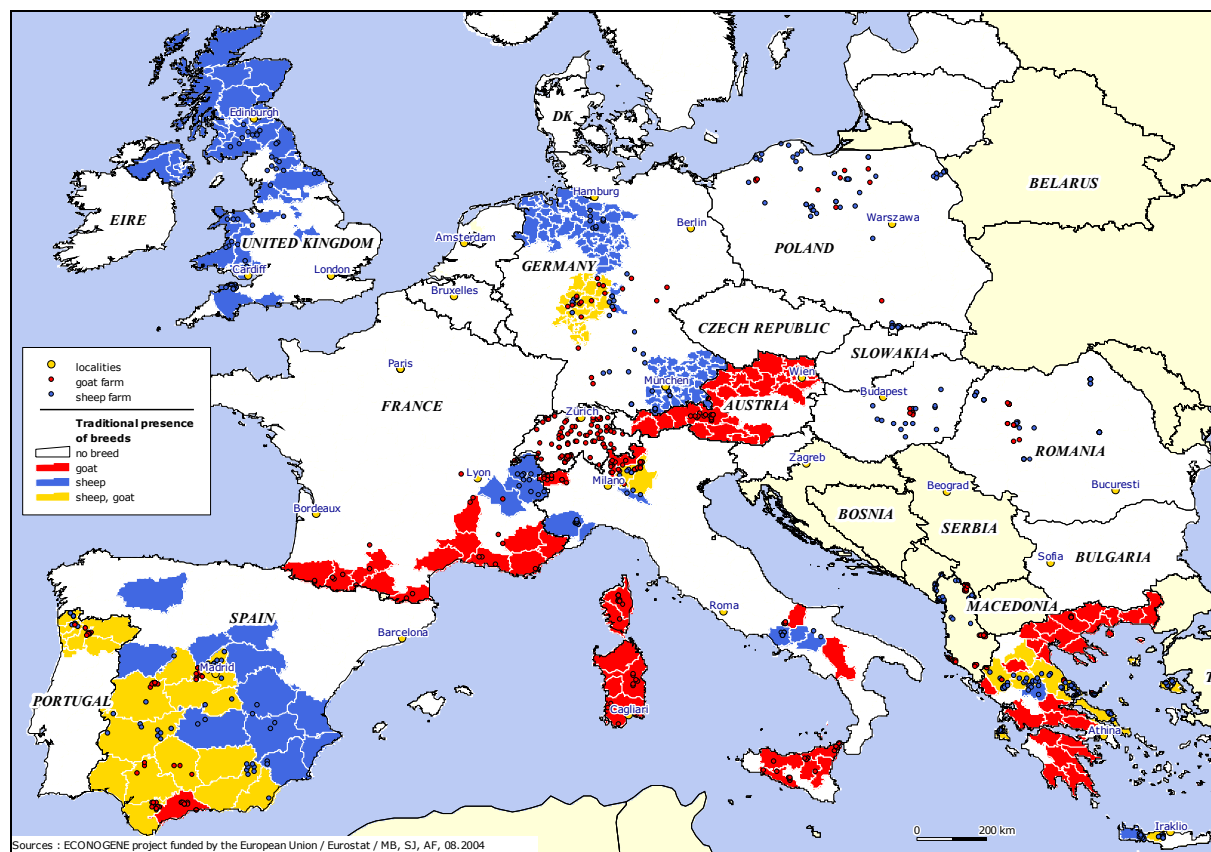


Figure 3.1 – Geographic distribution of ECONOGENE breeds in EU-15 countries

The location of sampled farms in all ECONOGENE countries was recorded at the time of sampling, using either Global Positioning Systems (GPS) whenever available, or the most accurate topographic maps. A protocol for recording coordinates was adopted in all countries to ensure consistency of georeferencing of farms. Longitude and latitude was measured adopting the WGS84 as the chosen reference coordinate system⁵⁴. Longitude and latitude was recorded in decimal degrees and altitude in meters.

⁵⁴ WGS84 is the World Geodetic System established in 1984. See website <http://www.wgs84.com/>

It so happens that the farm layers show farms rearing ECONOGENE breeds in NUTS level 3 regions that are not recorded as regions where the breed is present⁵⁵. There are two reasons for this. Firstly, as explained above, the geographic distribution of ECONOGENE breeds at the NUTS level 3 scale was assessed for traditional autochthonous breeds only. Conversely, all farms have been georeferenced, including those raising non-autochthonous breeds. Secondly, another exception was made when a breed was (more) often reared by hobby breeders, particularly when this was important for safeguarding a breed with smaller effective numbers of breeding animals. In this case, the breed may be kept in other areas than those defined above as regions where the breed is presently and/or traditionally significantly present.

3.3.2 NUTS-level-3 data and geographic boundaries

As explained above, NUTS are regional subdivisions of the EU for territorial statistics. Statistical data is sent by Member States to EUROSTAT, and validated by the Thematic Units to be updated into the Regio database. Regio is the regional database of New Cronos, and is structured in 14 datasets: agriculture, demographic statistics, economic accounts, education, labour force, migration, science and technology, structural business, health, tourism, transport and energy, unemployment, environment, and previous-year statistical yearbook of regions. Most data is only available at NUTS level 2. The interested reader can find more detailed information in the reference guide (European Communities, 2003).

The variables used here, all at level 3, are:

- unemployment rates in year 2000 (UNEM2000);
- active population in 2000, total area, and total population in 2000, recoded in the following variables:

⁵⁵ As far as the EU-15 is concerned, approximately 10% of farms in the usable database were in regions where ECONOGENE breeds were not considered as significantly present. This figure is 86 farms out of 419 (8%) rearing autochthonous breeds and 12 farms out of 51 (24%) of those rearing non-autochthonous breeds.

- density of active population, that is the active population relative to total area, in the year 2000 (ADJACT00);
- percent of active population in 1996, with respect to the total population of the region (PERCACTP);
- population density in 1998 (DENS1998);
- population density in 1995, to compute a derivate variable, measuring the change in population density, that is an index of DENS1998 with the base population density in 1995 equal to 100 (D98IDX95);
- gross domestic product measured in purchasing power parities in EUR (PPP-EUR) per inhabitant, in 1999 (PPPHAB99);
- number of bed places in hotels, as a proxy indicator for tourism, absolute value (BEDS2000) and per thousand inhabitants in 1999 (BEDSPERH).

Inference was used in limited cases for filling missing data as much as possible. When possible, average data from NUTS level 2 was used for NUTS level 3. Generally, however, missing data was left missing, and excluded from the analysis.

These data can be linked into a GIS using the NUTS codes. These are hierarchical codes and at level 3 they are in the format AA123, where AA is the two-digit ISO country code (e.g. AT for Austria, ES for Spain, etc.) and 123 is a number from 111 on (letters are used if numbers are not sufficient, depending on higher hierarchical levels). The data over boundaries is digitised in map layers and the one used here is that for level 3⁵⁶

⁵⁶ The one used here has been provided by DDS Digital Data Services GmbH, Karlsruhe, Germany, <http://www.ddsgeo.com/html/international/geo.europa.nuts.html> (link valid 13/08/2004)

3.3.3 *The CORINE Land Cover database*

The CORINE land cover database⁵⁷ offers an inventory of land use and land cover at the European level, using a 44 class nomenclature. The resolution used is a 250m by 250m grid. To these 44 classes, two classes are added, for missing data and open sea areas.

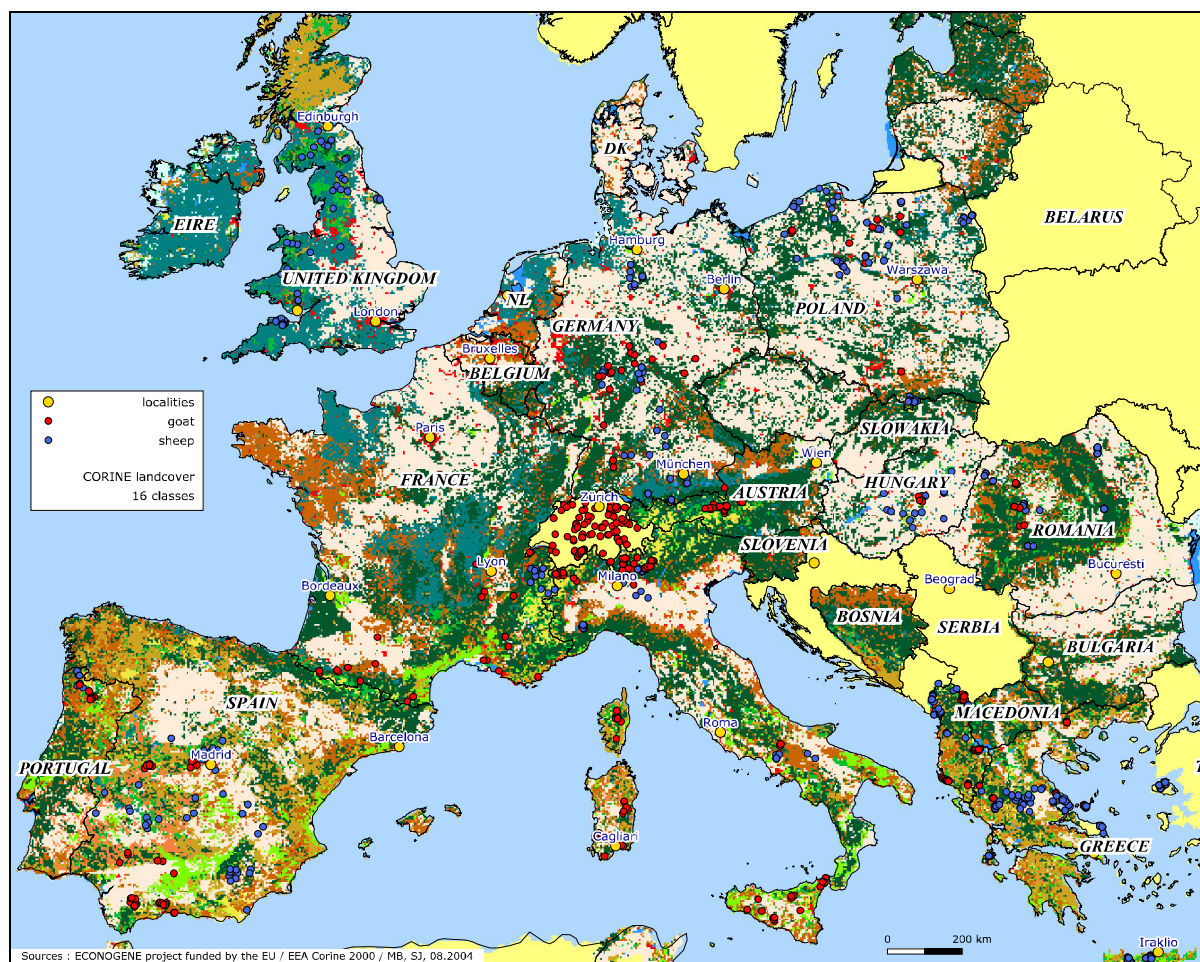


Figure 3.2 – CORINE land cover reclassified in 16 classes (legend: see Appendix 3)

There are three levels of detail, with level 3 counting thus 46 classes comprised in six level-1 larger classes:

- Artificial surfaces (level-3 classes: 1 to 11);

⁵⁷ European Environment Agency, 2000. Completion of CORINE database was achieved in December 1999. See the European Environment Agency website at <http://www.eea.eu.int/> for more information.

- Agricultural areas (12 to 22);
- Forest and semi-natural areas (23 to 34);
- Wetlands (35 to 39);
- Water bodies (40 to 44);
- No data (49);
- Sea and ocean (50).

Table 3.2 – Reclassified land cover in 16 classes and the corresponding original CORINE classes

New	CORINE	Level-3 Classes (original CORINE definitions in quotes, when given)
1	1 and 2	Urban fabric (Continuous and discontinuous)
"	3	"Industrial or commercial units"
"	4 to 6	Transportation infrastructures (roads, rail, ports, airports and associated land)
2	7 to 9	"Mineral extraction sites", "Dump sites" and "Construction sites"
3	10 and 11	"Green urban areas" and "Sport and leisure facilities"
4	12 to 14	"Non-irrigated arable land", "Permanently irrigated land" and "Rice fields"
5	15 to 17	"Vineyards", "Fruit trees and berry plantations" and "Olive groves"
6	18	"Pastures"
7	19 and 20	"Annual crops associated with permanent crops" and "Complex cultivation patterns"
"	21	Principally occupied by agriculture, with significant areas of natural vegetation
8	22	"Agro-forestry areas"
9	23 to 25	Forests (various types, each in a class)
10	26	"Natural grasslands"
11	27 to 29	Moors, heath land, sclerophyllous vegetation and "Transitional woodland-shrub"
12	30 to 33	"Beaches, dunes, sands", "Bare rocks", "Sparsely vegetated areas" and "Burnt areas"
"	34	"Glaciers and perpetual snow"
13	35 to 39	"Inland marshes", "Peat bogs", "Salt marshes", "Salines" and "Intertidal flats"
14	40 to 44	"Water courses", "Water bodies", "Coastal lagoons", "Estuaries" and "Sea and ocean"
15	49	"No data"
16	50	"Sea and ocean" ⁵⁸

Column 1, "New", shows the code for 16 classes and column 2 shows the corresponding CORINE original codes

A simplified classification was deemed sufficient for this research. Thus land cover has been reclassified in 16 new classes. These are shown in Table 3.2 as well as in the map of Figure 3.2. A complete legend for the latter is given in Appendix 3.

⁵⁸ This is an original CORINE class. Sea and ocean were counted as classes 44 and 50 (no double-counting). No explanation is provided in the original legend.

Mainly, reclassification was practical for ease of computation. The percent of each type of land cover for each NUTS level 3 region was computed as follows⁵⁹. By overlaying the layers containing CORINE land cover data and those with NUTS level-3 data and boundaries, it was possible to create 16 new variables in the NUTS level-3 data layer. These variables provide, for each of the 16 reclassified classes, the percent of NUTS level 3 area whose land cover is characterised by each class. The result by country was then aggregated for all EU-15. Figure 3.3 (p. 74) shows an example for class 10 of the new classification (natural grassland).

Some complex problems of geographic projection were solved by approximation. CORINE land cover also has an area totally missing in Greece, including the isles of Lesbos, Skopelos and Kymi. Thus, for Greece, as well as for Albania, data was used from the Global Land Cover Characteristics (GLCC) database of the Earth Observing System (EOS) that is part of the Earth Science Enterprise (ESE), a programme of the United States' National Aeronautics and Space Administration (NASA)⁶⁰.

The GLCC uses a resolution of 1 km. Data is from 1993 and is classified in 24 classes. A correspondence was established with CORINE (reclassified) 16 classes when computing the percent of type of land cover at NUTS level 3. No computation has been made to quantify a calibration of data that might overcome the partial limitations of the different scale of CORINE and NASA's GLCC. However, this information is used at NUTS level 3, a much less detailed scale compared to both land cover databases. Therefore, it is argued that the approximation is adequate and sufficiently precise for the needs of this research and does not add significant error.

On the basis of this land cover data, and in view of computing an index of marginality, a new variable was calculated and added to the NUTS level 3 database. This variable aims at

⁵⁹ Even so, computation was so resource-demanding, relative to the available technology, that it had to be done country by country.

⁶⁰ See http://edcdaac.usgs.gov/glcc/globdoc2_0.asp

synthesising information on the marginal aspect of an area given its land-use characteristics.

"Marginal areas" with respect to land use are here defined as those areas where there is relatively more less productive and non-productive land, compared to land used for arable farming and to urban areas and transportation infrastructure.

Land use classes chosen for less productive and non-productive land are: class 10 ("natural grassland area") and 11 (moors, heath, shrubs and scrubs). Class 10 is argued to provide a better idea of pastures in marginal areas. Class 6 (pastures) include large areas of "technically speaking" arable type of land which is used as pasture for grazing livestock even in some more intensive or less marginal areas of Europe (as some areas of Northern France or The Netherlands, for example). Class 1 (urban, industry and transport infrastructure) and class 4 (arable land) are used as an indicator of a less marginal land use.

Thus, the variable computed is the ratio of percent of area in land use classes 10 ("natural grassland area") and 11 (moors, heath, shrubs and scrubs) to the percent of area in land use classes 1 (urban, industry and transport infrastructure) and 4 (arable land), that is:

$$\text{MARGLAND} = (\% \text{ class 10} + \% \text{ class 11}) / (\% \text{ class 1} + \% \text{ class 4})$$

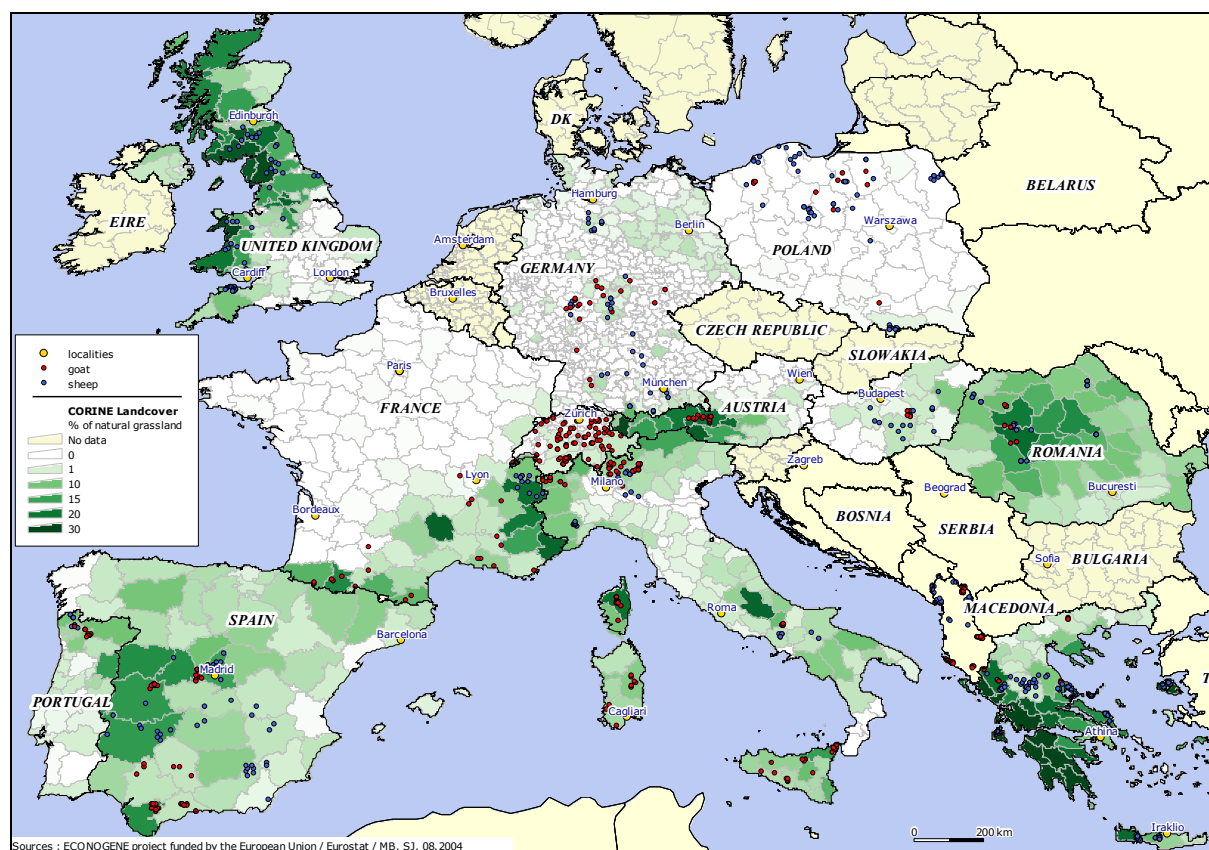


Figure 3.3 – Percent of natural grassland (class 10, new classification) at NUTS level 3

3.3.4 Computing an index of "relative marginality"

The geographic scale adopted is a major issue in defining marginality. In the EU-15, "less-favoured" areas are established at the level of municipalities or even part of them, and established by political debate and regulation.

In this Thesis, the approach is rather to compute a relative marginality, country by country. The chosen scale is NUTS level 3 and is dictated by the availability of data. As all choices, this one has advantages and disadvantages. As far as the former are concerned, it may be argued that EU-level comparability is enhanced by the use of consistent EUROSTAT data. Conversely, it may be objected that the presence or absence of a major urban centre or an international airport, for instance, could greatly influence the results. While this makes

intuitively sense, it is deemed that estimating the impact of a major city or other apparently biasing factors on the actual marginality of a region is not straightforward. It is argued that the ratio used here may enable capturing this impact at the adopted geographic scale.

Indices of "relative marginality" have been calculated country by country. The assumption implicit behind the decision to compute country by country instead of EU-wide derives from the ultimate objective of this index, namely to assess the potential of rearing traditional sheep and/or goat breeds in marginal areas. The postulation is that this is determined by breeders' choice and that this choice is more influenced by opportunities and resources within the country than internationally. Also, there is a fair amount of subsidiarity in EU agricultural and rural development policies. As far as the latter are concerned, rural development plans are adopted by Member States and these are free up to a certain degree to choose the particular measures they apply (cf. Chapter 1).

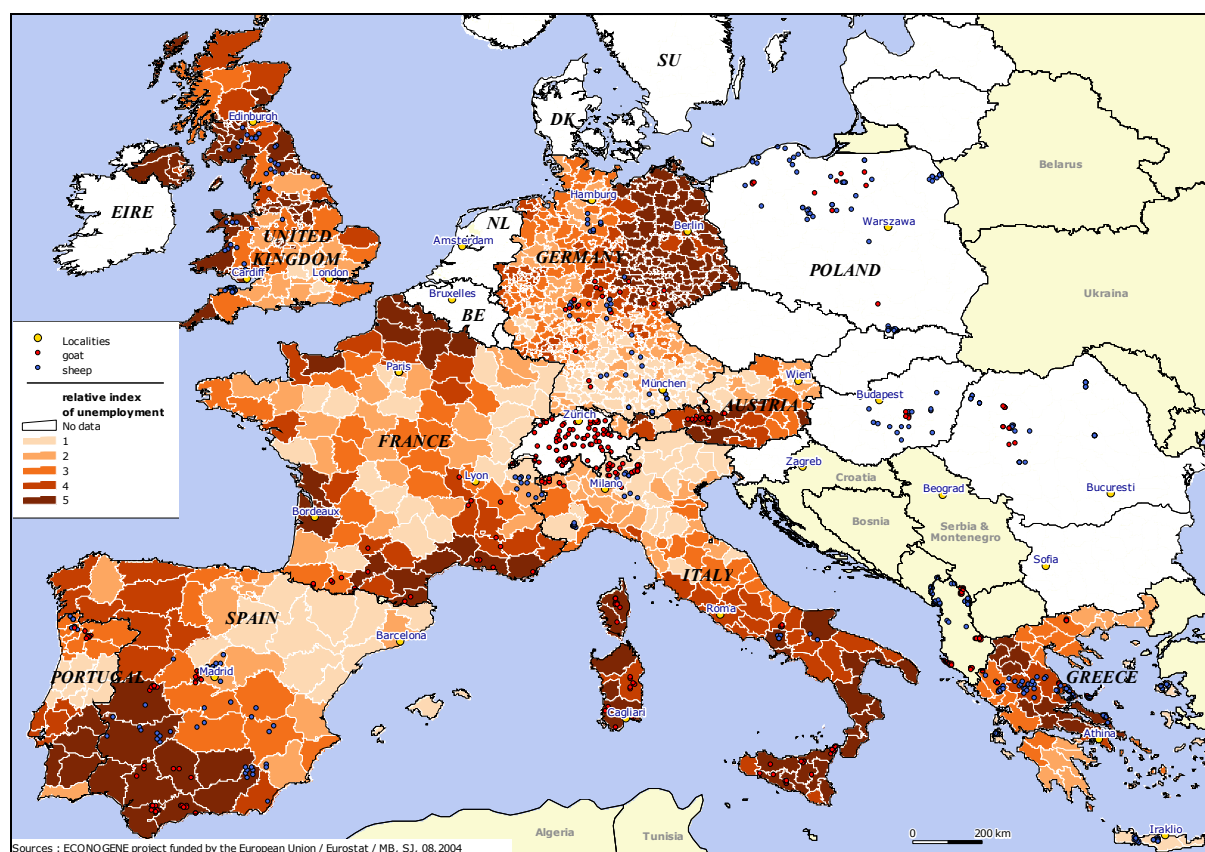
All indices were computed by calculating five quantiles of each variable and attributing at each index a value from one to five, where 1 indicates "least marginal" and 5 "most marginal". This implied using a reverse scale for some variables (when larger values were assumed to imply a lesser degree of "marginality", such as for example a larger proportion of active population or a higher GDP at purchasing power parities per inhabitant). Variables and corresponding indices are summarised in Table 3.3. Figure 3.4 shows a map of the index of relative marginality based on unemployment rates (IEMPL). Figure 3.5 shows the index of relative marginality based on land cover ratio (ILAND).⁶¹

⁶¹ The maps for all the other indicators are provided in Appendix 4.

Table 3.3 – Names of variables and of corresponding indicators

X_i	UNEM2000	ADJACT00	PERCACTP	D98IDX95	DENS1998	PPPHAB99	BEDS2000	BEDSPERH	MARGLAND
I	IEMPL	IADJACT0	IPERCACT	ID98IDX5	IDENS98	IPPHAB	IBEDS	IBEDPH	ILAND

X_i , original variables; I, indicators


Figure 3.4 – Index of unemployment (IEMPL) in ECONOGENE EU-15 countries (2000)

IEMPL measures marginality on the basis of unemployment rates, and has values from 1, the smallest quantile of unemployment rates, to 5, the highest unemployment. IADJACT0 is the index of the density of the active population, and ranges from 1, the highest density of active population, to 5, the fifth smallest quantile for the smallest density of active population. IPERCACT, analogously, has the value 5 where the percent of active population is the smallest. ID98IDX5 measures the change in population density between 1995 and 1998.

Thus, the value is 1 to 5, from the highest values of the original variable to the smallest, so that it measures 5 where the trend of population density has diminished from 1995 to 1998. IDENS98 is 5 where the population is the least dense and IPPPHAB is 5 where the average GDP at purchasing power parities per inhabitant is the smallest. IBEDS and IBEDPH measure the impact of tourism and are 5 in the areas with the minimum number of hotel beds, in absolute and relative, per-inhabitant terms, respectively. Finally, ILAND is 1 where there is less natural pasture and sclerophyllous or transitional scrubby vegetation and more urban areas and arable land, and measures 5 where the ratio is bigger and land is considered relatively more marginal.

Two different synthetic indices have been built, INDEXONE and INDEXTWO. Both are calculated in the same way, using three indicators. Two of them are the same for both indices: IEMPL and ILAND. As a third indicator, IADJACT0 or ID98IDX5 are used, respectively. The indices are computed as an average of the values of basic indicators, normalised to the range 0.2 to 1 (minimum to maximum degree of marginality) as follows:

$$\text{INDEXONE} = ((\text{IEMPL} + \text{IADJACT0} + \text{ILAND})/3)/5$$

$$\text{INDEXTWO} = ((\text{IEMPL} + \text{ID98IDX5} + \text{ILAND})/3)/5$$

3.3.5 *Modelling the geographic distribution of sheep and goat breeds*

The objective here is to measure the ability of these indices to describe the presence of ECONOGENE selected traditional breeds in NUTS level 3 regions. Put another way, a model is implemented to analyse if these breeds are significantly present in marginal areas as defined by the indices calculated in the previous section. The question is, assuming that the index is a

suitable measure of marginality, if marginality thus defined and measured does imply the presence of local, traditional sheep and goat breeds.

A simple logit model is used to explain a binary dependent variable, presence or absence of at least one traditional sheep or goat breed in a NUTS level 3 region. The dependent variable (y) is BINARPRE.

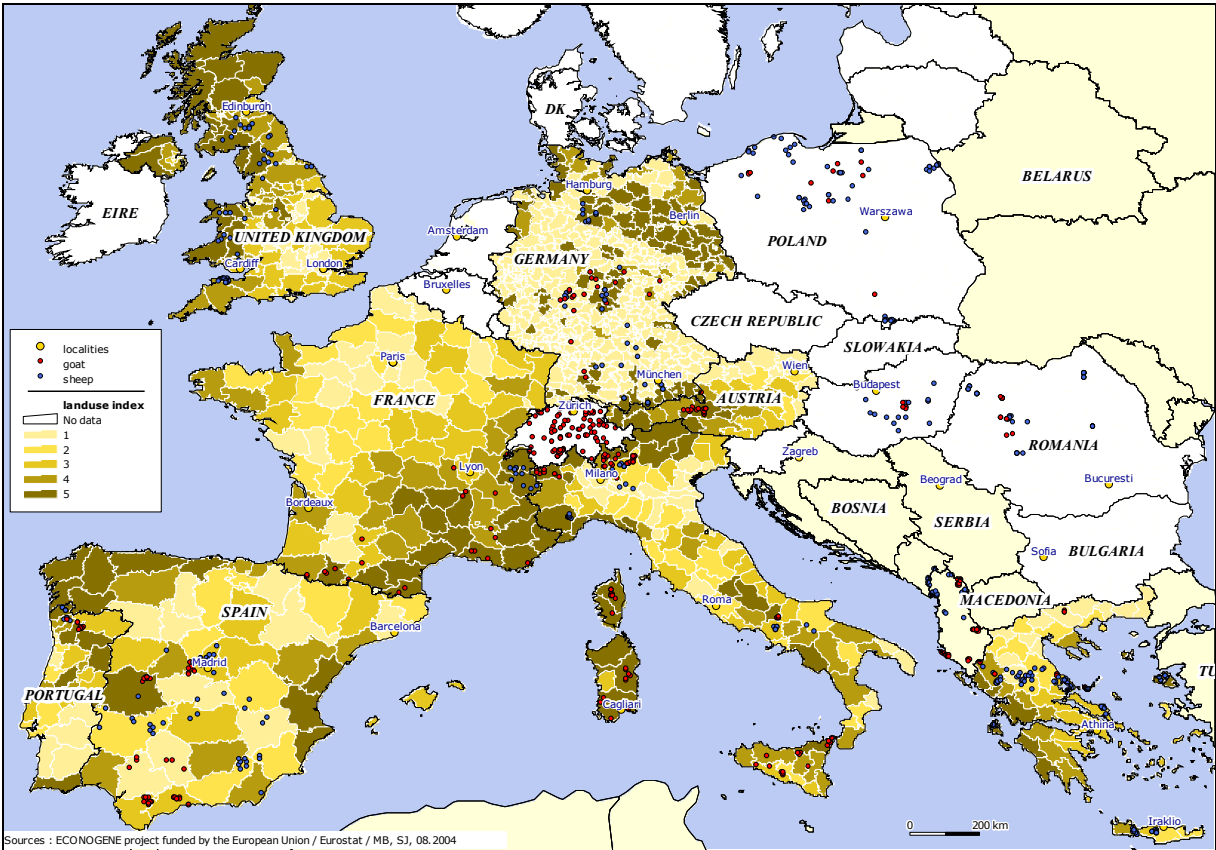


Figure 3.5 – Index based on ratio of land-use classes in ECONOGENE EU-15 countries

The outcome of the observed binary dependent variable y is considered as a result based on a latent variable y*. The relationship between the latent variable y* and the observed variable y is

$$y = 0 \text{ if } y^* \leq 0,$$

$$y = 1 \text{ if } y^* > 0,$$

The logit model explains the latent variable on a set of explanatory variables summarised in the vector x as

$$y^* = \beta'x + e,$$

where β is the vector of parameters to be estimated. It is assumed that e is logarithmically distributed across observations.

The probability of observing the outcomes in the latent variable results as

$$\text{Prob}(y=0) = \text{Prob}(y^* \leq 0) = \text{Prob}(\beta'x + e \leq 0),$$

$$\text{Prob}(y=1) = \text{Prob}(y^* > 0).$$

Assuming the error term e follows a logisitic distribution, the logit model results. The model has been estimated using a maximum likelihood procedure.

3.4 Results

3.4.1 Mapping marginal areas

Overlaying these different layers of data in a single GIS allowed answering several research questions. Firstly, by comparing the distribution of sheep and goat breeds and the location of sampled farms, it was possible to visually assess the occasional discrepancies. It is also possible to compute key statistics and analyse differences between zones where breeds and/or farms were present. One example is shown in Table 3.4.

Table 3.4 – Comparison of unemployment rates relative to where breeds are present

Year 2000 data	Unemployment rates	
	Overall country average	Regions where local breeds are reared
Countries		
Austria	3.8	3.7
France	9.0	11.6
Italy	9.9	14.5
Spain	14.4	17.4
United Kingdom	5.8	6.6
EU-15 average	8.4	

Source: EUROSTAT, 2002 and ECONOGENE Consortium, 2002-2004.

Most importantly, it was possible to link relevant data from the NUTS level 3 EUROSTAT database to the data in the farm database. This is of great use in order to analyse the impact of, e.g., unemployment or marginality defined by one of the indices computed here, on decisions regarding the development of local, traditional sheep and goat breeding activities. This will be discussed in the next chapter.

A visual analysis of the maps gives some interesting qualitative insights. Figure 3.6 (p. 82) and Figure 3.7 (p. 84) show a map of the two indices, INDEXONE and INDEXTWO, respectively. While some differences are evident between the two maps, generally the overall picture is similar. Marginal areas, by construction relative to other regions within each country, appear as often located at the periphery, like for instance in Scotland and Wales, in the southernmost parts of France and Italy, in Eastern Germany, and so forth.

The most important results, to be discussed here, concern the impact of marginality on the geographic distribution of local sheep and goat breeds. Visually, looking at the maps of the indices and at the map of the distribution of breeds (Figure 3.1, p. 67), it can be noticed that the studied breeds seem to be consistently located in regions defined as marginal by the indices. There are exceptions, though (e.g. some more central parts of Germany or some

north-eastern parts of Greece). These are assessed using the logit model whose results are discussed in the following section.

3.4.2 Discussion of logit model empirical results

This section discusses the results of a logit model (for model specifications, see section 3.3.5) where the dependent variable is

$$\text{BINARPRE} = \begin{cases} 1, & \text{if at least one traditional sheep or goat breed is present} \\ 0, & \text{otherwise} \end{cases}$$

The explanatory variables and results are shown in Table 3.5. Two models have been studied, both based on the same data. They consistently show analogous results, while the first one performed better with respect to the correct predictions of $y=1$ (Table 3.6).

Table 3.5 – Results of the logit model on the presence of breeds

Variable	Coefficient	Std. Error	Coefficient	Std. Error	Mean
Constant	-1,4026 ***	0,342	-1,482 ***	0,339	
ID98IDX5	-2,1524 ***	0,058			2,899
IADJACT0			0,225 ***	0,067	2,838
IPPPHAB	-0,1665 ***	0,064	-0,146 **	0,069	2,687
IBEDPH	-0,0247	0,060	-0,084	0,059	2,910
INDEXONE	2,9707 ***	0,472			0,556
INDEXTWO			1,115 ***	0,415	0,560

Significance level: * 0.10; ** 0.05; *** 0.01

The first model uses a vector of explanatory variables formed of ID98IDX5, IPPPHAB, IBEDPH, INDEXONE, while the second uses IADJACT0, IPPPHAB, IBEDPH, INDEXTWO. Comparing the two and keeping in mind the computation of the synthetic indices, it is apparent that the two models use the same basic indicators, but aggregation in the synthetic indices is different. Both models give slightly better results than those using the

basic indicators. Adding the indices that are not used here does not improve the model while on the contrary the parameter for IBEDPH is significantly different than zero.

In fact, all parameters for the two indices and all indicators added to the aggregated ones in the model were significantly different from zero. The model based on the single aggregated index has much poorer specifications and that with INDEXTWO alone failed to correctly predict any $y=1$. Conversely, aggregating more than three indices also resulted in worse specified model. All indices on their own also failed to predict the outcome $y=1$. All models with one single index were badly specified.

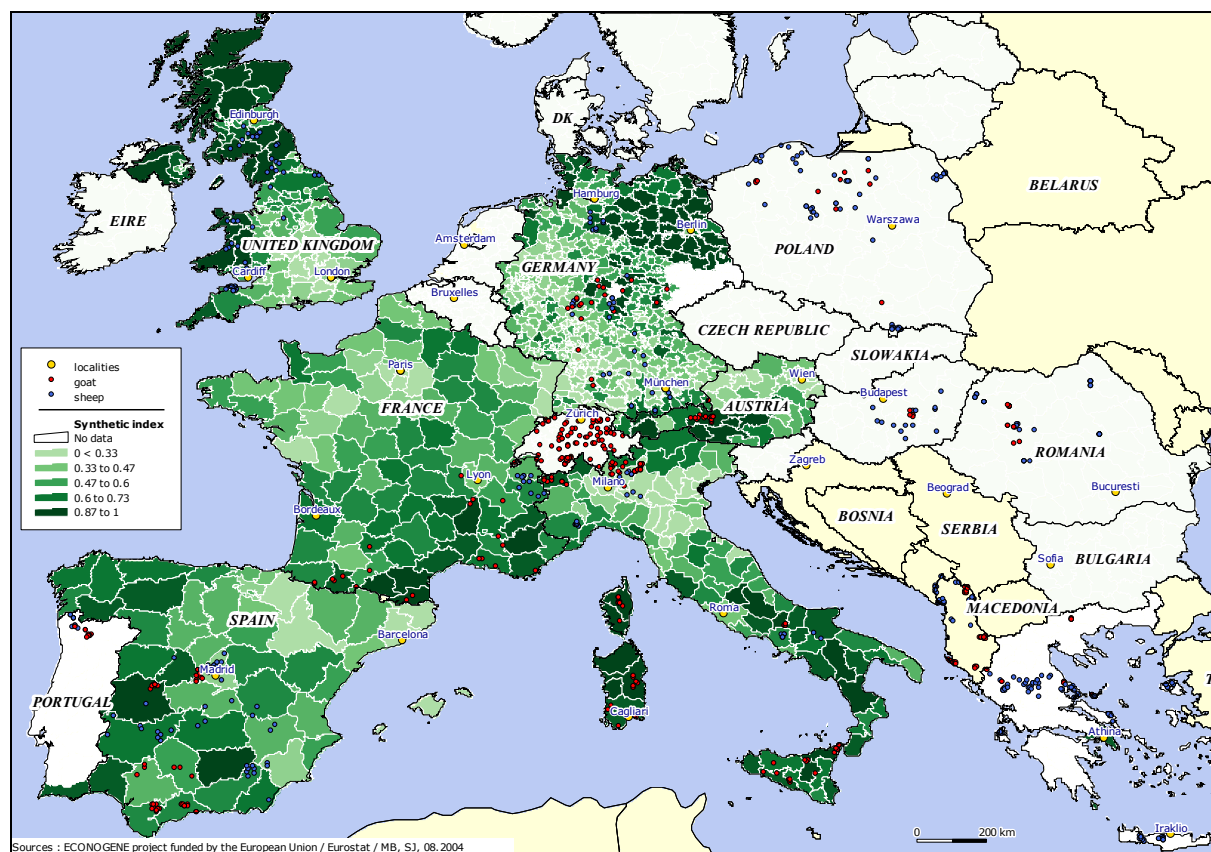


Figure 3.6 – Map of the synthetic index (INDEXONE)

When using all indices in the non-aggregated form, IADJACT0, ID98IDX5 and ILAND was significant at the 0.01 level, IPPPHAB was significant at the 0.05 level and IEMPL was

significant at the 0.10 level. Both synthetic indices have positive coefficient sign. Considering significance, and sign of IADJACT0 and ID98IDX5, it seems that ILAND has a greater influence on the sign of the aggregated indices. This is consistent with the fact that extensive sheep and goat husbandry is especially linked to a given type of land use and this is correctly measured by ILAND.

The characteristics of both aggregate indices are positive. Increasing marginality, as measured by these indices, is positively and significantly correlated to the fact that local, traditional breeds are present. One interesting interpretation is that the two indices are appropriate when defining rural marginal areas that are suitable for keeping local, traditional sheep and/or goat breeds. The first index, INDEXONE, may be preferred for its greater ability (19% instead of 9%) to correctly predict the presence of breeds, i.e. $y=1$, the rarest (approximately 30% of all records) of the two outcomes of the dependent variable.

Table 3.6 – Correct predictions of the two logit models

	Model with variable INDEXONE				Actual	Model with variable INDEXTWO			
	Y=0	Y=1	Total	% correct		Y=0	Y=1	Total	% correct
Y=0	522	32	554	94.2%	Y=0	545	9	554	98.4%
Y=1	196	46	242	19.0%	Y=1	221	21	242	8.7%
Total	718	78	796	71.4%	Y=1	766	30	796	71.1%

The index of the relative number of beds in hotels, IBEDPH, is not significant. IPPPHAB is significant and it has a negative sign. This means that the relative richness of a region and the traditional presence of local breeds are negatively correlated. One hypothesis is that it is more likely that poorer areas are already abandoned and so traditional breeds may have already disappeared from these regions. However, this cannot be implied in terms of direct causality from our data.

Comparing the two models, it can be noticed that in the first ID98IDX5 has the negative sign while in the second IADJACT0 is positive. The same result was obtained with non-aggregated indices. Thus, local breeds are negatively correlated to diminishing population between 1995 and 1998. The interpretation of this is not as straightforward as it may seem. On the one hand, it could be said that in the very extremely marginal region, the trend of abandonment has continued and it has not even recently been reversed and breeds have either never been present in such extremely marginal areas or they are not present anymore because of abandonment trends so strong as to be still ongoing between 1995 and 1998.

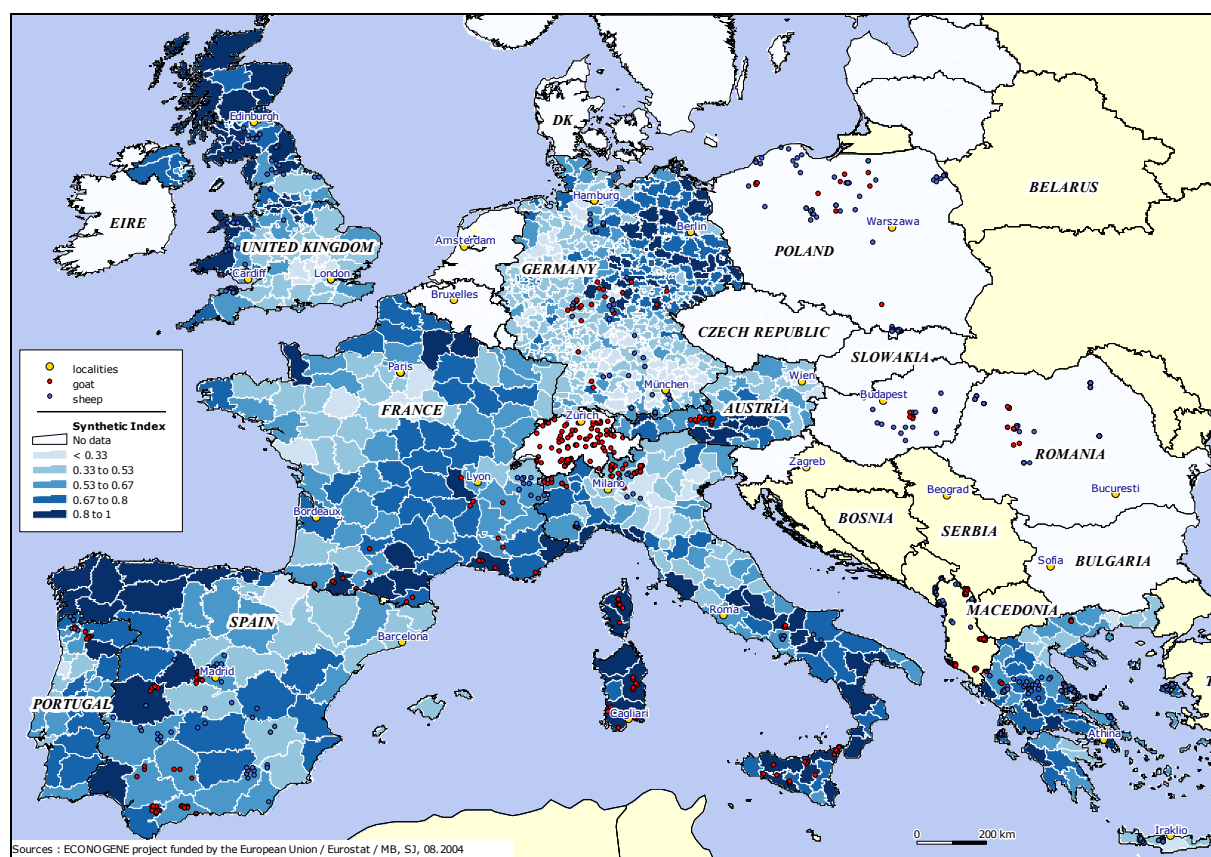


Figure 3.7 – Map of the synthetic index (INDEXTWO)

However, IADJACT0 is positive and the aggregate INDEXTWO, which also include ID98IDX5, is positive too. A larger value of IADJACT0, that is a smaller density of active

population, is significantly more positively correlated to the presence of local sheep and goat breeds. Another interpretation of the negative sign of the index of population density change may point to a well-documented dynamic of counterurbanisation (Mitchell C. J. A., 2004; Dahms and McComb, 1999; Saraceno, 1994) which actually increases the population in (at least some) marginal areas.

When ID98IDX5 is recalculated so that it assumes the value 5 when there is an increase in population density in 1998 compared to 1995, INDEXTWO behaves consistently, and so does the model, with the difference that total corrected predictions of the latter are (slightly) lower than both models above, 70.60%. Also consistently, the sign is reversed. That is, an increase in population density is positively correlated with the traditional presence of sheep and/or goat breeds. Again, interpretation is difficult⁶². It may mean that marginal areas are occupied by traditional local breeds, and that these areas in recent times witness a positive population trend, mainly from incomers. Since both an increased density and a smaller active population together are positively correlated to the economically significant presence of traditional sheep and goat breeding, it may be argued that in these regions there is an incoming migration of relatively less working-life active people, possibly people belonging to what Halfacree (2004) calls "bourgeois" back-to-the-land migration, to marginal rural areas (seeking the "rural idyll", cf. e.g. van Dam, Heins and Elbersen, 2002; Halfacree, 1995) and this may be the actual picture.

If this analysis is accepted, the presence of these breeds is linked to marginality which in its turn is an element of the attractiveness of a region to in-migration. Then the relationship between the trend in population and the presence of breeds is not causal, and the impact of continued trend of in-migration is not known. The impact of all indices on current breeding decisions of farmers is analysed in the following chapter.

⁶² The data and construction of the indices command an interpretation of correlation rather than one of causality. It is important to keep this in mind when some tentative explanations of findings are advanced.

3.5 Conclusions

Marginal rural areas suitable for extensive livestock can be defined as those areas where there are limited possible land uses and a greater percent of land is covered with natural grassland and less with urban areas. Recent trends in population dynamics are less straightforward to analyse and reveal contrasting tendencies. However, all aggregated indices are highly correlated with the presence of selected, local traditional sheep and goat breeds.

One caveat is necessary, with respect to the sample of breeds. Sheep and goat breeds were selected in the ECONOGENE project for the study of genetic diversity as well as for their presence in marginal areas. Of all breeds in the countries of EU-25 where the project was carried on, ECONOGENE selected approximately 10% of sheep and 18% of goat breeds⁶³ that are in the EAAP database (cf. chapter 2). It may be argued that this introduces a bias in the analysis presented here. While it was not possible to quantitatively assess this, because of the lack of data, it is maintained that this does not invalidate the analysis. On the one hand, of all sheep and goat breeds, most of the autochthonous ones which are used in more extensive systems are often located in approximately the same areas. On the other hand, the approach aimed to analyse if the location of *this sample* of breeds was significantly found to be in "marginal" areas. It is deemed that these two arguments corroborate the validity of the analysis presented here.

It can be objected that while these indices certainly explain the presence of these "marginal" sheep and goat breeds, this does not *per se* prove that they explain "marginal areas" correctly. However, it is argued that they are carefully built so that a certain idea of "marginality" is conveyed. "Marginal areas" are thus defined *relative* to other "non-marginal" (or "less-marginal") areas and – if the assumption that land use and unemployment correctly

⁶³ And 14% of sheep and 27% of goat *autochthonous* breeds, with a slight bias for sampling non-endangered versus endangered breeds. See chapter 2 for further details.

predicts the marginal aspect of a region is accepted – the indices built here allow quantifying the picture of "marginality" in an adequate and useful way.

One great usefulness of this GIS approach is that it allows linking these regional data to the farm and thus permits modelling farm decisions affecting the future development of local, traditional sheep and goat breeding in rural marginal areas. It may be said that the picture provided in this chapter is a snapshot of the present situation. In the next chapter, the effect of the indices of relative marginality on future trends of sheep and goat breeding at the farm level is analysed, together with other farm-level characteristics.

Chapter 4

MODELLING FARMERS' DECISIONS IN THE HUSBANDRY OF TRADITIONAL SHEEP AND GOAT BREEDS IN EUROPE

4.1 Introduction

Local livestock breeds have become endangered in many parts of the world (FAO, 1999). Sheep and goat breeds in the European Union have undergone the same fate. Different causes might have resulted in the same outcome of local, traditional sheep and goat breeds becoming endangered or extinct. Farmers raising these breeds may have abandoned farming overall, or they may have just replaced the breed with one considered more productive. Moreover, in the case of sheep and goats, breeders have sometimes shifted to other livestock, e.g. cattle, or other forms of agriculture.

In marginal areas, this tendency has been attributed to effects induced or at least reinforced by the Common Agricultural Policy (Caraveli, 2000). Different reasons may explain the different degrees of attractiveness of traditional sheep and goat breed husbandry versus other type of agricultural production, being this animal husbandry or other. A major driving force could well have been agricultural policy (cf. Chapter 1). Other factors could rather be endogenous and be linked to the farm structure, including the family structure, age of the farmer, and so forth. Further aspects that are interesting to analyse relate to the geographic differentiation of farmers' strategies and whether rural areas defined as marginal have a greater tendency with respect to this type of husbandry. This will also be analysed here, based on results from Chapter 3.

It is often suggested that successful conservation of traditional animal breeds requires adopting in-situ strategies. Although alternatives such as conservation in parks or stations as well as ex-situ conservation (cryoconservation) do exist, they often have problems of keeping the required within-breed diversity and adaptation properties of the breed linked to agricultural production in a specific area. That is, the breed loses its characterising properties. In-situ on-farm conservation, however, is threatened by the abandonment of the rearing of these breeds. Therefore, the objective of this chapter is to identify forces that drive the decisions of farmers to reduce, continue or even develop the activity of breeding local, traditional sheep and goat breeds.

It is often stated that this decision will depend on the economic attractiveness of this activity. However, the literature has shown that farmers are, as firms in general, not (or not always) pure profit maximisers⁶⁴ but rather follow multiple objectives (Meskens and Mathijs, 2002). Then profit levels act as a goal, setting a minimum level that has to be reached (Chaplin, 2000). Besides, farmers also take into account the opportunities around them (options of employment outside the farm) or the quality of their work environment (hardship of work, general quality of life, etc. – cf. Hubbel and Carlson, 1998) as well as environmental preferences (Dupraz et al., 2003). Information also plays a major role (Marra, Hubbell, and Carlson, 2001).

The objective of this chapter is to better understand the driving forces that lead farmers to develop their breeding activities of local traditional breeds. We link this decision to on-farm structural parameters as well as to the natural and socio-economic environment.

The following section will review the literature related to farm dynamics. While this literature concentrates mostly on the exit decision of farmers, it seems to be of relevance to

⁶⁴ This is also true for firms in general (e.g. Blume and Easley, 2002)

our analysis. Moreover, to my knowledge, no literature exists to analyse the dynamics of different farm activities, in particular not paying attention to the specifics of breeding traditional livestock being cast in a farm dynamic framework. There exist studies that use a choice-experiment approach (Scarpa *et al.*, 2003a) and that analyse revealed and stated-preference approaches to value traits of breeds by farmers (Scarpa *et al.*, 2003b). Also sociological studies that analyse the issue do exist. In their methodological approach the latter are of more relevance to chapter 5 and will be discussed there.

In section 4.3 the data used in the analysis will be presented and the econometric model implemented will be described. The estimation proceeds in two steps. First only variables relevant to the individual farm are taken into account. Geographic reference points are only rudimentarily treated by using country dummies. In a second step, geographic aspects are explicitly included in the analysis using the marginality index developed in chapter 3. A discussion of the results follows in section 4.4. Section 4.4.3 presents further results with indices of marginality added to the model. The paper concludes on the prospects of in-situ conservation of traditional livestock breeds.

4.2 Literature review on farm exit dynamics

There is a literature on the decision to continue farming in different contexts (part-time, full-time). In this literature the decision to discontinue/continue farming is explained by different characteristics of the farmer, such as socio-demographic characteristics, level of education, income, etc. Influence of characteristics of the farm itself (type of farming, economic prospects of the farm) and the region (employment alternatives etc.) have also been studied.

In this literature the impact of off-farm income has been analysed. Off-farm income has often been viewed as a factor helping farmers continuing their farming-activity (Zurek, 1986).

Yet, Pfeffer (1989), as well as Bollman (1991), reported on the contrary that part-time farmers seemingly use off-farm activity as a transition to leaving the farm. These contrasting outcomes that are found in the literature for different case studies, suggest that the effect can be considered to be highly context-dependent. For instance, Kimhi and Bollman (1999) have found that in both Canada and Israel, exit probability decreases with the extent of off-farm work. They conclude that off-farm work is complementary rather than a substitute for farm work. All these studies were based on micro-level data.

Other studies base their analysis on regional data. For example, Glauben, Tietje and Weiss (2003) have also found that exit rates in Germany are lower in regions with a high share of part-time farms, which indicates that off-farm income may have a stabilising impact on structural change in agriculture.

Glauben, Tietje and Weiss (2003) also found that exit rates are higher in regions where the farm average size is smaller, suggesting that exit probability of smaller farms is higher. Farm exits thus drive the structural change observed in German agriculture. However, this may also be a function of the particular geographic and institutional context. Indeed, Kimhi and Bollman (1999) found that smaller farms were also more likely to exit in Canada, but not in Israel. On the contrary, they found that both Canadian and Israeli farmers over a certain age are more likely to exit as they become older.

4.3 Methods and Data

The purpose of this modelling effort is to identify factors that hinder or help the future development of the activity. Because of the ordered nature of the dependent variable an ordered logit model is adopted. Let y_i be the breeding plans observed on farm i . They are an observed decision based on a latent variable y_i^* which measures the attractiveness of the

breeding activity. The relationship between the latent variable y_i^* and the observed variable y_i is

$$\begin{aligned}
 & y_i = 0 \text{ if } y_i^* \leq 0, \\
 (1) \quad & y_i = 1 \text{ if } 0 < y_i^* \leq \mu, \\
 & y_i = 2 \text{ if } \mu < y_i^*
 \end{aligned}$$

The parameter μ is the threshold parameter breaking between the value of the dependent variable 1, "stable" trend in the stock of animals and the value 2, "growing". The threshold between "decrease" and "stable" has been normalised to zero without any loss of generality (Greene, 2003, p. 669).

The ordered logit model explains the latent variable using a set of explanatory variables summarised in the vector \mathbf{x}_i as

$$(2) \quad y_i^* = \boldsymbol{\beta}'\mathbf{x}_i + \varepsilon_i$$

where $\boldsymbol{\beta}$ is the vector of parameters to be estimated. It is assumed that ε_i is logarithmically distributed across observations and the ordered logit model results. The probability of observing the outcomes in the latent variable results as

$$\begin{aligned}
 & \text{Prob}(y_i = 0) = \text{Prob}(y_i^* \leq 0) = \text{Prob}(\boldsymbol{\beta}'\mathbf{x}_i + \varepsilon_i \leq 0) \\
 (3) \quad & \text{Prob}(y_i = 1) = \text{Prob}(0 < y_i^* \leq \mu) \\
 & \text{Prob}(y_i = 2) = \text{Prob}(\mu < y_i^*)
 \end{aligned}$$

The logistic probability distribution is given by

$$\Pr(x) = \frac{e^x}{1 + e^x}$$

The model is estimated using a maximum likelihood procedure with the data collected in the farm survey presented in Chapter 2.

The dependent variable is BRTREND, that is, the trend in the stock of animals of the breed, on a given farm. The coding and frequencies for the dependent variable are given in Table 4.1.

Table 4.1 – Dependent variable for the nine EU-25 countries and Romania

BRTREND	Meaning	Count	Frequency
0	Declining	70	0.135
1	Stable	183	0.354
2	Growing	263	0.509

When estimating the parameters for the model described by equation system (3), the parameters do not lend themselves to easy interpretation. For interpreting the results, marginal effects are estimated. Marginal effects are the partial derivatives of probabilities of each outcome with respect to the vector of characteristics. They are computed at the means of the explanatory variables. Increasing one of the explanatory variables while holding β and μ constant⁶⁵ is equivalent to shifting the distribution to the right (Figure 4.1). Then, unambiguously, assuming that β is positive for the explanatory variable considered, Prob($y=0$) must decline. Similarly, Prob($y=2$) is positive. However, what happens in the middle is

⁶⁵ In this case, three possible outcomes are considered, and one single threshold parameter, μ , as explained above.

ambiguous and great care should be taken to interpret the coefficients (Greene, 2003), thence the importance of calculating marginal effects.

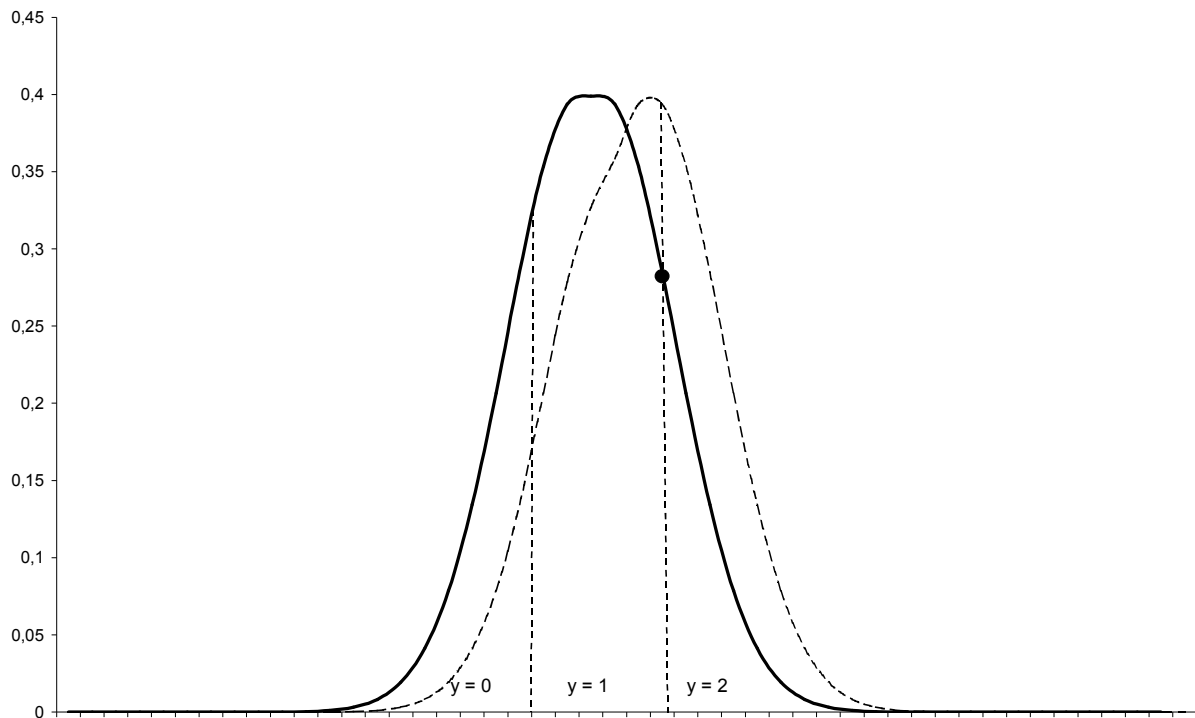


Figure 4.1 - Effect of increasing one variable on the (here normal) distribution of probabilities

In practice, these are computed for all but dummy variables by evaluating the product of the vector of estimated coefficients and the mean values of the explanatory variables. Marginal effects for dummy variables are computed differently by calculating the difference of the probabilities evaluated at both values of the dummy, keeping all other variables constant at their mean.

Table 4.2 – List of explanatory variables and mean values

Explanatory variables	Variable meaning	Type of measure	Mean
BIRTHFRM	Year of birth of the farmer	Year	1955
REVOUTF	Classes of percentage of off-farm revenues on total revenues	0 = none; 1 = 0-25%; 2 = 25-50%; 3 = 50-75%; 4 = 75-100%	0.92
AGE60	Age of the farmer \geq 60	If farmer older than 60 = 1 Otherwise = 0	0.16
AUTOCHTH	Origin of breed raised: whether or not autochthonous in the country	If breed is autochthonous = 1 Otherwise = 0	0.84
EDUCPROG	Participation in education programmes on type of husbandry	If farmer has participated = 1 If not = 0	0.55
MKTBYREL	Presence of marketing strategies for the most relevant production	If a marketing strategy is present = 1; if not = 0	0.51
RATIONS	Differentiated rations according to animal age or physiological condition	If rations are differentiated = 1 otherwise = 0	0.65
REVCLAS2	Classes of revenues (annual total gross revenue from agriculture, excluding support/subsidies)	1 < 5000 EUR 2 5000-10000 EUR 3 10000-20000 EUR 4 20000-50000 EUR 5 > 50000 EUR	2.78
TRACTORS	Number of tractors	Number	1.13
YOUNGWRK	Presence of successor for the farm if farmer older than 60	If farmer older than 60 and successor present = 1; otherwise 0	0.11
YRSINCE	Number of years since the breed is raised on the farm, in three classes	1 less than 5 years 2 between 5 and 10 years 3 more than 10 years	2.72
YSCHOOL	Total number of years at school	Number of years	10.09
SUMSHGT	Percent of total farm revenues from sheep and/or goat products	Proportion from 0 to 1	0.77
AT	Farms in Austria	If country=Austria 1 otherwise 0	0.029
DE	Farms in Germany	If country=Germany 1 otherwise 0	0.085
ES	Farms in Spain	If country=Spain 1 otherwise 0	0.140
FR	Farms in France	If country=France 1 otherwise 0	0.064
GR	Farms in Greece	If country=Greece 1 otherwise 0	0.221
HU	Farms in Hungary	If country=Hungary 1 otherwise 0	0.025
IT	Farms in Italy	If country=Italy 1 otherwise 0	0.163
PL	Farms in Poland	If country=Poland 1 otherwise 0	0.103
RO	Farms in Romania	If country=Romania 1 otherwise 0	0.089

For the logit model a logarithmic distribution of probabilities is assumed. Thus, for continuous variables, marginal effects are computed as follows:

$$\frac{\delta \text{Prob}(y=1)}{\delta X_i} = \frac{\beta}{[1 + \exp(X_i\beta)]}$$

Table 4.2 provides a description of the explanatory variables used in the model and their respective means. Records with missing data are left out and the number of observations used equals $N = 522$. The average birth year is 1955 so that the farmer being interviewed had an average age of 47 years. In the questionnaire, farmers older than 60 were asked if there was a successor for the farm. Thus, the information was coded into two variables: AGE60 taking the value 1 if the farmer is older than 60 and 0 otherwise, and YOUNGWRK, taking the value 1 if there is a successor and 0 otherwise. The combination of the two variables is necessary to account for all possibilities.

Overall 16% of farmers are older than 60. In this subset of farms excluding missing data, approximately 75% of these farmers have a successor for the farm.

84% rear autochthonous breeds and slightly more than half of them have marketing strategies for the most relevant production of their breed and participated in education programmes on this type of husbandry, respectively.

The proportion of farms, assessed on the mean value given for country dummies for $N=522$, varies little, with respect to the whole dataset ($N=604$). That is, list-wise, and overall, each country has a similar amount of missing data, so that the results are not biased. For more details on descriptive statistics of the farms cf. Chapter 2.

4.4 Discussion of empirical results

Table 4.3 presents the estimated parameters. The model has been estimated in three versions. Firstly, in model 1 (columns 2 and 3) only farm characteristics are used as explanatory variables. In the second model, country dummies have been added to the model (columns 4 and 5). The left-out dummy is that for the UK. Then testing the likelihood ratios and failing to reject the null hypothesis that the parameters for two non-significant variables (TRACTORS and YSCHOOL) in model 2 are different from zero, a third model (column 6 and 7) was also estimated. While it can be seen that model 3 changes little or nothing, with respect to the magnitude, sign and significance of parameters, it proved to perform better in terms of total correct predictions, and particularly with regard to correct predictions of the least frequent outcome, $y = 0$. As it can be seen in Table 4.1, the distribution of this is quite skewed towards $y = 2$.

4.4.1 Results of model 1

Firstly, results of model 1 are interpreted. Since the estimated parameters cannot be directly interpreted with respect to their impact on the probability of the decision outcome, the discussion focuses directly on the marginal effects that are presented in Table 4.4.

As revenues from off-farm activities (variable REVOUTF) increase, the probability that the trend in the stock of animals of the breed is declining and the probability that this stock is stable both increase, while the probability that the stock is growing decreases. This implies that off-farm revenues seemingly have the effect of enhancing reduction of activities with traditional breeds. In some cases this may correspond to an overall reduction of agricultural activities. In other cases, although it has not been possible to test this assumption, off-farm revenues may favour more capital-demanding agricultural activities, in lieu of extensive husbandry.

Table 4.3 – Characteristics of the ordered logit model and their significance

Variable	Model 1		Model 2		Model 3	
	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.
Constant	-57.544 ***	21.272	-58.856 ***	22.310	-63.776 ***	21.722
BIRTHFRM	0.031 ***	0.011	0.031 ***	0.011	0.034 ***	0.011
REVOUTF	-0.154 **	0.067	-0.140 *	0.075	-0.132 *	0.072
AGE60	-0.690	0.408	-0.783 *	0.433	-0.795 *	0.434
AUTOCHTH	0.446 *	0.266	0.655 **	0.312	0.632 **	0.309
EDUCPROG	0.462 **	0.184	0.408 **	0.206	0.434 **	0.203
MKTBYREL	0.787 ***	0.196	0.785 ***	0.223	0.818 ***	0.221
RATIONS	0.116	0.191	0.170	0.200	0.182	0.199
REVCLAS2	0.012	0.062	0.007	0.069	0.016	0.069
TRACTORS	-0.147 **	0.069	0.014	0.088		
YOUNGWRK	0.730 *	0.388	0.775 *	0.412	0.802 *	0.412
YRSINCE	-0.553 ***	0.176	-0.597 ***	0.188	-0.632 ***	0.185
YSCHOOL	0.027	0.024	0.030	0.030		
SUMSHGT	-0.160	0.322	-0.342	0.362	-0.423	0.346
AT			0.944	0.683	0.838	0.633
DE			0.593	0.486	0.649	0.478
ES			0.918 **	0.446	0.807 *	0.422
FR			1.369 ***	0.514	1.453 ***	0.508
GR			1.546 ***	0.441	1.406 ***	0.387
HU			3.406 ***	1.128	3.447 ***	1.126
IT			0.491	0.433	0.356	0.404
PL			0.816 *	0.485	0.788 *	0.479
RO			1.584 ***	0.512	1.486 ***	0.480
μ	2.067***	0.322	2.165 ***	0.149	2.176 ***	0.149

Significance level: * 0.10; ** 0.05; ***0.01

The age of the farmer (BIRTHFRM) and the presence of a successor (YOUNGWRK) are relevant and significant variables. The younger the farmer, the higher is the probability that the trend of animals of the breed grows. However, AGE60 cannot be interpreted but carefully, because while marginal effects for $p(y=0)$ and $p(y=1)$ are significant, the parameter for AGE60 has a p-value of $p=0.1010$, thus slightly above the significance level 0.10.

Table 4.4 – Marginal effects for the ordered logit model 1

Variable	Y=0	Y=1	Y=2
BIRTHFRM	-0.0029 ***	-0.0047 ***	0.0077 ***
REVOUTF	0.0148 **	0.0237 **	-0.0385
AGE60	0.0796 ***	0.0897 ***	-0.1693
AUTOCHTH	-0.0482 **	-0.0626 ***	0.1108
EDUCPROG	-0.0453 **	-0.0696 ***	0.1149
MKTBYREL	-0.0766 ***	-0.1177 ***	0.1943
RATIONS	-0.0112	-0.0176	0.0289
REVCLAS2	-0.0012	-0.0019	0.0030
TRACTORS	0.0141 **	0.0227 *	-0.0367
YOUNGWRK	-0.0563 ***	-0.1195 ***	0.1757
YRSINCE	0.0530 ***	0.0852 ***	-0.1382
YSCHOOL	-0.0026	-0.0042	0.0068
SUMSHGT	0.0153	0.0247	-0.0400

Significance level: * 0.10; ** 0.05; ***0.01

If the breed has been present on the farm for a longer period of time (YRSINCE), the probability that the stock of animals is stable or declining increases while that of a growing stock decreases. This may be due to farmers that have in recent years decided to raise traditional breeds and who are still in the process of expanding this activity. They are expressly motivated by traditional breeds. On the other hand there are farms that traditionally have raised those traditional breeds who have not yet made the change towards "improved" breeds or other activities, but who plan to reduce their activity in the future. This seems to indicate that the in-situ conservation will not take place on the old farms where the breeds are traditionally found.

Two factors seem to contribute in a highly significant way to decreasing (increasing) the probability that the stock of animals declines (grows): participation in education programmes (EDUCPROG) related to this type of animal breeding, as well as the presence of marketing strategies for the most relevant production of the breed (MKTBYREL).

As far as participation in ad-hoc education programmes (EDUCPROG) is concerned, two explanations of the effect of this variable are possible. On the one hand, a breeder who

participates in education programmes is more apt to develop strategies that help him building his enterprise on this breed. On the other hand, another interpretation would point out a different direction of causality. According to this second viewpoint, farmers who have been willing to participate in education programmes are successful in continuing to raise the breed, and even increase the number of animals. This is because they can reap the fruit of their education efforts and point to the importance of human capital (Kearney, Boyle and Walsh, 1994; Jenkins, 2000; Terluin, 2003). They may be able to improve the efficiency of production thus making their economic activity more successful.

The variable MKTBYREL was computed from variables on marketing strategies by type of strategy (label, on farm sale, etc.) and type of product and from variables on the relevance of these different products. When at least one type of marketing strategy is present for the most important product of the breed (be it milk, meat, reproductive animals, or other products), MKTBYREL is equal to one, otherwise it is equal zero.

The presence of ad-hoc marketing strategies for the most important production significantly diminished the probability that the trend is declining or stable. A breeder applying these marketing strategies would probably be more interested in promoting the breed's products, envisage and implement new marketing strategy and be overall encouraged in enhancing the farm's activities based on this type of husbandry. Put the other way round, presence of these ad-hoc strategies may significantly enhance the success of these activities.

As shown in Chapter 2 (cf. Table 2.13 p. 52), for 25% of farms the major source of income is not based on sheep or goat produce. Thus, the characteristic MKTBYREL can also be interpreted as an indicator of the importance of sheep and/or goat breeds in the farm. In fact, the estimation of the effect of a binary variable on the presence or absence of marketing strategies, regardless of the relative importance of the product had given non significant

results and this provides a different picture for farmers that are more likely to develop husbandry based on traditional, local sheep/goat breeds.

The number of tractors on the farm is a variable taken as an indicator of higher intensification, on the basis of mechanisation. Here, a higher number of tractors tends to increase the probability of a declining stock of animals. This could be explained as a tendency of farms of either being interested in investing in this type of traditional management based on husbandry of local breeds or in a more intensive, arable crop-oriented farm system. More capital endowment makes less capital-intensive production techniques such as breeding traditional sheep and goat breeds less attractive. There may be a crowding out effect.

Alternatively, this variable might account for another explanation, namely different farm systems and technological endowment in different regional contexts. In regions that are more prone to mechanised and capital-intensive agriculture, raising traditional breeds may be at a comparative disadvantage.

The variable TRACTORS may account for these differences. Since this analysis is performed on several distinct EU countries⁶⁶, plus Romania, differences of this sort can be quite important. Therefore, the analysis is repeated with nine dummy variables accounting for all countries but one, the base country (here, UK).

The variable RATIONS is another indicator of greater technicity of production activities. It is a binary variable accounting for the adoption or not of the zootechnical decision of differentiating alimentation according to the physiological status of the animal (growth, reproduction, carriage, lactation...). The parameter for this variable is not significant.

Some of the farms (16% in the usable dataset) rear non-autochthonous breeds. Thus, a dummy variable was used in order to analyse the impact of the type of breed on the farmer's

⁶⁶ Austria, France, Germany, Spain, Greece, Hungary, Italy, Poland and the United Kingdom.

decision. AUTOCHTH is equal to one if the focus breed on the farm is autochthonous in the country, zero if it is not. If the breed is autochthonous, the probability that its stock of animals on the farm declines or is stable is reduced. Farmers rearing autochthonous breeds are less likely to reduce their breeding activities or to maintain them at the same level.

One interesting finding is that the class of revenues (REVCLAS2) has no significant influence on the decision. Nor is the level of education significant that was measured by number of years attending school (YSCHOOL) significant. This is somewhat surprising and in contrast to findings from other studies that have shown a significant correlation between level of education and participation in some types of environmental programmes (Hawthorne and Alabaster, 1999) or greater integration of alternative food enterprises in the agro-food system (Barlas *et al.*, 2001). A tentative interpretation would be to understand this as the different perception of the conservation of livestock biodiversity, as compared to other environmental issues. However, our dataset does not allow a conclusive statement on this aspect.

The variable SUMSHGT, measuring the percent of farm revenues (not including off-farm income generating activities) deriving from sheep and/or goat produce, is not significant. However, performing a likelihood ratio test reveals that the parameter for this variable is significantly different from zero ($p < 0.0001$). Thus, the variable enhances the explanatory power of the model.

4.4.2 *A model with country dummies*

Since the countries covered by the database are very different in their natural and socio-economic characteristics, a model is analysed introducing a dummy per country (minus one, to avoid the dummy trap). Comparison between the two models is performed with a Likelihood Ratio (LR) test. With country dummies, we obtain a test statistic:

$$LR = -2 * (\text{LogLr} - \text{LogLu}) = -2 * [-458.001045 - (-441.110319)] = 33.781$$

This gives a p-value of $p = 0.0001$ for the chi-squared distribution with 9 degrees of freedom. The critical tabulated chi-squared at 0.01 level, with nine degrees of freedom is 21.664. Calculated LR is much larger and thus the null hypothesis that all dummies jointly are equal to zero is rejected. We thus take as a better model the unrestricted one with a dummy variable per country (model 2). A further improvement of the model was obtained by dropping the variables TRACTORS and YSCHOOL. Not only were they not significant individually, but also jointly the parameters were not significantly different from zero ($p=0.074$). The results of this model are shown as model 3.

Despite the country dummies not being all significant, they greatly add explanatory power to the model, as shown by the likelihood ratio test. This, and the fact that all parameter estimates but one do not change substantially, may also reassure that the model being estimated uses an adequate and robust specification.

Marginal effects for model 3 are summarised in Table 4.5. As stated above the variable TRACTORS is not significant. When excluded from the model (still including YSCHOOL), a likelihood ratio test reveals that its parameter is far from being significantly different from zero ($p=0.706$) as it was the case for model 1, without country dummies. In line with the hypothesis formulated above, the inclusion of dummies for each country annihilates the possible significant effect of different endowments with tractors on the development of traditional local sheep and goat breeds on the farm. This is the most relevant difference in this case and it suggests that the number of tractors accounted for regional differences and that the decision to increase breed stock is not dependent on the capital intensity of the farm.

Table 4.5 – Marginal effects for the ordered logit model 3 with country dummies

Variable	Y=0		Y=1		Y=2
BIRTHFRM	-0.0029	***	-0.0055	***	0.0084
REVOUTF	0.0115	*	0.0215	*	-0.0329
AGE60	0.0864	***	0.1078	***	-0.1942
AUTOCHTH	-0.0656	**	-0.0903	***	0.1559
EDUCPROG	-0.0386	*	-0.0696	***	0.1082
MKTBYREL	-0.0725	***	-0.1292	***	0.2016
RATIONS	-0.0161		-0.0292		0.0454
REVCLAS2	-0.0014		-0.0026		0.0040
YOUNGWRK	-0.0546	***	-0.1366	***	0.1913
YRSINCE	0.0549	***	0.1029	***	-0.1578
SUMSHGT	0.0368		0.0690		-0.1057
*AT	-0.0532	***	-0.1432	***	0.1964
*DE	-0.0456	**	-0.1110	***	0.1565
*ES	-0.0559	***	-0.1373	***	0.1932
*FR	-0.0779	***	-0.2352	***	0.3131
*GR	-0.0924	***	-0.2302	***	0.3226
*HU	-0.1002	***	-0.3737	***	0.4739
*IT	-0.0281	*	-0.0599	**	0.0880
*PL	-0.0536	***	-0.1344	***	0.1880
*RO	-0.0815	***	-0.2404	***	0.3219

Significance level: * 0.10; ** 0.05; ***0.01

Conversely, AGE60 becomes significant with country dummies. Since in model 1 the parameters to the variable AGE60 had a p-value of $p = 0.1010$, it may be argued that the difference between the two models in this case is very limited and may well occur for sampling reasons.

As before in model 1, it is also here observed that the younger the farmer, the higher is the probability that the stock of animals of the breed grows. When the farmer is older than 60 (AGE60=1), the contrary is true, and thus it becomes more likely that the number of animals remains stable or is decreasing. However, the presence of a successor compensate for this, at least partly. The continuation of the breeding activity for older farmers depends on the presence of a successor who will take up the breed stock and continue the farm. If it is foreseen that the farming activity is abandoned by the farm household, activities are phased out slowly over the last years before retirement. At the same time the presence of a successor

reduces the probability that the breeding stock remains stable. This seems to suggest that the successor either plans to extend the activity, possibly to improve the livelihood, or else to change the orientation of the farm to some extent, including reducing the stock of animals of traditional breeds.

Table 4.6 – Corrected predictions of model 3, with country dummies

Dependent Observed	Predicted			Row sum	% correct
	Y=0	Y=1	Y=2		
Y=0	13	36	21	70	19%
Y=1	4	87	92	183	48%
Y=2	0	55	208	263	79%
TOTAL	17	178	321	516	60%

Table 4.6 shows the percent of correct predictions of the model. As one sees in Table 4.1, the distribution of the dependent variable puts most of the probability mass on higher values. Model 3 provides slightly more accurate predictions at $y=0$ (approx. 19% vs. 18%) and significantly more total correct predictions (approx. 60% vs. 50%).

4.4.3 *Assessing the impact of a marginal location on breeding decisions*

The two models above use only farm-level data. To investigate the impact of the farm's geographic location (and particularly of being in a marginal area) on decisions concerning the future development of traditional breeding activities, an extended model that integrates the marginality index of chapter 3 is presented here.

In chapter 3, indices of marginality have been computed for ECONOGENE countries belonging to the EU-15 only. Since data to construct these indices were not available for the new EU-25 countries, we exclude now farms located in Hungary, Poland and Romania. The

total number of farms is reduced from 604 to 470. The frequencies of the observed outcomes of the dependent variable are given in Table 4.7.

Table 4.7 – Frequencies of the dependent variable in the models with indices

BRTREND	Meaning	Count	Frequency
0	Declining	57	0.141
1	Stable	156	0.388
2	Growing	189	0.470

Frequencies in model (2) with index of marginality and other variables

The variable added is INDEXTWO, an aggregated index of marginality that synthesise information about the population density change between 1998 and 1995, the unemployment rate in 2000, and a ratio of types of land cover. The construction of the index is detailed in chapter 3. The index ranges between values of 0.2 and 1, with larger values indicating a greater degree of marginality for the region. The index has been calculated for NUTS level 3 regions and as the location of farms is georeferenced in a GIS, each farm can be located in its adequate NUTS 3 region by overlaying GIS layers. This can be considered as a snapshot of the present situation. A strong correlation has been found between marginality defined by this index and the traditional presence of local, traditional sheep and goat breeds. However, this does not imply that the index on its own is able to identify areas where this type of husbandry is potentially successful in the near or medium-term future. Thus, one question investigated here is whether or not being in a marginal area as defined by this index has an influence, and which if any, on decisions on the future trend of breeding at the farm-level.

Of the two indices calculated in chapter 3, INDEXTWO was used because it was missing less relevant data in the farm database. However, as both indices basically convey the same information, this choice should not have strong influence on the results.

Table 4.8 – Characteristics of the ordered logit model 4, with the index of marginality

Variable	Coefficient	Std. Error	Mean
Constant	-54.0004 **	25.000	
BIRTHFRM	0.0302 **	0.013	1955
REVOUTF	-0.2194 ***	0.082	0.898
AGE60	-1.1998 **	0.499	0.159
AUTOCHTH	0.8999 **	0.446	0.890
EDUCPROG	0.4468 *	0.229	0.547
MKTBYREL	0.6470 **	0.256	0.425
RATIONS	0.3758 *	0.226	0.639
REVCLAS2	-0.0191	0.079	2.860
YOUNGWRK	0.7827 *	0.475	0.112
YRSINCE	-0.8682 ***	0.230	2.769
INDEXTWO	-3.0171 ***	0.726	0.614
SUMSHGT	-0.8212 *	0.422	0.787
AT	1.0887	0.666	0.037
DE	0.6548	0.536	0.104
ES	0.7152	0.450	0.179
FR	1.7739 ***	0.538	0.082
GR	1.4689 ***	0.412	0.284
IT	0.1838	0.431	0.209
μ	2.4453 ***	0.182	

Significance level: * 0.10; ** 0.05; ***0.01

The first step has been to rerun the estimation for model 3 restricted to the data set of the 470 farms from the EU-15 countries, that is, without Hungary, Poland and Romania. The main differences found between the EU-15 model without INDEXTWO and model 3 presented in section 4.4.2 is that SUMSHGT turns out to be significant and AUTOCHTH did not appear to be significant in the EU-15 model anymore ($p > 0.10$). Then INDEXTWO has been added, and a likelihood ratio test performed that confirmed the hypothesis that the parameter for this variable is highly significantly different from zero ($p < 0.01$). Since the coefficient of INDEXTWO is significantly different from zero, evaluation will focus on the model including this variable, whose parameter estimates are given in Table 4.8. In this model, AUTOCHTH is significant.

Model 4 achieves more correct predictions for outcomes $y=0$ and $y=1$ in comparison to any of the other models (Table 4.9).

Table 4.9 – Correct predictions of ordered logit model 4

Dependent	Y=0	Y=1	Y=2	Row sum	% correct
Y=0	14	32	14	60	23%
Y=1	6	91	62	159	57%
Y=2	1	54	134	189	71%
Column sum	21	177	210	408	59%

As the model is slightly different (one variable added) and is based on a subset of farms from countries that have different characteristics, some tests have been performed, in an iterative procedure by conducting a series of comparison using likelihood ratio tests and checking the percent of correct predictions. It has been found that the model designated as model 4, whose characteristics are reported in Table 4.8 is the one that provides the most appropriate estimation. The parameter for TRACTORS and YSCHOOL were not significantly different from zero ($p=0.706$ and $p=0.025$, respectively). In contrast to models 1 to 3, SUMSHGT becomes highly significant ($p < 0.0001$).

Generally, the model with INDEXTWO (model 4) does not show very relevant differences, except for a few variables detailed in the following. Significance level and sometimes magnitude of parameters change a bit, yet signs for significant variables are the same. The two most relevant differences are that RATIONS and SUMSHGT become significant. SUMSHGT is also significant in the model using the same variables as model 3 but limited to farms in EU-15 countries. RATIONS is significant only after introduction of the variable INDEXTWO. It should be remembered that the parameter for this variable is significantly different from zero. Therefore, focusing on marginal effects as above, the analysis is made on the results of the model including this variable.

Table 4.10 – Marginal effects for the ordered logit model with variable INDEXTWO

Variable	Y=0	Y=1	Y=2
BIRTHFRM	-0.0025 **	-0.0050 **	0.0075
REVOUTF	0.0185 ***	0.0360 **	-0.0545
AGE60	0.1411 ***	0.1293 ***	-0.2704
AUTOCHTH	-0.1007 ***	-0.1071 ***	0.2078
EDUCPROG	-0.0384 *	-0.0719 ***	0.1103
MKTBYREL	-0.0528 **	-0.1070 ***	0.1598
RATIONS	-0.0331	-0.0595 ***	0.0926
REVCLAS2	0.0016	0.0031	-0.0047
YOUNGWRK	-0.0518 **	-0.1405 ***	0.1923
YRSINCE	0.0730 ***	0.1426 ***	-0.2156
INDEXTWO	0.2538 ***	0.4954 ***	-0.7492
SUMSHGT	0.0691 **	0.1348 *	-0.2039
AT	-0.0616 **	-0.1971 ***	0.2587
DE	-0.0448 **	-0.1171 ***	0.1619
ES	-0.0503 **	-0.1264 ***	0.1767
FR	-0.0861 ***	-0.3030 ***	0.3890
GR	-0.0998 ***	-0.2500 ***	0.3497
IT	-0.0148	-0.0310	0.0458

Significance level: * 0.10; ** 0.05; ***0.01

The model confirms the effects of variables as discussed for model 3. Three more variables need to be discussed here. Two, as said above, that are now significant. INDEXTWO, that has been added, is discussed next.

The interpretation of the effect of a greater technicity as measured by the practice of differentiating feed rations according to the physiological status of the animal (RATIONS) must be careful. Approximately 64% of farmers adopted this practice in farms of the seven EU-15 countries. This proportion is similar to that for all 604 farms in the ten EU-25 countries.

The parameter to this variable is significant at the 0.10 level. However, only one of three marginal effects, that for Prob(y=1) is significant. Thus what happens to the extreme outcomes is not totally unambiguous. The existence of the practice measured by RATIONS=1

significantly diminishes the probability that the trend of the stock of the breed is stable. It is expected that farmers interested in developing the breed be more likely to adopt such a practice, in order to maximise animal welfare, health and performances. In fact, the importance of differentiated rations is well documented and well known (Journet, 1988). Thus, more than a causal relationship, a correlation could be expected to exist between the adoption of the practice and the decision to increase the breeding activities in the future.

A greater proportion of farm-produce income originating from sheep and/or goat breeds (SUMSHGT) significantly increases the probability that the stock of animals in the breed is reduced or remains stable, and reduces the probability that the future trend of the stock is "growing". Consistent results were obtained by testing the model with a binary variable that measures the fact that the most important part of farm-produce income originates from sheep and/or goat, or not.

This can be interpreted as indicating that farmers rearing these breeds who diversify more their sources of farm revenues are more likely to increase breeding activities with traditional breeds. However, it is not clear from the available data if this is to be interpreted as a greater viability allowing those farmers who diversify sources of income to invest more on this type of animal breeding. Alternatively, it may imply that all breeders seek an equilibrium between sources of income and that those depending more on sheep and/or goat produce wish to reduce the stock of animals of their sheep or goat breed, while those having less revenues from sheep and/or goat breeds may wish to increase this proportion. The link of causality may be reversed and this result may imply that farmers who have less revenues from sheep and/or goat might be those who wish to develop their activity with the breed. This is consistent with the finding explained above, that farms where the breed has been present for a shorter length of time (YRSINCE) are more likely to increase the stock of the breed.

This variable SUMSHGT is significant when INDEXTWO is introduced in the model. As seen in Chapter 2 (Table 2.13), there are large differences between countries as to the part of revenues originating from sheep and/or goat produce. Thus, one may expect that INDEXTWO carries information that combined with country dummies interact to render SUMSHGT significant. However, this interpretation is impaired by the fact that in the model without country dummies SUMSHGT is not significant, also when INDEXTWO is added. It may be concluded that the effect is complex and explanation is not straightforward.

INDEXTWO account for the relative degree of marginality of the NUTS level 3 region where the farm is located. Its inclusion in the model allows analysing the reaction of farm breeding plans to the marginality of the region. In this index, information about marginality is based on a higher unemployment rate, a diminution of population density in 1998 compared to 1995 and an increase in marginal land use. The latter is estimated as a ratio between natural grassland, heath, moors, scrubs and other less-productive land as compared to the surface of urban, transportation infrastructure and industrial area, as well as arable land.

This variable is significant and an increase in marginality as measured by it determines an increased probability that the trend of the local breed is declining as well as an increased probability that the trend is stable. In areas that are more marginal, thus, farmers are less likely to develop their activity with local traditional breeds. One possible interpretation of this is that as the degree of marginality increases, the attractiveness and/or viability of this type of animal breeding activity decreases.

Tests have also been performed adding the other indices as well as modelling the component indices of INDEXTWO separately. Parameters for all other indices were not significantly different from zero. When the three indices aggregated in INDEXTWO were used, the model was as well specified, having slightly less correct predictions overall and for $y = 2$. It was possible to see that the index measuring the change in population density

(ID98IDX5) was not significant and that the factors contributing most significantly are unemployment rates (IEMPL) and land cover (ILAND). Both have the same coefficient sign and marginal effects on probabilities as INDEXTWO.

It has been shown in Chapter 3 that a significant correlation exists between the presence of local, traditional sheep and goat breeds and present-day relative marginality measured by these indices. It is argued that the impact of the variable on present-day breeding decisions of farmers, as given in this model, implies that the trend of (at least partial) abandonment of traditional activities in these marginal areas is still ongoing. This can be taken as an indication of a potential danger of disappearance of husbandry of local breeds in marginal areas and/or of the existence of a serious limitation to the development of farming activities based on these breeds.

4.5 Summary and concluding remarks

In this chapter both the effects of endogenous variables (farm characteristics) and the influence of farm location (relative marginality of the region) on the breeding decisions of farmers have been investigated.

The findings presented here provide scope for some general suggestions for actions that may help preserving and developing the husbandry of local, traditional sheep and goat breeds.

Support for young farmers is argued to be one of the most effective policies that may increase the likelihood that these activities be developed. Rather than continued subsidies, it is suggested that setting-up aids be provided. They may come in form of support to develop ad-hoc marketing strategies for relevant products. The presence of marketing strategies seems to enhance the likelihood that the breeding activity is further developed.

Information also appears to be an essential element. Ad-hoc education programmes could be an interesting measure to support. Breeders participating in education programmes related to the particular type of animal husbandry were consistently found across analyses to be significantly more likely to increase their traditional-breed husbandry activities.

However, the relation of causality may be reversed and there is a possibility that findings here would rather be suggesting than breeders actually participate in education programmes and/or make use of ad-hoc marketing strategies *because* they are interested in developing their activities with the local breed. They may also be motivated by other reasons, not captured by the available variables. According to this view, they may actually be seeking ad-hoc solutions to pursue their own breeding project.

Breeders whose income depends on a relatively larger share of sheep and/or goat produce were found to be more likely to reduce their stock of animals of the local breed. Again, it is possible that the causality be reversed. Thus, farmers who rely relatively less on sheep and/or goats as the source of their income may be relatively more willing to develop this activity. In some cases, they may be at an early stage with respect to the presence of the breed on the farm. Conversely, breeders whose income comes mainly from sheep and/or goat produce may wish to partially reduce or even phase out these breeding activities in order to either change activity, partly or totally shift to a different breed, increase differentiation of farm produce, or else. The data available here do not allow this kind of distinction. Further investigation is needed, possibly combining large-scale quantitative surveys with in-depth, qualitative case studies, to inquire more deeply into the different possible interpretations suggested here.

Probably, one of the most relevant findings is the one concerning the effect of the relative marginality of the region where the farm is located on farmers' decisions about breeding activities. One interpretation of the results may plea for the development of the region, including alternative economic opportunities and/or more infrastructures. In fact, the index of

marginality showed the impact of both a larger unemployment rate and higher values of the ratio of marginal land (grassland, moors, scrubs, and the like) to arable land and urban areas, communication infrastructure and industrial areas. As measured by this index, a higher degree of marginality reduces the probability that the breeds are developed. As it has been shown in chapter 3, the aggregate index of relative marginality is well correlated to the presence of ECONOGENE-selected traditional sheep and goat breeds. In the usable dataset, 90% of farms are located in the regions where the breeds are traditionally present. The findings presented in this chapter suggest that the trend of abandonment (or at least reduction of) activities related to local, traditional sheep and goat breeds is ongoing and is likely to necessitate rural development initiatives to enhance the livelihood of marginal areas.

Chapter 5

CONSERVING LOCAL GOAT BREEDS AND PASTORALIST SPACES: A CASE STUDY IN SOUTHERN FRANCE.

5.1 Introduction

Marginal areas in Europe have known massive abandonment trends in the last four to five decades. More recently, they undergo various articulations of those complex phenomena commonly referred to as "rural restructuring". As far as the former dynamic is concerned, the very "creation" of marginal areas and indeed the construction of the marginality concept are to some extent linked to the specialisation of agriculture. Specialisation has led to intensification, including a shift in social perceptions and economic practices of land cultivation. Farms have undergone mechanisation and a shift towards livestock breeds that were more productive under controlled conditions.

Land more difficult to cultivate mechanically has been abandoned, especially in mountain or remote areas. Depopulation of rural areas and reduction of stocking levels is a long-term trend that is now omnipresent, e.g. throughout the Alps. This dynamic is considered as one of the major driving forces behind changes in ecosystem function and dynamics (Cernusca, Tappeiner and Bayfield, 1999; Dirnböck, Dullinger and Grabherr 2003). Studies have also shown the influence of these trends on diminution of ecosystem biodiversity (e.g. Laiolo, Dondero, Ciliento and Rolando, 2004 on the consequences of pastoral abandonment on diversity of the alpine avifauna).

The dominant political discourse of "modernisation" climaxed in the Sixties. Under this discourse, local livestock breeds have disappeared at an increasing rate (Hall and Ruane,

1993; Hammond, 1996) In Europe, approximately 35-40% of all livestock breeds are presently considered as endangered, it has been estimated that about one third of those existing at the beginning of the twentieth century have already been lost (Hammond and Leitch, 1996; see also Chapter 1). More recently, both an interest in the preservation of endangered breeds and an attention to rural development in marginal rural areas have at least partly shifted the focus of policy and action.

In parallel to these dynamics, counter-productivist movements have focused interest on rural spaces and, more recently, a "revolution" of agricultural policies has allegedly occurred through a series of reforms at the EU level. While the extent of change brought by these reforms has been contested (e.g. Walford, 2002; 2003), both dynamics elucidate a certain transformation of perception and practices in (marginal) rural spaces.

Here, one caveat is necessary when it comes to the term "rural". This is a concept that the recent literature and debate have somehow decried. It might seem awkward to use it. Indeed, as outlined amongst others by Frouws (1998), Halfacree (1993) and Mormont (1990), it has become increasingly difficult to delimit what is "rural" from what is "not rural". Phenomena such as "counter-urbanisation", or the pressure from urban areas on "rural" land, are well known and contribute partly to the larger and complex phenomenon of "rural restructuring". More and more people live in "rural" settings but work in the towns. City-dwellers increasingly own property in "rural" areas, for holidays stays and the like. As Bolton and Chalkley (1990) stressed, there is a broad heterogeneity with respect to the lifestyles and motives of migrants, leaving no room for simplistic stereotyped analyses.

While the issue is relevant, it is argued that this concept of a "disputed rural" is actually an element of tangible conflicts in practices. A given representation or perception of "rural" (as well as of "marginal", for that matter) is one facet of the question. This is linked with conflicting dynamics in use, as this paper will to illustrate.

The term "rural" is used here and it is considered useful as a label for the commonly perceived geographic (and broadly speaking "agricultural") sense that defines as "rural" certain given characteristics of landscape – both those perceived as "natural" and those perceived as shaped by man (namely through agriculture in general and in our case husbandry in particular). Also, the term "rural" is the common reference for policies such as the Common Agricultural Policy (CAP) and its "second pillar", Rural Development Plans (RDP).

In this context, some caution is also needed with respect to the term "marginal areas". As Wright (1997) put it, the term is not precisely defined. Here, we assume that marginal areas are those where there are limited possible agricultural land uses because of higher altitude, shorter growing season, steeper slopes, more limited soil fertility and generally lower productivity. These areas are mainly suitable for extensive livestock farming. Another term which has been used in Council Directive 75/268/EEC is "less-favoured areas" (Commission of the European Communities, 1975). The use that is made here of the former term should be intended to include the latter as well⁶⁷.

In European marginal rural areas as defined above, the following brief and simplified account generally applies. After the massive exodus from these areas to major urban centres and from agriculture to industry, especially rapid since the end of World War II, a counter-exodus is observed more recently (Halfacree, 1994).

Policy choices investing in fast long-distance travelling (e.g. high speed train or "Train à Grande Vitesse", TGV, in France) have enhanced mobility of people living and/or working in major city centres. This enhances re-location opportunities for top-management corporate workers or international institutions' bureaucrats from major towns. In doing so, it brings more purchasing power into the market for real estate. Prices increase and conflict over resources in marginal rural areas may ensue, noticeably over access to land.

⁶⁷ The issue of marginal areas has been dealt with in more detail in Chapter 3.

Sencébé (2002) cites results of surveys in France where most interviewed people associated "rural areas" or "the countryside" with idyllic views of quietness, beauty, nature, freedom. The majority of interviewees affirmed that they wanted to live in the countryside. The rural space, however, was significantly perceived as "an empty container". Very little reference was made to agricultural activities. Livestock was rarely associated with the vision of the countryside or rather of what has been called the "rural idyll". As Boyle, Halfacree and Robinson (1998, p. 142) put it: "the rural idyll [...] can be a strong force guiding migration".

In synthesis, while some regions are marginal with respect to a given type of agricultural development, they may be considered as regions offering opportunities for other social demands, such as tourism or urban counter-exodus, or for minorities seeking alternative lifestyles. They can also be the "haven" for traditional production systems or professions.

Thus, this chapter aims to show that the issue of livestock biodiversity conservation may be interpreted as an illustration or a particular form of the debate in the topic of "rural restructuring". It implies land-use and geographic issues that go well beyond genetics and agronomy, which need to be tackled too in order to find a sustainable way of livestock conservation.

5.2 Livestock biodiversity and marginal rural areas

It is recognised that in most marginal rural areas pasture grazing is often the most appropriate land use, in some cases the sole possible. One factor that may partly explain abandonment of marginal areas could be linked to a dynamic common to many European countries, noticeably though not exclusively to more Southern ones, i.e. a large increase of in-stable type of animal rearing conditions. This increase has also been possible with policies that financed investments in infrastructures and mechanisation, and more generally with all

market-distorting agricultural policy subsidies that have accompanied the development of intensification, specialisation and reduction in number of farms as well as enlargement in size.

Capital intensification of livestock production has been accompanied by an increase in genetic uniformity of livestock. Hennessy, Miranowski and Babcock (2004) have recently shown how this appears to be a necessity for a certain type of large-scale capital-intensive agricultural development. For example, most of the pigs reared under commercial farming systems in Europe and North America belong to two or three breeds. Ninety percent of all North American dairy cattle and 60% of all European cattle belong to only one breed, the Holstein-Frisian (Drucker, Gomez and Anderson, 2001).

Presently, a greater understanding of, and interest in, the preservation of biological diversity is gradually shifting the focus to the conservation of rare breeds. Moreover, the recent literature on controlled comparisons of performance of "improved" breeds in more difficult environments, in contrast to locally adapted traditional breeds, have shown that local breeds may be the best choice, when results are expressed in terms of net benefit per unit input of each major limiting resource (e.g. Ayalew et al., 2003). In a study on minority British sheep for meat production, Hall and Henderson (2000) found that, although economic advantages of using rare or minority breeds in comparison to numerically stronger genotypes were not demonstrated, any economic penalties were not demonstrated either.

The "discourse of modernity" in previous decades envisaged a drive towards more mechanisation, more industry and subsequently more services, increase of productivity and reduction of work force in agriculture. Larger farms and differential geographic development resulted, with farmers being marginalised in areas that could produce less or needed extensive management or more manual labour. In what some have called the "discourse of postmodernity", marginal areas have known a revived interest, parallel to a different outlook on environmental issues, evolving gradually since the late Sixties. Thus, two main waves of

back-to-the-land movements can be grossly distinguished, one in the aftermath of 1968, another one more recently (started in the late 1980s and early 1990s but somewhat more spread over the years than the first wave and, in a sense, ongoing). Contemporarily, governments and institutions such as the Commission of the European Communities have put a focus on "rural development" and the importance to protect marginal areas from total abandonment, on the one hand, and to preserve local livestock breeds, on the other hand.

Parallel to, and often prior to, governmental action, local actors have realised that certain breeds were endangered and have initiated actions aiming at their protection or recovery. This has been performed with some differences and some commonalities between countries. A country-based case study (Southern France) is presented here, and the assumption is made that while certainly some aspects are relevant to Southern France only, others are either common to many other countries and regions or even universally valid.

5.3 A case study in Southern France

5.3.1 Background

The region of this case study is known as Provence and corresponds roughly to the administrative region of Provence-Alpes-Côte d'Azur (PACA). In contrast to most of Europe, husbandry in this region is particularly characterised by the rearing of small ruminants. While it has about fifty to sixty thousand bovine LU (livestock units), sheep sum to a total of approximately 125-130 thousand LU and goats to about five thousand⁶⁸. As shown in Table 5.1, between 1970 and 2000 agricultural land use has declined of approximately 20% while non agricultural land use has increased of about 37%. Assuming a steady change, this would have occurred at a rate of 1% per year over this 30-year period.

⁶⁸ Data from year 2000. Source: AGRESTE, 2002.

Table 5.1 – Change in land use in the Provence Region, between 1970 and 2000

Land Use	1970		2000	
	1000 ha	%	1000 ha	%
Utilised Agricultural Area	1,157	36%	917	29%
Non cultivated Agricultural Land	324	10%	278	9%
Plantations and forests	1,172	37%	1,262	40%
Non-Agricultural Land	527	17%	724	23%
Total Land Area	3,180	100%	3,181	100%

Source: AGRESTE, 2002.

Partly, our investigation has included some other geographically Provençal sub-regions, belonging administratively to Rhône-Alpes (Department of Ardèche) and Languedoc-Roussillon (Department of Gard). We have limited our survey to breeders in the area deemed to be the "traditional zone of breeding" of the two focus goat breeds, the Rove and the Common Provençal.

Our research question was initially the following one, in two parts:

- (1) How to explain that in the same region, of two endangered goat breeds, one, the Rove, is the object of successful actions to preserve it, so that after declining to about 400 animals in the early Seventies, it has now revived to more than 5,000 in 2001 – data according to the European Association of Animal Production (EAAP) database – and spread outside the original region;
- (2) and why is the other, the Common Provençal, still considered as endangered, while some action is presently being taken?

Subsequently, though, the key question appeared rather to understand in which territorial and social dynamics local breed conservation is grounded. A corollary that demanded attention was how breeders' worldviews influence action in livestock biodiversity conservation. In the following, the two goat breeds are briefly presented. Then the objectives and methodology applied to the case study are described.

The Rove goat breed (Figure 5.1) is a quite typical goat: large (males' withers height is about 85 cm, and their weight is about 80 kg), with multicoloured coat and very large, twisting horns. One of its special characteristics is to have been used in transhumance accompanying sheep herds. Farmers raising large herds of sheep in the plain usually kept some goats for their aptitude to guide the herd of sheep and adapt to harsh conditions from sea level to more than 2,000 metres of mountain altitude. They especially kept castrated males called "menons" in French, with large bells at their neck, and these would be able to thrive on scarce food and pull the herd of sheep up and back down the mountains, including passing through snow, opening the path, as the snow glides on their hair while it would stuck to mutton wool freezing the sheep possibly to disease or even death.



Figure 5.1 – Rove goat with kid, grazing shrubs on grassland edge

Perceived as beautiful (Figure 5.1), these goats are still proudly kept by some sheep breeders, despite being less useful and even hard to manage now that transhumance is organised using trucks. This was one reason of endangerment of this breed. However, the breed was used somewhat differently elsewhere.

The first researchers investigating on this peculiar breed, even before it was considered as such, were told little about them except that they should go where the largest concentration was to be found, in the village of Le Rove, near Marseilles. The village eventually gave the name to this breed⁶⁹. There, its main use was to produce a particular kind of cheese, the "brousse", obtained quite uniquely by curdling milk with vinegar instead of rennet. The "brousses" were sold in Marseilles, by the breeders themselves, who went around shouting in the streets to call for customers. While no denomination of origin protects this particular cheese and you may buy cow-milk imitations, only one producer is still making it with this breed and in the traditional way in the village. Conversely, many newcomers have settled in several Provençal areas where they produce and sell various types of goat cheese.

The history of the Common Provençal is quite different. This breed is linked to the typical mixed farm of the past, with various types of cultures and many animal species on the same farm. There, it was mainly up to the women to deal with, e.g., poultry and goats, while culturally "more manly" activities dealt with arable land and sheep rearing. Specialisation, the disappearance of that type of mixed family farm and the cultural bias against goats were some of the drives that dramatically reduced the number of goats.

The revival of both breeds is largely due to a few distinct waves of newcomers, most of them neither of agricultural family background, nor originally coming from the region where they decided to settle as breeders. One important first wave of newcomers markedly happened

⁶⁹ The origin of the name is not unanimously attributed to this village. Amongst other interpretations, one suggests reference to the Provençal "roure", meaning the oaks (*Quercus robur* L.) that covered the hills around Marseilles in the past. Accordingly, the name of the village would have this same origin.

in the aftermath of the events of 1968. Subsequent setting-ups of incomers in more recent years are more difficult to be seen as spurring from one single event or period.

However, some authors in various countries have interpreted similar events as grounded in the existence of a re-emergence of a "new" counter-culture in the early 1990s (McKay, 1996). According to Halfacree (2004), the new counter-cultural relationship with the rural was central from the onset, and this is a distinguishing element compared to post-1968 waves of incomers. While this seems to be at least partly the case here, it is argued that the trend of incomers belonging to a vaguer "second wave" is ongoing. While present general public awareness of environmental issues blur the distinction between mainstream and counter-cultural, young people are still presently launching farms based on pastoralism and on rearing these local breeds, partly as a "counter-cultural reaction" to a certain "mainstream" view of agriculture and economic development.

As far as the Rove goat is concerned, this breed was little known and particularly neglected at the administrative level. Having known the breed for the first time in 1960, A. Sadorge, a breeder and pastor, started undertaking personal initiatives, driving forces around him. In the early Seventies, the "Société d'Ethnozootecnie", founded by R. Laurans in 1971, assigned to J. Blanc a study on the situation of the breed, which revealed itself as "desperate". Actions were undertaken, people interested, enrolled and mobilised (see Evans and Yarwood, 2000, for an account and an actor-network theory analysis of how a similar association of people around the issue of livestock breeds evolved in the UK). A. Sadorge was a key person, eliciting interest and enrolling important actors, including academic-level institutions as the national Institute for Agronomic research (INRA) as well as Universities and people within such institutions.

The history of the Common Provencal breed is somewhat more conventional. The breed was present in the typical mixed family farm of the past, and typically managed by women

with poultry and the general life of the family-farm courtyard. As production has become more and more market-oriented, farmers specialised in developing activities like sheep husbandry and crops. Both a cultural bias against goat breeding as a "less-manly" activity and a (perceived) greater ease with sheep rearing determined that goats in general tended to disappear along with the general disappearance of the small-scale mixed family farm. Some newcomers, since the late sixties and early seventies, rather decided to base their activities on local breeds and chose the Common Provençal rather than the Rove. The reasons for this choice are also investigated in the present research.

5.3.2 Objectives, methodology and "sampling" of interviewees

The general aim of this study has been to understand the meaning and implication of the idea of the conservation of rare breeds. More precisely, we want to analyse the agricultural and territorial dynamics in which the preservation of livestock breeds factually develops.

While much of the mainstream political discourse focuses on subsidies as a (supposed) necessity to overcome the differential in productivity between traditional versus so-called "improved" breeds, the assumptions underlying this study are that perceptions and life choices of breeders are the most important factors for successfully retaining or attracting breeders, that marginal areas and less productive but less demanding breeds are reciprocally adapted to each other and that motives for breeders are inherently different from unit productivity of animals under controlled conditions.

In-depth, non-directive interviews were used to collect the discourse of farmers and a few experts. The approach adopted is grounded in an interpretive epistemological perspective (Kaufmann, 1997). A first wave of non-directive interviews (Rogers, 1942; 1945; Pagès, 1970) was conducted in September 2003 (three experts and three farmers) and formed the explorative phase.

These preliminary interviews gave some hints for the subsequent semi-directive interviews that were based on a very flexible structure. In the survey, the target group were farmers and two more experts. Face-to-face interviews were conducted in October 2003 and January 2004. All interviewed farmers belong to the respective association "for the defence and development of the breed". The president and vice-president of the two associations were amongst the interviewees. Overall, in the two phases of the survey, five experts, seven out of seventeen farmers rearing the Common Provençal breed and twenty-two out of seventy Rove breeders were interviewed. The latter were also divided in subgroups (Table 5.2 and Table 5.3).

The guidance of the interview is provided in Appendix 5. It is important to understand this as a general reminder that the interviewer uses to make sure that all important points are discussed. At no time has it been used strictly or to ask direct questions. There is no fixed duration and a delicate balance is to be obtained between a general freedom of speech and the need to focus on matters of interest for the research. The interviewee's free flow of narration provides a richer texture and greater insight into each individual's construction of the sense of his/her practices. As Blanchet and Gotman (2001) put it, if the interviewer poses a lot of precise questions, the interviewee usually ends up letting the interviewer guide him/her and waits passively for the next questions, becoming less prolix, less spontaneously associative and less articulated around a certain internal logic.

While no qualitative research generally aims at representative sampling, we paid great attention to interviewing enough farmers from groups with slightly different characteristics. As far as the Common Provençal goat is concerned, all of the very few breeders produce milk and cheese on the farm, and basically all of those who rear the pure breed and are part of the breeders' association are back-to-the-land newcomers.

The picture for the Rove breed is more heterogeneous. On the one hand there is a lively tradition, amongst sheep breeders, to keep some goats. They may own as many as a few thousand sheep (the largest farm associating two farmers have together 8000 sheep but average farms would have a few hundred sheep). Besides sheep, they also keep a few goats (in variable numbers from just a couple to a few dozens). However, they consume their goat produce directly and sell very little or none at all. They generally do not make cheese except for own consumption and they have no significant financial revenue from goats.

Table 5.2 – Sample of interviewed Rove breeders, by type of production and herd size

Type of production	Total no. of farms in the region	Interviewed breeders (number of surveyed farms compared to total in the region, by herd size)			Interviewees' herd size	
		Small herd	Average herd	Large herd	No. of animals of interviewees	Idem (prev. col.) as % of region total
Sheep meat and goat meat	31	2 out of 13	2 out of 9	5 out of 9	358	45%
Goat meat only	12	1 out of 5	0 out of 4	1 out of 3	425	47%
Goat cheese and meat	8	1 out of 3	1 out of 2	1 out of 3	223	40%
Goat cheese only	19	3 out of 7	2 out of 6	3 out of 6	670	48%
TOTAL	70	7 out of 28	5 out of 21	10 out of 21	1676	46%

Source: Institut de l'Élevage, 2001 and own calculations. Data on size based on year 2000.

On the other hand, there are the "specialised" goat breeders, who principally or exclusively rear goats. One important finding was that these were mostly newcomers, or "back-to-the-landers" ("néo-ruraux" in French). However, as far as type of production is concerned, there are again some different subgroups amongst them: those selling milk, those producing cheese directly on the farm, those selling kids (goat meat) and lastly those producing both meat and cheese, the Rove being originally a double-purpose breed.

Another subdivision may be made on the basis of time of settling into farming activities, this happening either immediately after 1968 or more recently. While this was more difficult because of lack of data in the available census of Rove goat breeders, a combined sampling approach was adopted, making large use of the "snow-ball technique"⁷⁰. Overall, careful attention was paid to selecting interviewees from all different groups (Table 5.2). The size of herds is classified in small, average and large, obtained by measuring three quantiles for the herd size of farms in each type of production (Table 5.3).

Table 5.3 – Smallest and largest herd size of farms, by type of production

Type of production	Herd size of farms (number of goats)			
	Smallest	< 1/3 quantile	< 2/3 quantile	Largest
Sheep meat and goat meat	3	12	23	74
Goat meat only	4	15	30	230
Goat cheese and meat	15	20	108	150
Goat cheese only	12	53	78	190

Source: Institut de l'Élevage, 2001 and own calculations.

Each interview lasted from a minimum of one hour to well over three hours, with the odd informal, non-recorded addition of sometimes a whole evening spent on the farm. Such interviews allow seizing the contours of a very broad picture of farms rearing local breeds, as well as it permits to gain a thorough insight into the perceptions of farmers, including those concerning interactions with other actors and networks.

5.3.3 *The discourse of back-to-the-land breeders*

From the interviews a complex picture emerged of the functioning of the two associations whose aim is to protect and develop the respective breed. It appeared that almost all farmers

⁷⁰ This is a typical, well-know technique in qualitative sociology, where difficult-to-identify populations are sampled adopting peer referral: an interviewee suggests or gives directions to another, and so forth. In this case, indications were given spontaneously by almost all breeders and all extension experts. Things were rendered simpler by the relative small size of the total population.

for whom these two breeds are the sole or major source of income are newcomers, or "back-to-the-landers". These have pursued a precise life project, that was to move away from something they did not like, either town-dwelling or a given type of job, and come and raise goats "so to live in closeness with nature", as Farmer R1⁷¹ puts it. Farmer C1 says

"It was my objective, you see. I wanted to have a mixed farm, so now I have 42 goats, 20 sheep, six cows, about 500 meat-producing chicken and 60 laying hens, as well as half an hectare of emmer. And I was lucky to find someone who sold 10 local does [female goats] which was my objective..."⁷²

Mostly, this process was initiated personally and in some cases against all odds. It has many commonalities with other back-to-the-land movements. These actors can be defined as people who have chosen to settle in "isolated rural" (so defined in French official statistics), breaking with their previous style of life, including sometimes even a stable profession, and who carry a project of professional activity localised in the rural space. Generally, as Halfacree (2004) puts it, this move is "underpinned fairly explicitly by a critique of mainstream society".

Indeed, mainstream society might as well counter-criticise or oppose their project. Rearers of both breeds describe the following situation: mainstream goat breeding is performed in-house, with large numbers of goats and large infrastructures; people who wish to revive a tradition of pastoralism are suspiciously looked at and they do not get credit easily. Farmer R2 when asked the initial question to kick-off the interview replies "welcome to the Middle Age".

⁷¹ Farmers are cited so as to respect anonymity. All codes begin with "R" for farmers rearing the Rove goat breed and with "C" for farmers rearing the Common Provençal one. The number that follows the letter generally reflects the order of the interviews, as a convenient reminder, while in some case the planned order had to be changed. For the sake of respect of anonymity within such a small population, no further details are given.

⁷² I have tried as much as possible to convey the idea of a colloquial French far from being pure in grammar and that I have found hard to translate, not being a professional translator. I have loosely translated with some mistakes that are intended, on purpose, to approximate a familiar language.

He explains:

"when I started, I had absolutely no funding. I live like it's Middle Age. I have no farm, I live here in this house and have to keep my goats in some fields at some kilometres' distance, there's no water, no light, nothing at all, and I have built some housing from scratch, on my own, but I'd need very little infrastructure, you know and I am tired of this because now I've realised I can really live of this, I wasn't sure, well, I didn't give a damn, it was a passion, but now I'd like to do better and I'd need little money you know, but if I asked – no way – and should I ask the same amount for a new car they'd give that immediately but for doing my job, no way!"

Later on he affirms "anyway if you want to rear the Rove you're a fool, an utopian". In fact, deepening the question further and developing on this theme, he reclaims his personal "utopianism" as the essence of his professional endeavours: "you see, there's people who make a lot of noise, scream on the street. I do it more silently. I do good work with my goats, it's my way to do my personal battle." (Farmer R2)

Another farmer, starting her activity more recently, had to attend an agricultural school so that she'd gain access to assistance and recognition as a farmer. She affirms "and when I said I wanted to start an activity with the Rove goat breed, they laughed at me, they scorned me and more than that they would not let me pass my examination anymore!" (Farmer R14).

However, these people generally appear to be spurred from a strong inner motivation. They do not give in. They do not look for subsidies either. They certainly do not subscribe to recent policy trends of "landscape management" as the main reason for their existence.

"They call us landscape managers now, we're not there to produce anymore, production should be in milk-factories elsewhere, I don't know, where they can force production to enormous levels per doe, it's horrible, I went seeing that in Poitou, 700 does, all attached to machines... but they want us to be there for folklore, whatever... They'd pay us to be out there and to manage landscape, we don't like that..."

"Interviewer: you mean you don't like subsidies?"

"We want to live with our own resources and sell our produce at a just price. No, we do not like subsidies, anyway we get very little, you certainly know that, a few big ones get 80% of the pie, don't they?" (Farmer C6)

While some aspects are common between the different "subgroups" of Rove breeders, namely the attitude towards subsidies and the love of the breed, perception was somewhat different amongst sheep breeders that raised the Rove goat in comparatively small numbers. Most if not all of them, in contrast to goat breeders, are sons and grandsons of sheep breeders. They keep the Rove goat breed more as a tradition:

"Well, I do not have much to say, I keep them, they've always been there, so, well, I also like them very much, they're beautiful, and they're for my pleasure, I actually do not live off them, but it's part of my farm, it's part of pastoral traditions..." (R8)

However, an interesting finding reveals that they are also sheep breeders as a choice, a strong identity with a given occupation, that of being more a pastor than a livestock breeder.

Despite the apparent difference in being a sheep rather than a goat breeder, there's a lot in common in the type of link that is established with the animals and with the land.

In essence, these breeders pose a strong choice, they want to rear a particular breed in a particular way. They choose a profession that is not the same as farming in-house but is based on a different concept: pastoralism. In respect to this, as well as to their personal attraction for it, they explain their choice of the breed.

5.3.3.1 Breeders love the breed

When asked to explain their choice of the Rove breed, almost all farmers give the same first answer: "because it's beautiful". Some Common Provencal breeders also say that, while most of them underline the importance it had for their choice the fact that they wanted to rear a local breed. Rove goat breeders often utter with emphasis "I love this goat. Does are gentle, beautiful, strong, binding" (Farmer R22). When asked why things happened around this breed, what drove this conservation action, they seem to voice that it is self-evident:

"Why something happened? Well, very simply, because there are breeders who love this breed, that's enough, is that not?" (C3)

After these initial statements about the beauty of the breed, Rove breeders particularly stress the rusticity and adaptation to harsh conditions. "These goats thrive on nothing at all. They can eat small branches of wood and still produce milk. Not enormous quantities, but well enough. And you know, what's interesting is, their milk, the fat content is extremely high. That's good, because you make great cheese." (Farmer R11).

5.3.3.2 *Environment, food quality and the "good old taste"*

Generally, explicit reference to environmental issues is rare. Even in relation to these rare breeds, the concept of biological diversity is not explicitly formulated. However, many breeders show some broad, imprecise apprehension about the world being generally in a bad predicament. A few of them go further and worry about climate change and similar issues.

One aspect that those amongst the goat breeders who produce cheese particularly stress is food quality. They are proud to speak up for their breed and pastoral management as a way to "produce more in harmony with nature" (farmer R3):

"The elders say they find the good taste of their old times... we do not work with those Rhône-Poulenc additives!" (farmer R21)

"and there's also people coming to buy who say we do not ask enough for our cheese, and even one who paid us, er... we ask 1.60 he paid 1.90" [...] (R22)

and concerning more productive breeds

"because, the Saanen, the Alpine, kept in stables, you see, they produce a lot, but when producing ever more and more and more milk, you end up making water, you see these poor cheese floating in litres of water! [laugh earnestly]" (farmer R2)

Quality cheese is one particular combat. A difference is evident between the two associations. The Common Provençal breed society fought a long battle to get recognition of their typical cheese with a controlled denomination of origin (AOC, Appellation d'Origine contrôlée, in France): the Banon goat cheese. Wishing to link this to a pastoral or grazing

management of land use, they also obtained that this cheese be compulsorily linked to three breeds, the Common, Rove and Alpine, particularly excluding the Saanen breed, that –they say – is always reared in "off-the-land" conditions.

The Rove breed is a dual- or even multi-purpose breed. We express here the empirically grounded theory that breeders of the Common and of the Rove approach two different "main" professions: cheese-makers and pastoralists, respectively. Whereas many Rove breeders are also cheese-makers, they expressly choose a breed that is adapted to a pastoral lifestyle, and to grazing range and clearing forest undergrowth. Some of them do not even produce cheese at all. Despite the fact that their discourse focuses on quality as well and that for many of them this is directly linked to cheese quality in particular, their personal and collective combat is not in the field of denominations of origin. However, some of them have their own "private" label or other ad hoc marketing strategies. There is no simple straightforward common pattern in Rove breeders' choices.

5.3.3.3 *Land use and access to land*

One issue that almost everybody raised was the problem of access to land. Some data show an impressive increase in real estate prices in recent years (Table 5.4). Agricultural census data also show that in the PACA Region, utilised agricultural area (UAA) shrank by 21% from 1970 to 2000, amounting in the latter year to slightly more than nine hundred thousand hectares, i.e. about 29% of total area. At the same time, non agricultural land increased by 37% (cf. Table 5.1).

Table 5.4 – Change in real estate prices from 2001 to 2003 in Provence-Alpes-Côte-d’Azur

Sale price (EUR/m ²)	2001	2003	% increase
Individual houses	2 407 €	3 404 €	+ 41%
Multiple dwellings	2 823 €	3 224 €	+ 14%

Source: Ministère de l'équipement, transports et aménagement du territoire, France, 2004.

Here is one answer to the question "would you tell me something about the difficulties someone wishing to start a pastoralist farm encounters?":

"The land! Here things are getting absolute nonsense. You know, you see this house, small as it is, well, with some land here and some poor buildings for the animals, well a correct price for someone who'd like to do this job would be about one million [French Francs, i.e. slightly more than 150,000 Euro] ... and then one day someone by mistake came here and he was looking for a house for sale, he offered two and a half millions! [French Francs, i.e. slightly more than 380,000 Euro] ...so, such a price is impossible for young people wishing to start as we did some years ago!" (Farmer C4).

When asked to tell more, most breeders explain about how infrastructures such as the TGV linking Paris to Aix-en-Provence in slightly less than three hours has made it easier for people to either buy second residences or even live there somewhat permanently:

"About five years ago we were 700 in the village, now we're 1400, we used to have a lot of land and let the goats graze freely now we can't do it anymore, all is fenced, trespassing forbidden... I don't know, they work in Paris, maybe some official or civil servant working

two or three days, I don't know or getting some arrangement to work their 35-hour week on three days..." (Farmer R22)

The access to land is perceived by most breeders as a problem that is out of their control. Many of them recriminate against this choice of society saying that all is done for the sake of money and there is no perception of the importance of animal grazing, e.g. to avoid forest fires, etc. They complain about "these villages that are becoming tourist deserts living a few months per year" (Farmer R8) and they advocate their permanent presence so that land is kept alive.

5.3.3.4 *Two (or more) worldviews*

Overall, the aspects sketched above converge to suggest that a given and particular worldview explains the choice of pastoralism and of this breed, of life in sometimes remote marginal rural areas.

As it has been mentioned, a few different types of breeders can be identified and each group consistently reveals a given worldview. One group is formed by sheep breeders. These come from a long family history of farming and they keep their breed for pleasure. Their worldview is conventional, and rural development the way it is intended in mainstream policies is more or less accepted, with the occasional criticism of subsidies and of the obstacles to the pastoral profession they're attached to, e.g. to the free movement of animals. Another broad group is constituted by newcomers, but these split into various subgroups. There is a part of them who chose the pastoral way of rearing the breed in the specific marginal area as a personal combat against a certain way of conceiving economic development:

"There's those who shout in the street, go on TV, destroy McDonald's, I make less noise but this is my way, my personal fight, I try and do proper work with this breed..." (Farmer R2)

In fact, these farmers affirm clearly their stance against a kind of "more technical" way of breeding livestock:

"Technology is perverse, it ends up against a wall. It's a funnel, you push and push, and produce ever more ever more, it cannot but crash. One should see things more globally." (Farmer C1)

And this is clearly linked to the general perceived state of the world:

"Things are going very badly, we're going crashing against a wall" and "well, OK, I'm pessimistic, er... but you can't be optimistic when you see the way the world goes!" (Farmer R2)

"Why, everything is done for money and things are quite going badly, mankind don't care about nature anymore... For me it's spirituality, you may think I'm a bit crazy, sort of enlightened, but, well, it's all bundled together. For instance, my children are not vaccinated and I believe they're stronger because they're closer to Nature..." (Farmer R3)

Some younger breeders of more recent farm installation announce a slightly different motive, more personal:

"Well, we came here 'cause we wanted to live in this far-off area, and then I felt somewhat isolated and all this countryside, so I wanted to do something of it and I decided to get some goats" (farmer R13)

"Goats came later. We wanted to live here and get something done, work the land, we didn't know in the beginning, then goats came to our mind and of course it was self-evident that it had to be a local breed" (Farmer C1)

However, engaging further in the interview, the will to live "a simpler life" underlying the motive became evident:

"And I love Nature, being there, guiding the herd and it's not my stuff to work all the time and certainly not in an office" (Farmer C4).

One could still get grasps of a worldview where organic farming, small-scale craftsmanship and phytotherapy completed the picture, in contrast to monoculture, "conventional" cropping in arable land, large-scale industry and antibiotics.

Conversely, some younger breeders, having started their activity recently, and in some cases having the particularity of being "a son of the land", i.e. being native of the region although not of an agricultural family, showed another approach:

["would you tell me something about how it all began for you, why this breed, etc.?"]

"Well, I wanted to be a farmer. [...] So why this breed, because it's quite en vogue, quite popular now, and I wanted to sell my cheese on the farm and also to selected "gourmet" restaurants and so it was good for marketing" (Farmer R9)

This choice is also consistent with the kind of occupation. Farmer R9 define himself as a farmer, mainly a breeder, but certainly not a pastor: "so my way of doing, you see, some do not like, they say it's not the tradition, they'd say the Rove should graze in free range but I plant some alfalfa and my goats graze there, in fenced pastures, I do not like guiding and following the herd! I just do not like it, you see, it's a personal taste, I need to be always on the move, I need to be doing things, well, sometimes I go out there in the wood with them, because they sometimes do need more woody plants, but I don't like it, and I also cultivate some other things, it's a mixed farm, and I go selling my produce my own, you see [...]".

Consistently, a different worldview is explicitly uttered:

"[the other breeders] criticise everything, and they should use no technical advances, and their animals could not produce more milk, and they don't like it, but I am enrolled in the official milk control and I don't see why this breed could not produce some more milk!"

(Farmer R9)

Strikingly, in some instances a direct and involuntary opposition is also found, as one farmer cited above declared himself against vaccination, while another belonging to this latter subgroup – drifting a bit outside the scope of the interview – narrates about its participation in a campaign of international aid where he "raised funds to provide refrigerators for *** [an African country], so that they may correctly preserve vaccines" (Farmer R9).

5.3.3.5 *The perceived future of the breed*

As far as the future of the breed is concerned, contrast is even greater, with some breeders showing a certain pessimism about the future and considering themselves lonesome fighters that have been somehow abandoned even by the association of breeders. Others are more hopeful and what is apparent is that it's those who are presently in the core of the association who are the most optimistic.

[Question: "How do you see the future of traditional breeds?"]

"How do you see the future of cultural minorities all over the world in the future, it's me who ask you" (Farmer R2)

And talking about the way a breed should be:

"we shouldn't make of the Rove a goat of 4 litres a day, we must keep control of the breed! [...] And frankly, the future, I see it very dark. If the future of the Rove is to industrialise, that goes bad, well, I have nothing against [R9], but that's not tradition anymore!"

5.3.4 *The importance of people and networks*

Evans and Yarwood (2000) provide a synthesis of the process of network creation and operation. They describe four overlapping phases: problematisation, interestment, enrolment and mobilisation; and they underline how a fifth moment of "dissidence" may happen, where some actors may no longer consider themselves in accord with the initiating actor(s) and this may lead to a collapse of the network, or at least to a major restructuring.

There is evidence of the great importance of key people that catalyse the collective action. Almost all breeders speak about [Expert E1] in these terms:

"then now, there's Mrs. [E1] and things are going very well with her. Have you met her? I suggest you do, she knows a lot and since she's there we do good work" (Farmer C1)

"and it's good that Mrs. [E1] is there now, because I know the association will survive and she helps with advice, so that we exchange males, you know, that's good for the breed and it has to be done properly" (Farmer R15)

Another breeder suggested an interview with Ms. ***⁷³, an extension expert of the local Chamber for Agriculture, and then learned that she had just stopped working there a few days before. The reaction was "oh my god! We're done for!"

When asked about the single most important aspect to consider when attempting to preserve local breeds, extension experts generally agree: "you should have a solid unified group of intrinsically profoundly motivated, intelligent breeders who work together" (Expert E1). However, when questioned about conflict inside the Rove goat association as compared to the much smaller one for the Common Provençal, the same expert explains that "goat breeders are independent. They're the least supported by the CAP and they're proud of their independence. But it's hard to make a collective-action group out of independent people. You see, I've done Genetics, but all the technical stuff here is very simple. I had done better, had I chosen a Master's in Conflict management!"

Expert E1 goes on to explain that the Rove goat is a beautiful, impressive, very peculiar goat breed. "[in the Rove association] there is more passion. For the Common, that's indeed a

⁷³ For the sake of anonymity the name of the person is hidden and three stars are put instead.

much more common goat, it's more intellectual, less passionate, you just choose it because you reason on its importance and you want to preserve a breed and a tradition".

The main approach of our research was not historical, so that it's not an easy task of charting the various stage of development of the two associations. However, some major aspects emerged thanks to the non-directive aspect and the fair length of the interviews.

As far as the Common Provençal is concerned, the association is very small, young, and know almost no conflict at all. Breeders of this breed affirm they were unified by their common struggle to get a ruling in favour of a protected denomination of origin for a local traditional cheese (Banon). Historically, the Common goat population was not well described. Besides, its appearance – more common in comparison to that of the Rove breed – has supposedly influenced its attractiveness. As one extension expert puts it, "you need some more intellectualisation to love the Common Provençal, the Rove is very beautiful, it's easy to fall in love with it. Now, there's as many Common as there was Rove goats twenty years ago, but I am not sure we'll get to 4,500 in twenty years time." (Expert E1). In this association there's less conflict "because there's less passion, more reasoning" (Expert E3).

As it has been summarised above, the initiator of the Rove breed society was A. Sadorge. He was very successful in the first phases, particularly at involving and enrolling people. Successful action and an expansion of the association were realised. The role of A. Sadorge was regularly underlined by those breeders who have been there since the beginning. As one breeder says, "it was a great loss, 'cause he died and then the association collapsed!" (Farmer R15).

Expert E1 compare this to a completely different context. Some cattle breed became endangered or their number was greatly reduced in the second half of the twentieth century. In parallel, she explains, money was allocated to extension (mainly aimed at in-vitro fecundation and genetic improvement) and that meant the existence of regular contacts with an extension

expert. "He didn't do anything for breed conservation, he had no time, no money fro that, but the simple fact that he was there, well, we realised that numbers of animal in the breed increased greatly again".

Presently, the association appears to be split in four subgroups. Of these, only one is active, members of the other group pay their membership dues "to contribute, because it's important to support the breed anyway" but do not participate actively. One subgroup is formed by the sheep breeders. They deem that it is up to the goat breeders who really make a living out of the breed to develop and protect it and to manage the association. They disagree on the standard of the breed and the type and focus of selection: "well, we [the sheep breeders] like it red, one colour, or black, but they [the newcomers] want every colour,... Well, ok, each of us has his own taste... Besides, you see, we're also far apart, and it's not the same job, well, yes, we're part of the association but, well, we don't have much time to be active..." (Farmer R13)

Another less active subgroup is formed by those who affirm that they are geographically too distant. Or they may just feel alright with the state of things. This group include also those who are "young" with regard to the husbandry of these breeds. This group of people in some cases just utters the single comment about the "poor association which is a bit sleeping now" (Farmer R14), without showing signs of conflict or dissatisfaction. They actually do not appear to be interested in actively taking part in it either. Their attitude can be interpreted as a confirmation of the argument of Expert E1 about the independency-seeking attitude of these farmers and the clash between this and the need for at least some collective action.

The remaining two groups are those in overt conflict. Both are mainly constituted by long-time members of the association. One of the two is formed by some of the "dissident" members. Conflicting views regarding the development of the breed, what actions to prioritise and "good pastoral practices" have caused a sort of "imperfect" internal secession. While most of them are still official members paying their affiliation, they are no longer active. The other

subgroup includes some "ancient" members and a few young, recent ones. Both subgroups overly explain their dislike of the other or their discord.

["would you tell me more about the association?"] "well, you see, there's been some stasis, then now there's this new president and I succeeded in having [R**⁷⁴] as vice-president and to have him come to Paris to the International Agricultural Show,[...] And you see, there's some breeders within the association, after these people put all that time and energy and they go to Paris to make the breed known, then some say, alright, you're going to Paris to sell your doe kids! But that's not true!" (Farmer R15)

Some large differences appear within each of these two groups. Thus, generalisation is quite complicated. However, broadly speaking, it could be said that the latter group is formed by a few "normal" people, who happen to be farmers and express a somewhat milder version of social critique. They are more entrepreneurial and include Farmer R9 (cf. above) as well as some media-prone breeders who have either appeared on TV, be at the forefront of organising participation in the International Agricultural Show in Paris, wrote books about the Rove, and so forth. They have well-managed marketing strategies, such as on-farm sales or even a private label for sale of a "veritable brousse" in Marseilles.

The other group is mostly formed by post-1968 back-to-the-landers, who show a more radical critique of society overall. These breeders show disappointment with the other group and recent major choices of the association. They typically express their choice of being shepherds and they generally do not show much interest in such marketing strategies as labels. Some of them admit to having a problem with marketing, having disregarded the importance

⁷⁴ Since it is stated that this farmer is the president of the association, and can be recognised, the respect of the anonymity pact demands that the number is not given so that citation of his interview is not linked to the person.

of commercialisation in order for the farm to be viable. At one extreme, they survive on little financial benefit, out of a chosen "simple living" and anti-consumerist lifestyle.

5.4 Discussion and Conclusions

Most breeders of the two local goat breeds are newcomers, or "back-to-the-landers". They are strongly motivated to pursue a life project based on rearing these animals. Most of them have the explicit objective of reviving a pastoral tradition. Collective action for breed conservation is the direct result of a few individuals determined to invest human capital into action to preserve and develop this type of husbandry.

One of the most relevant obstacles these breeders face presently has to do with land, and this is particularly accentuated by the phenomenon of counter-urbanisation.

The concept of counter-urbanisation often conveys a somewhat partial vision of the repopulation of rural areas. In particular, it tends to ignore or take little notice of less mainstream forms of "counter-migration". In this paper, we have focused on one such "alternative" form of counter-migration: back-to-the-land or "agricultural immigration". Paradoxically, we may in resume say that the conflict over land is intense between two groups of "newcomers" with different perceptions of rural development: the "idyllic" group people working in "urban" settings, migrating into a rural space where they simply do not imagine farm animals as a presence, and the "back-to-the-land" migration of those starting an agricultural (pastoral) activity based on extensive livestock management.

Boltanski and Thevenot (1991) provide a framework to discussing conflict over different uses of the land. Their thesis is that individual and collective behaviours are underpinned by a common reference to a superior principium. According to this, the magnitude of things is evaluated as beautiful/ugly, fair/unfair, good/evil, and so forth. On this basis, accord or

conflict are the only two possible outcomes. The Authors describe the existence of "different worlds", each having its own coherence and common superior principium. These different worlds can enter in conflict because, they argue, of these differing principia.

Thus, following this framework, the same rural space is actually a contested meta-space belonging to different worlds. It can be considered a collective good of universal interest by an environmental activist (world of civil society), a factor of production by a "conventional" farmer (world of "productivist" agriculture), a quiet home place for urban commuters (world of "the rural idyll") or a profit opportunity for a property developer ("world of business").

Another major hindrance for the breeders to develop is conflict within the breed society and/or conflict of worldviews relative to more global trends of society and of policy. Most breeders rearing these breeds share a worldview that has been designated as "resistance to globalisation". In the following, this is summed up in a simplified, artificially dualistic way.

On the one hand, globalisation is apparent in policies that aim at concentrating farming in large units in given areas and envision rural development in marginal areas as driven by tourism, recreational amenities and landscape management. In this perspective, markets are mainly supplied by large-scale and long-distance food-chains and uniformity of solutions is generally devised, e.g. standard "improved" breeds reared in-stable.

"Resistance" translate here into smaller farms acting for the revival of a pastoral tradition, a way of life and a profession. Most interviewed breeders envisage local food chains, quality food and a productive permanent presence on the land. Local, adapted solutions are looked for and individual choice is affirmed as the main motive that make it possible for marginal areas to be "re-colonised" in a way other than by second residences.

In synthesis, we consider that conservation of rare breeds is not so much a result of policies but rather of two dynamics, namely the survival of traditional professions and the quest for alternative lifestyles and production systems carried by back-to-the-land movements. The

people in this movement have some common viewpoints but hold different worldviews, hence they face some difficulties in cohesion. Conflict is a major issue since some collective action seems to be necessary.

Reflecting back on the first research question, the success of the conservation of a local breed seems to rely upon the charisma and strong will of a limited number of key people. This is also considered to depend on the particular perception of the qualities of the breed and interest in it. These qualities are not so much linked to production performances alone. Different groups of breeders have different preferences regarding the desired qualities of a breed. These may have to do with a red coat colour or very long, twisted horns. It may have to do with an "image", a perception, a symbol. This can be either the attractiveness of a pastoral lifestyle or an entrepreneurial choice to exploit niche products within a mainstream view of rural development and "deluxe" food chains.

It is argued that the Rove attracted attention by people having the resources to enrol other key people and built a network around the issue of the conservation of the breed. This breed also happens to have a striking, particular phenotype that is apparently more effective in eliciting interest in newcomers. The combination of the two played a role in the successful conservation of this breed. Moreover, in contrast with the Common Provençal, alongside the important group of newcomers, the Rove is also still reared by sheep breeders descendants of a long family tradition of husbandry.

There was a cultural bias against the Common Provençal breed, which were kept by women. This breed did not survive in traditional farms. Presently, farmers who are interested in this breed express difficulties they encounter in improving the genetic status of the breed because of the very limited numbers of pure bred males.

Conversely, the Rove was the pride of transhumance-oriented sheep breeders. It walked magnificently in front of the herd of sheep, in its beautiful red coat, with a hand-carved

wooden collar and a hand-made bell. These breeders did not consider goats are "less manly". Today, all interviewees in this group still proudly affirm that it is *them* who saved the breed.

Today, as explained above, there is evidence that the presence or absence of key people is an important factor that may enhance the chances that an endangered breed escapes from extinction. It is argued that the creation of breed societies is an indicator of a fundamental consciousness of the importance of networks of people who share at least some basic goals.

Rare breed survival is less a "biological" problem and more one of the survival of different agricultural land uses. It depends on a certain relationship between livestock, the land and the human actors. The human factor plays a major role. Biological diversity cannot be conceived without a certain, parallel diversity of professions and of agricultural models of development, including a diversity of products, lifestyles and perceptions.

In reference to the recent social aspiration to preserve local livestock breeds, one aspect policy and future action should take particular heed of is the conflict over land. It is argued that access to pasture is fundamental for breeders and herds. Negotiation, mediation of knowledge, multi-level dialogue between all actors concerned is essential. One focus could be put on education, as perception of pastoralism and in fact of the very presence of livestock and agricultural activities seems to be biased for most rural newcomers in the "idyllic" group.

Chapter 6

SUMMARY OF RESULTS AND CONCLUSIONS

6.1 Contents of this chapter

This chapter summarises the main results of the Thesis and presents their integration in a unified output. Sections 6.2.1 to 6.2.5 provide a summary of the various parts of the Thesis and the integration of their results. Section 6.3 gives an overview of insights and learning and suggests some orientation for future policy and action. Finally, section 6.4 presents the major limitations of the Thesis and suggests some opportunities and scope for future research.

6.2 Summary and integration of results

6.2.1 Policy and society choices

Chapter 1 presented a general introduction on the issue of livestock biodiversity loss. After briefly outlining the major root causes of this dynamic, a special focus has concentrated on the European case and particularly on the impacts of the Common Agricultural Policy (CAP) on marginal areas and on sheep and goat biodiversity loss.

One of the many factors shaping the evolution of agriculture and rural development in Europe, the CAP is argued to have largely contributed to the marginalisation of some farming systems, including extensive livestock-based ones. Thus, it has also contributed to the loss of AnGR and to abandonment of regions now considered "marginal areas".

The analysis of the CAP presented here was rather brief, in a descriptive and historical approach. The trade-offs between productivity improvements and biodiversity have been

discussed in a social welfare framework. Recent CAP reforms putting an increasing accent on rural development and agri-environmental policies (AEP) have also been analysed.

AEP are a subset of rural development, the so-called "second pillar" of the CAP. The series of measures covered by AEP include those aimed at the conservation of livestock breeds in danger of being lost to farming. The importance of these has been assessed and its relative marginality is apparent in official data for overall public expenditure. While the "second pillar" is allocated an overall share of 13% of the CAP in the provisional EU budget for 2005, AEP total 27% of EAGGF expenditure planned for rural development between 2000 and 2006. Measures in support of less-favoured areas have been allocated a share of 12% of this budget. Of all public commitments engaged in 2001, measures in favour of endangered livestock breeds amount to slightly more than eight million euros⁷⁵, i.e. 0.5% of AEP and a very minor proportion of total CAP budget.

It is argued that these policies for the conservation of farm animal breeds at risk of being lost to farming have a limited direct impact in comparison to the overall impact of the "first pillar". The latter could well be contributing to engendering and maintaining the problem. In the light of this, the impact of present reform is deemed to be limited with respect to improving the chances of livestock biodiversity and of marginal areas.

The latest CAP reform has been adopted in June 2003. While de-coupling is a central element and cross-compliance with EU environmental standards is enforced, it is still uncertain whether the effect will be as fundamental as stated in official press releases. Moreover, some limitations and delays have been introduced that reduce the immediate impact of change. The single farm payment can be delayed by Member States until 2007. There will be no reduction in cereal intervention prices. The dairy quota regime will remain in place until 2014-2015 and the new dairy aid payment will remain coupled until 2008. It is argued that these major limitations

⁷⁵ Of which 60% from the EAGGF.

may actually greatly reduce the capability of the reform to reverse the impacts of the CAP on marginal areas and livestock biodiversity.

The view expressed in this Thesis is that it is possible and desirable to conserve all the breeds. This can be set as a goal, and the most effective action to reach this objective can be researched and applied. Policy funds are only one of the available solutions. Presently, these are assessed to be rather limited. Accordingly, other solutions may include voluntary approaches and the development of marketing niches and special marketing channels that have proven effective in some cases.

6.2.2 Descriptive analysis of sheep and goat breeding activities

Chapter 2 has presented the datasets used in the Thesis. One is the dataset of the characteristics of farms rearing the sheep and goat breeds studied in the ECONOGENE project⁷⁶. This dataset based on the results from a survey of farms has been analysed in detail. It comprised 551 farms in nine EU-25 countries⁷⁷ (of which 470 in seven EU-15 countries) and 53 in Romania. The analysis provided some useful insights for understanding the dynamics of farms rearing these breeds and for further analysis discussed in chapter 4.

Of all farms in the usable database, 84% rear autochthonous breeds, approximately two thirds of these being breeds with less than 10,000 breeding females, one of the EU criteria for a breed to be eligible for conservation premia. Almost all farms rear other species of farm animals and for a quarter of them crops and/or livestock other than sheep or goat are the major sources of revenues from farm produce.

Considering the age of the farmer, 17% of farmers were older than 60 at the time of the interview. Only 55% of these had a successor for the farm.

⁷⁶ As a reminder, in the countries of the EU-25 where the ECONOGENE project is carried out, 25 goat and 40 sheep breeds have been studied. These are 20% of goat and 12% of sheep breeds in the relative countries.

⁷⁷ Austria, Germany, Spain, France, Greece, Hungary, Italy, Poland and the UK.

Many farmers (38%) have additional income generating activities outside the farm. For half of them more than 50% of their total income derives from these activities while 30% declared that off-farm income accounted for 75% to 100% of total income.

Farmers generally adopt one or several strategies to enhance their success in this type of animal breeding. Most farmers belong to one farmers' association and/or have participated in education programmes concerning precisely this type of animal breeding. Half of those rearing autochthonous breeds and 88% of those rearing non-autochthonous breeds also adopt at least one type of marketing strategy for at least one product.

Asked about the future of their breeding activities, most farmers would continue as presently or expand while 9% consider reducing and 2% abandoning over the course of the next ten years. It is to be noticed that four of the latter thirteen farmers are older than sixty and have no successor for the farm. Only two of these four farms rear an endangered breed and no significant correlation exists between the future of activities with traditional breeds and a given breed or set of farm characteristics. It is difficult to conclude something on such a small number as 13 farms abandoning the activity. Only some description has been provided. Remarkably though, none of these farms had cattle or pigs and all had exclusively sheep and/or goat produce as a source of farm-based income.

Not surprisingly, no farmer who is older than sixty and has no successor for the farm considers expanding activities. However, while 13 of them either reduce or abandon activities, mostly because they abandon farming, 17 declare they will continue as in the present situation for the next 10 years.

Large differences for all characteristics have been found across countries. This makes it hard to give any general conclusions, and the latter should always be considered very carefully. Overall, the relevance of key characteristics was highlighted and commanded further in-depth analysis, the object of chapter 4.

6.2.3 *Marginal areas and the husbandry of sheep and goat breeds*

It is often stated that extensive livestock and marginal areas are reciprocally adapted, the former being considered as the best or sometimes only possible viable agricultural system in the latter. Moreover, marginal areas are generally considered particularly suitable for extensive husbandry systems.

From this premise, chapter 3 focused on the definition of "marginal areas", a term that is found not to be defined precisely in the literature, as well as on the correlation of the relative marginality of a region with the geographic distribution of sheep and goat traditional breeds that were studied in the ECONOGENE project.

Marginal areas are defined here as areas with limited possible land-uses because of several restrictions on productivity. These include higher altitude, lower soil pH, shorter growing seasons, steeper slopes, and so forth. This rather physical and agronomic definition is also combined with one that is based on socio-demographic and economic factors, such as unemployment rates, active population, per-capita gross domestic product, etc.

Taking the EU NUTS level 3⁷⁸ as the geographic unit of analysis, a GIS is built with several layers of information: land cover, socio-demographic and economic variables, NUTS level 3 boundaries, the presence or absence of studied breeds and the geographic location of farms surveyed within the ECONOGENE project.

On this basis, indicators of relative marginality measured as quantiles of the different variables have been computed and two aggregated indices of relative marginality combining three of these indicators have been built. Both indices used the indicators for marginality based on unemployment rates and on the type of land use. The third indicator used was in one case

⁷⁸ As a reminder, NUTS stands for Nomenclature Unit of Territorial Statistics, and is a common EU reference based on administrative regions and used to collect consistent and comparable statistics across the EU.

based on the density of the active population and in the second case on the change in total population density between 1995 and 1998.

In order to analyse the correlation between the relative marginality measured by these indices and indicators and the presence or absence of ECONOGENE breeds, a logit choice model has been implemented. The model has been estimated using either one of the two aggregated indices and the three other indicators. The same basic information was present in each version of the model, differing only for the combination in the aggregated index.

A very significant correlation has been found for all indicators and indices but one (measuring the number of hotel beds per inhabitant as an indicator of tourism). Both models excluded indicators whose parameters were not found to be significantly different from zero on the basis of likelihood ratio tests.

Both aggregated indices have been found to be significantly and positively correlated with the presence of ECONOGENE sheep and goat breeds. These seem to be traditionally present in regions presently defined as relatively marginal with respect to unemployment and type of land use. Correlation with the indicator of per capita GDP at PPP was also found to be significant but negative: regions that today are relatively poorer are less likely to be correlated with the presence of studied breeds.

The indicator based on the change in population density between 1995 and 1998 is also negatively correlated with the presence of breeds but the interpretation is less straightforward in the light of counter-urbanisation dynamics known by (at least some) marginal areas in recent times. Indeed, if marginal areas are also characterised by an increase in population densities in recent years, then the reverse of the indicator would also provide a good picture of marginality as an indication of the presence of these breeds.

In the light of these results, the indices that have been built are considered suitable to define marginality correlated with the presence of local, traditional sheep and goat breeds. They

are used in an ordered logit choice model to investigate the impact of the geographic location of farms (with respect to the relative marginality of a region) on the future decisions concerning breeding activities.

6.2.4 The farms and the future of breeding activities: A choice model

In this Thesis, it is suggested that the best option for breed conservation is on-farm rearing. As such, breed conservation is linked to the breeding choices of farmers. Replacement of a traditional breed with other breeds or other species of farm animals together with reduction or abandonment of husbandry or even of agricultural activities overall is considered as the key problem in the erosion of AnGR. In marginal areas, many outside forces have contributed to this dynamic. These have been analysed in chapter 1.

However, breeding decisions are also a function of farm-level characteristics, such as the family structure, age of the farmer, sources of revenues, and so forth. In chapter 4, on the basis of farm-level data obtained from the questionnaire survey presented in chapter 2, breeding decisions have been studied in an econometric choice model.

The dependent variable, the decision concerning future choices regarding breeding activities on the farm, has been analysed in three categories: reducing the stock of the breed on the farm, continuation as is, increasing the breeding activity. This decision could be organised in three ordered categories from least (reduction) to highest (increasing) and the appropriate choice model resulted in an ordered (logit) choice model.

The explanatory variables included the age of the farmer, the presence of a successor for farmers older than sixty, the years of school education attended, the sources and magnitude of revenues, whether the breed raised is autochthonous in the country and whether the farmer has participated in education programmes on this type of animal breeding as well as whether or not (s)he adopts marketing strategies for the most important product stemming from the breed. The

impact of a more technically refined practice in feed management as related to the physiological status of the animal and the importance of capital intensity measured by the number of tractors have also been analysed. Further considered was the percent of income derived from farm produce that originated from sheep and/or goat produce.

In the first part of the chapter, three versions of the model have been analysed. One only included all the variables whose coefficients were found to be significantly different from zero using likelihood ratio tests. The second version included country dummies and this model was found to be better specified. Then a third model was compared to the second and likelihood ratio tests found that once country dummies were introduced, the parameters for two variables were not significant, as explained below. The results for these three models are summarised here.

Farmers rearing autochthonous breeds have been found more likely to increase the stock of animals of the breed.

The age of the farmer, the presence of a successor and the number of years since the breed has been present on the farm are all variables found to significantly affect breeding decisions. Younger farmers are more likely to develop breeding activities in the future⁷⁹ and the absence of a successor is a significant drawback for the development of the breed on the farm. A socio-demographic variable found not to be significant is the number of school years attended. This is somewhat unexpected in contrast to some studies on the participation in some types of environmental programmes. Our data did not allow interpreting further on this.

The lower the number of years since when the breed is present on the farm, the more it is likely that the trend of animals is growing. This is explained as an indication that farmers having started activities based on the local breed more recently are motivated to expand them.

⁷⁹ The dummy variable for the farmer being older than sixty was only significant for the models with country dummies.

Revenues from other income-generating activities outside the farm have been found to significantly affect breeding decisions. The higher the share of revenues, the more the probability increases that breeding activities are reduced. Conversely, the level of annual total gross revenue from agriculture (excluding support/subsidies) is not a significant variable.

Participation in education programmes on this type of animal husbandry enhances the probability that the breeding activities are developed further. Farmers who adopt marketing strategies for the principal production of their breed are also significantly more likely to increase the breeding activities.

The number of tractors as an indicator of capital intensity was not significant in the model with country dummies. It is concluded that it rather conveyed information on different farm systems and technological endowment in different regional contexts. The technical choice of giving differentiated rations according to the physiological status of the animals does not affect breeding decisions in either model.

In the second part of the chapter, an extended model has been studied that integrates the marginality index of chapter 3 in order to investigate the impact of farms' geographic location in a (more or less) marginal area on decisions concerning the future development of traditional breeding activities. This model was restricted to the countries in the dataset that belong to the EU-15 (Austria, France, Germany, Spain, Greece, Italy, and the United Kingdom), due to data availability. The total number of farms included is reduced from 604 to 470.

In the models restricted to ECONOGENE EU-15 countries, the variable measuring the share of farm revenues from sheep and goat produce becomes significant. A larger share of revenue originating from sheep and goat produce diminishes the probability that breeding activities are developed.

The introduction of the marginality index significantly improves the model. The adoption of different rations according to the physiological status of the animal becomes significant. The

interpretation, however, is not unambiguous. It is likely that farmers interested in developing this kind of breeding activities may also more likely adopt this practice, whose benefit in animal husbandry is widely recognised.

The parameter for the index of relative marginality is significant. An increase in relative marginality measured by this index increases the probability that the trend of the stock of the breed is declining or stable. This indicates the fact that recent trends of increasing marginality with respect to land use and unemployment represent a potential danger of disappearance of husbandry of local breeds in marginal areas. It reveals the existence of a (possibly serious) limitation to the development of farming activities based on these breeds. The trend of (at least partial) abandonment of traditional activities in marginal areas may still be ongoing.

6.2.5 Local action for breed conservation: actors and networks

Concern over the livelihood of marginal rural areas and landscape management has accompanied the political debate on rare breeds. Rural spaces have become the object of debate, of contested meanings that reflect contested and conflicting attitudes, representations and practices. A given rural area can indeed be considered "marginal" with respect to a certain connotation of mainstream agricultural development. Indeed, the same space is granted a new status by three opposing paradigms: (1) an idyllic rural attractiveness for urban dwellers in search of quietness, of beauty, of an empty container⁸⁰ for peaceful living; (2) a symbol of rural otherness for counter-cultural "back-to-the-landers" underpinned by an explicit critique of mainstream society and a search for a "purer" lifestyle; and (3) the view of rural as a "mainstream" agricultural landscape (either with a sectorial agricultural production approach or a more recent rural development focus).

⁸⁰ Findings of surveys cited in chapter 5 show that while most urban dwellers wanted to live in the countryside, very few of them connected the rural space with agricultural activities and less still with the presence of farm animals.

Accompanying these dynamics, a gradual shift of focus has been occurring within "mainstream" institutions, including a debate over rural development that occupied the Commission of the European Communities since the 1980s.

Parallel to institutional activity, and in many cases as forerunners, various social actors counteracted the tendency of abandonment of "marginal areas" and of "minor" livestock breeds and undertook actions avoiding both breed extinction and the loss of pastoralist traditions. Some of these actors appear as newcomers placing a counter-cultural vision into the rural dimension. Their purpose of a new kind of livelihood included choosing local breeds as the centrepiece of their counter-cultural project.

In this chapter, these dynamics have been researched in the framework of a case-study survey in Southern France. Non-directive interviews of extension experts and breeders of two local goats, the Rove and the Common Provençal, have been carried out adopting an interpretive sociological approach.

One research question in an incipient phase focused on the differential fate of the two breeds and aimed at investigating how one of the two, the Rove breed, had been rescued from endangerment, while the second is still considered at risk. At an early stage, though, the question was more precisely targeted at understanding how conservation of a breed is perceived and enacted, and in which territorial dynamics it is grounded.

Findings reveal a strong link between the breeders' perception of local breeds, and of pastoralism, and their broader worldview. Most breeders are associated with one of the many "back-to-the-land" migrations and their choice to rear local breeds in the pastoral way is consistently found to be linked to their vision of society as a whole.

Their account is interpreted as the will to resist to mainstream discourse and practice of economic development altogether and of rural development in marginal areas in particular. The thorough analysis of their discourse confirms hypotheses that the innermost motive of their

action is not (or not primarily) profit maximisation and that they are inspired by the perception of beauty and attractiveness of a breed and/or the symbol of the factual achievement of an independent and "alternative" lifestyle (and profession).

In the case of the Rove breed, a tendency of another nature is linked to the presence of a lively tradition of breeders who are descendant of farmers. Breeders from this group were particularly unified by a few key people, who were able to interest and enrol other actors, including institutional ones, and articulate a network around the creation of an association for the safeguarding of the breed.

Moreover, for the Rove breed, a (smaller) group of younger farmers are acting within the boundaries of the new type of niche-market and "mainstream" rural development paradigm. These choose the breed from a rather entrepreneurial motive, because they want to sell on the farm and to deluxe restaurants. In the new discourse on rural "naturalness", on local food chains and on "quality" food, they are able to find niche-marketing targets that fit their view of "reform" rather than "revolutionary" development of marginal areas.

These different worldviews are found to be consistent with breeding choices, which are pursued "against all odds". However, they are the source of conflicts that can undermine the efficiency of collective action that remains to a certain extent necessary. One element that seems to counter-balance this risk of secession in the breeding association is the deep attachment to the existence of the breed. Dissident breeders still pay their membership due "because the association must continue to exist". They just avoid contact by disengaging from active action. Another helping factor is the presence of a much appreciated extension expert, whom many breeders consider as the major helping factor in the good development of the breed.

As far as the Common Provençal breed is concerned, the collective action has focused on obtaining recognition for a protected denomination of origin and according to some breeders this has provided a unifying principle of action and avoided the existence of major conflicts.

The Common breed is considered as "less attractive" and more intellectualisation is reportedly necessary to prefer it. This contrasts to the Rove breed, which is "easy to fall in love with". Historically, the Common Provençal has been negatively discriminated as a minor, womanly occupation. Arguably as a consequence of this, no single breeder of traditional agricultural origin has catalysed collective action, as it has been the case with the Rove breed. These two aspects may explain the different evolution in the number of breeding animals.

It can be argued that the presence of key people is an important factor that may enhance the chances that an endangered breed is successfully kept alive and developed. At the same time, the creation of breed societies may be seen as an indicator of a fundamental basic consciousness of the importance of networks of people who share at least some key goals.

Rare breed survival appears to be less a "biological" problem and more one of the survival of different agricultural land uses. It depends on a certain relationship between livestock, the land and human actors. The human factor plays a major role. Biological diversity cannot be conceived without a certain, parallel diversity of professions and of agricultural models of development, including a diversity of products, lifestyles and perceptions.

All breeders and extension experts agree as to the presence of a major issue in relation to the access to land resources. Pressure over land, mainly from urban incomers subsumed under the "idyllic" paradigm of rural space, has made land an increasingly limiting factor whereas access to pastures is an indispensable given for viable extensive pastoral management.

In reference to recent social aspiration to preserve local livestock breeds, one aspect policy and future action should take particular heed of is this conflict over land. Access to pasture is fundamental for breeders and herds. Negotiation, mediation of knowledge, multi-level dialogue

between all actors concerned is essential. One focus could be put on education, as perception of pastoralism and in fact of the very presence of livestock and agricultural activities seems to be biased for most rural newcomers in the "idyllic" group.

6.3 Integration of results, lessons learned and suggestions for policy and action

The so-called "first pillar" of the CAP has largely contributed to the marginalisation of some regions and to reduction in breed biodiversity. While present reforms try to mitigate these (as well as other) impacts, their success is limited. However, the "second pillar" is gaining importance, albeit its relative share of the budget is still minor (13% in 2005).

It is uncertain that the trend of erosion of livestock biodiversity in general and sheep and goat breed diversity in particular is presently reversed. Nor is it clear that it will be reversed in the near future should present policy continue as now.

Within rural development there is scope for policies aimed at conservation of livestock breeds in danger of being lost to farming. As far as species are concerned, efforts especially address sheep and cattle breeds. These policies are allocated an infinitesimal share of the total CAP budget and a recent analysis has highlighted that many breeds in danger of extinction are not considered in rural development programmes and that payments to farmers do not completely take into account all EU eligibility criteria. (Signorello and Pappalardo, 2003).

This calls for a revision of policy. Furthermore, and possibly – it is argued – more importantly, premia per livestock unit of endangered breed reared are but one possible solution to the problem of breed loss.

The analysis based on the impact of the relative marginality of a region on farm-level breeding decisions has shown that the trend of breed loss does not seem to be completely reversed. Increased relative marginality with respect, e.g., to relatively higher unemployment rates diminishes the probability that farmers develop their breeding activities. The issue is

complicated and involve a large set of complex interacting factors. However, it can be argued that alternative development and employment opportunities, a more vital rural community, could well enhance the chances of marginal breeds. Thus, the multi-sector approach of RDP can be one appropriate solution in some regions.

To some extent, this may seem to be conflicting both with the mitigated importance that surveyed breeders seem to credit to these policies (see chapter 2, p. 57) and with the results of the econometric model. In fact, from the latter it is seen that larger shares of revenues coming from income-generating activities outside the farm decrease the probability that the breeding stock is growing in the future. However, farmers may prefer to live in an area which keeps up with general development regardless of their main source of income.

Also, while for some farmers marginality is an obstacle, according to some aspects of the dynamics outlined in chapter 5, for others "marginal areas" may coincide with a vision of a counter-cultural personal project. In fact, at least in some cases, it may happen that inherently motivated farmers establish their personal course of actions "against all odds", adjusting to the consequences, not relying on support from agricultural or rural development policies and in spite of the degree of marginality of their region.

Some of these farmers make use of one or more marketing strategies. It is found that the use of these for the most relevant production increases the likelihood that breeding activities are developed while reducing the probability that farmers envisage a future declining stock of the breed. The marketing aspect is acknowledged to be important by farmers who fail to successfully apply some of the strategies or who use them partially or imperfectly. This is a consistent finding from the sociological case-study.

Some other farmers, though, adopt an approach that has been described as "extended territorial strategy" (Belletti et al., 2002) and put the accent rather on pastoral land-use, development of a network, localism and in some case a form of "radical environmentalism".

Evidence in other case-studies suggests that these groups are inherently different (Bryeden et al., 1996, cited in Shortall and Shucksmith, 2001). Consistently again, findings from chapter 5 suggest that livestock biodiversity conservation is to be considered in connection with the existence of a diversity of farmers and of farming systems. Suggested actions should be interpreted in this light and not as universal solutions to be applied everywhere.

One aspect that seem common to all, however, is the importance of the access to land. This reveals the existence of some impacts on local breeds of other sectoral policies, such as, for instance, transportation policy and infrastructure development. The model of development may be the key to the apparent dilemma that emerges from the present integrated analysis.

While a higher relative marginality appears as an obstacle to the development of breeding activities, the policy response of bringing tourism into marginal areas to foster its economic development does not seem to successfully address the issue. In fact, conflict over access to resources is at least partly a consequence of high-speed travelling and of the increased accessibility of marginal regions for both tourists and long-distance commuters. This brings more purchasing power into the market for real estate. Prices increase and conflict over resources in marginal rural areas may ensue, noticeably over access to land.

A different approach to rural development and different concrete actions are suggested here. The proposed paradigm is that of a locally-based integrated development that would involve actions more focused on the enhancement of the livelihood of marginal areas on the basis of endogenous resources.

This is not a thoroughly novel suggestion, and is found in both the academic literature (Ray, 2000; Shucksmith, 2000) and to some extent in policy (e.g. the LEADER programmes). What is novel, though, to my knowledge, is its proposal in the framework of the conservation of local breeds.

Ray (1999) has drawn attention to the danger of an ill-defined conceptualisation of "endogenous development", "capacity building" and "social capital". This Author outlines how these concepts have been increasingly present in the rural development discourse.

An abundant literature has sprung from the debate. While this is not discussed in details here, it is important to notice that the concept of "endogenous development" is used here with an empirically grounded connotation. A deeper theoretical account over this aspect is outside the scope of this Thesis and of this conclusive chapter. What matters here is an awareness of the implications of the concept in a wider context and of the use that is here made of it. This is briefly explained in the following.

"Endogenous development" here refers to the paradigm within which it is suggested to interpret the action- and policy-oriented suggestions that are advanced. Evidence from the case study in this Thesis and others reported in the literature (e.g. Ventura and Milone, 2000) suggests that local action can at least to some extent compensate the lack of adapted policies or the existence of policies contributing to engendering the problem. Success has for instance already been the outcome of projects based on the adoption of new marketing channels such as farmers' markets (and their local adaptations) and community supported agriculture (Hinrichs, 2000; Verhaegen and Van Huylenbroeck, 2001).

Farmers' markets are (re-)building face-to-face connections in many parts of the UK, France, and other EU countries (Hinrichs, 2000). They are likewise successfully used elsewhere in the world (Bingen, Serrano and Howard, 2003). Community supported agriculture is a particular form of marketing that is growing in the US and the UK, based on contracts between a farmer and consumers that regularly buy a more or less fixed quantity.

Considering the positive contribution that the adoption of marketing strategies generally entails, these particular ones may also enhance the likelihood that husbandry with local breeds in marginal areas be developed or maintained. Besides, such marketing channels are new

institutions that may help building a sense of belonging to a local network and this is considered to be a factor enhancing livelihood and increasing quality of life (Kearney, Boyle and Walsh, 1994).

One public support that can be encouraged is the funding of education programmes. These, possibly extended to other actors besides farmers, may also profitably include in the curriculum aspects related to marketing strategies, namely to the above-mentioned less well-known ones.

Capacity building and social capital have both recurrently been described as key elements in social and economic life (e.g. Kearney, Boyle and Walsh, 1994; Jenkins, 2000; Terluin, 2003). Economic development – given the availability of capital and labour – is consistently found in case-studies to be related to a high capacity of local actors and to strong internal and external networks (Terluin, 2003).

Bringing together farmers, experts, local authorities, consumers, and other stakeholders could have the effect of enhancing the collective human and social capital. It is also suggested that all initiatives be linked to the particular breed(s) and that mixed types of marketing strategies be used.

As Shortall and Shucksmith (1998) expressed it, the advocacy of "capacity-building" says nothing about the ultimate objectives of a development initiative. Some initiatives may put the accent on the goal of economic development alone or they may confuse the process of community development as a "process to a goal" (Shortall and Shucksmith, 2001). Here, it is suggested that action undertaken be embedded in a collective process. This process would aim at translating a willingness to transform some aspects of society into concrete, local action. Drivers underpinning this willingness to act for social change may stem from a new paradigm of rural development or in some cases a counter-cultural critique or in other instances a desire of society to reverse the trend of unsustainable development (be it in the form of the reduction in the emission of greenhouse gases or, as here, the conservation of livestock biodiversity).

It is argued that the importance of conflict over access to land resources could not be overstated, particularly in systems based on transhumance and/or pastoralism. There is probably no easy, ready-made solution. It is suggested that a broad participative approach be favoured, involving all stakeholders in open discussions focusing on participative management of resources. Discussions would arguably gain in efficiency and efficacy if they focused on the basic needs of each stakeholder and on the search for a solution capable of satisfying all needs. In fact, two (or more) opposing worlds would be brought together. In line with Boltanski and Thevenot (1991), it is deemed that focusing on right/wrong issues or on the allocation of property rights to one group or the other would lead to an impasse or to a less-than-optimal solution.

It is maintained that the dynamics of local action interpreted within an endogeneity framework imply connections with an extra-local context and have far-reaching implications that are of relevance to the sustainability debate (Ray, 1999).

Suggestions that are made here are grounded in the findings of the research. They are explained in a local context and the implications of the extra-local should be kept in mind. In other words, local action may fail to completely counter-balance the impacts outlined in chapter 1. Conversely, it may participate in a larger debate that seeks to address the transition to a more sustainable lifestyle. One question that remains open is whether local action alone, "against all odds", would suffice to reverse the trend of livestock biodiversity loss. Findings from the sociological part of this Thesis seem to indicate that a positive answer is likely.

6.4 Limits of the Thesis and directions for future research

This Thesis has been conceived as empirical and interdisciplinary. The approach was oriented to problem-solving. While the importance of fundamental research cannot be denied, it is argued that interdisciplinary empirical research bridging the gaps between disciplines and

applying methods of several of them is a possibility and even a necessity in complex issues such as the one treated in this Thesis.

Adopting an interdisciplinary approach implies that in none of the single disciplines used could the analysis be carried with a deeper theoretical discussion or with fundamental theoretical innovation⁸¹. Conversely, the analysis is enriched by all disciplines and gains in broadness of scope and in the ability to capture more of the complexity of the issue. Besides, the empirical and transversal approach is nonetheless solidly grounded in the rigorous theoretical foundations of each discipline. The advantages of this approach are deemed to surpass its shortcomings. Environmental issues typically command interdisciplinarity. They are complex and multifaceted and can hardly be thoroughly tackled by single disciplinary approaches.

GIS methods used here permitted the additional study of a geographic aspect – location of the farm in a relatively more marginal area – within the framework of econometric choice models. Sociology provides a different perception of social dynamics and a different viewpoint on the human actor that enriches the comprehension of complex issues. The insights gained in the sociological case study complement the econometric analysis and help in understanding the fundamental causes driving the results.

Quantitative and qualitative methods are considered complementary and enhance understanding of how some particular groups may interact in collective actions related to breed conservation, how their actions are grounded in inner motives and how they may in some cases take unexpected directions relative to breeding choices in marginal areas.

⁸¹ Each and every chapter could well be developed into a self-standing thesis in political science, or in the broad field of GIS methods and approaches or in rural sociology, and so forth.

Finally, with an eye to policy orientation, assessment of relevant agricultural and rural development policies is needed in order to provide suggestions based on a sound knowledge of the existing.

GIS provide a useful framework to analyse many of the issues in relation to the geographic location. One aspect which is interesting to develop further is marginality, or uneven development of different areas. To give one example, based on available data no conclusive statement can be made with respect to the impact of population change in marginal areas. A study of this can be an interesting addition to the existing research on uneven development in rural areas, rural change and the future of marginal areas.

One limiting element, in this and other analyses, is probably linked to the scale adopted, the level 3 of the NUTS classification of regions. Had the data been available, a finer interpretation of some of the driving forces would probably have been possible. It is not sure however that the results would have necessarily be different and it is argued that the indices built here are generally appropriate.

Another limitation is that in general the analysis is rather static, a common limitation in many GIS studies (Berger, 2001). An interesting development is suggested in Bertaglia and Roosen (2002) and would consist in implementing the findings of this Thesis, supplemented by further research, within a multi-agent system. This could render the GIS dynamic and exploit approaches and results from various part of this research and elaborate new research within a larger framework.

In an effort to capture the complexity of various causes of AnGR diversity loss, multi-agent systems (MAS) may provide an interesting context to integrate different methodologies. Recognising the difficulties in aggregating individual decision to group patterns satisfying commonly made economic assumptions (Kirman and Vriend, 2001), MAS proceed in a bottom-up modelling approach. MAS provide a structure to model interactions between adaptive agents

whose actions are grounded in ‘simple’ rules, whereas the outcome emerging for the whole is more than the simple sum of its parts (Macy and Willer, 2002) and could further understanding of complex issues by generating unexpected results.

As Berger (2001) has underlined, an agent-based approach is especially useful when (1) markets are imperfect, (2) behaviour is more complex than pure maximisation and (3) adjustment processes are implied (e.g. adjustment to policy changes). MAS “facilitate the solving of autonomous programming problems while exchanging variables between them”.

An agent modelling approach is described in Figure 6.1. Various programming techniques are recursively applied to many farms, considered as the many agents interacting with each other. A model of farmer behaviour provides useful additional input to the farm decision sub-model. Farmers’ behaviour may be represented in a somewhat simplified, abstracted form, providing the economic farm decision sub-model with threshold levels for the choice of abandonment of activities. These thresholds are a function of attitudes towards life style, non-agricultural income-generating activities, alternative farm enterprises such as residential tourism, etc. Alternatively, the output of a behavioural model may be based on the results of chapter 5 and of further research developing on those results. The computations provide an input to the farm decision sub-model. Outputs from individual farms are inputs to the market, diversity and land use sub models.

A farm economic sub-model is built that represents farm decision-making as driven by CAP scenarios and market forces, as well as by farmers’ behavioural features and farms characteristics.

Input from the CAP into the market sub-model and the farm sub-model is given by results of scenario modelling such as for instance the CAPRI model⁸² or similar models. Input from the market sub-model to the farm sub-model is given by a series of vectors summarising market

⁸² Information: http://www.agp.uni-bonn.de/agpo/rsrch/capri/capri_e.htm

prices for substitute commodities, agricultural inputs, etc. Output from the farm decision model is the number of animals and genetic characterisation of sheep and/or goat breeds – as an input to a diversity model – and allocation of agricultural land to types of uses. The latter, simulated for a large number of farms in a geographic distribution, serves as an input to a GIS model combining socio-economic and land cover data. This enables monitoring land use change as a result of a change in management practices driven by changes in policies, farmers' choices, etc.

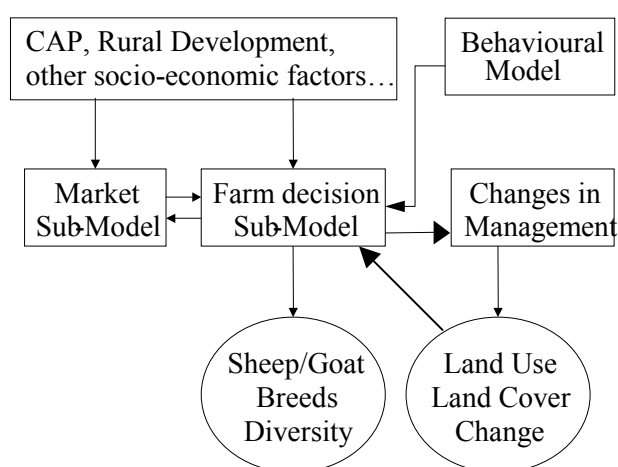


Figure 6.1 – Simplified schematisation of a multi-agent model components

This agent-based approach can make a significant contribution to the interdisciplinary study of the impact of complex decision making on changes in the socio-economic conditions on farms, on changes in land use and on the dynamic of breed diversity loss. It can be conceived as a useful framework to unify the results of efforts of broad collective networks that are increasingly common in the international research context.

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APPENDICES

Appendix 1 – List of breeds sampled by the ECONOGENE project

C O U N T R I E S	S H E E P	G O A T S
Albania	Bardhoka Ruda Shkodrane	Liqenasi Hasi Mati Capore Muzhake Dukati
	3	6
Austria		Pintzgauer Tauernschecken
	0	2
Egypt	Ossimi	Baladie
	1	1
France	Thone et Martod	Rove Pyrenean Corsican French Alpine
	1	4
Germany	Grey Heath Rhöensheep Brown/White Mountain Sheep German merino	Thuringian forest goat German Alpine goat
	4	2
Greece	Orino Sfakia Anogeiano Kalarritiko Pilioritiko Kefalleneas Karagouniko Lesvos Kymi Skopelos	Skopelos Greek goat
	10	2
Hungary	Racka (black and white) Cigaja Cikta Hungarian merino	
	4	0
Italy	Gentile di Puglia Latacauda Altamura Bergamasca Delle Langhe	Girgentana Grigia molisana Bionda dell'Adamello Orobica Valdostana Camosciata (It. Alpine) Argentata dell'Etna Sarda
	5	8
Jordan	Awassi	Jordan mountain
	1	1

APPENDICES

C O U N T R I E S	S H E E P	G O A T S
Poland	Zelazna (Polish lowland) Pomorska Kamieniec Polish mountain Polish heat Polish merino	Polish fawn coloured goat
	6	1
Portugal	Churra Bragançana	Brava
	1	1
Romania	Turcanà Tsigaië Transilvanian Merino Black Karakul	Carpathian
	4	1
Saudi Arabia	Naemi Najdi Heri	Beeshi Najrani
	3	2
Spain	Merinos Merinos 2 Manchega Colmenareña Segureña Rubia del Molar	Verata Payoya Florida Guadarrama Malaguena
	6	5
Switzerland		Stiefelgeiss (St. Gallen booted Goat) Pfauenziege (Peacockgoat) Gemsfarbige Gebirgsziege (Alpine) Gemsfarbige Gebirgsziege 2 (Alpine) Bundner Strahlenziege (Grisons striped)
		5
Turkey	Daglic Akkaraman (White Karaman) Morkaraman (Red Karaman) Karayaka	Angora Hair Gurcu Abaza
	4	4
United Kingdom	Scottish blackface Swaledale Welsh Mountain Exmoor Horn	
	4	0

Appendix 2 – Farm Questionnaire

Questionnaire on husbandry systems based on traditional
sheep and goat breeds in marginal rural areas - ECONOGENE

Identification (of the interviewer and the farm)

Code: □□-□□□□

Interviewer name:

.....

Institution:

.....

Country:

.....

Date of interview: /...../.....

Address of the farm:

.....

Municipality:

.....

Region:

.....

Country:

.....

Geographic position

using GPS devices and expressing coordinates in WGS84 system (see specific protocol on the WEB)

measuring GPS position from a map (see GPS protocol on the WEB)

Indicate coordinate system you are using:

WGS84 (the standard coordinate system):

ITRF.....

Other (please specify name)

Description:
.....
.....

Position (latitude and longitude in degrees and decimals)

Latitude :

Longitude:

Altitude:meters

Name of the two closest localities a)

b)

If rearing conditions include transhumance, then fill in position(s) in following page

Transhumance: geographic position(s)

using GPS devices and expressing coordinates in WGS84 system (see specific protocol on the WEB)

measuring GPS position from a map (see GPS protocol on the WEB)

Indicate coordinate system you are using:

WGS84 (the standard coordinate system):

ITRF.....

Other (please specify name)

Description:
.....
.....

APPENDICES

Please indicate position(s) and periods, the farm being “position 0” on previous page (latitude and longitude in degrees and decimals)

Position	1	2	3	4
Period				
Latitude				
Longitude				
Altitude (meters)				
Name of the two closest localities				

APPENDICES

A. General information about the farm

Code: □□-□□□□

1. The farmer and his/her family

1.1. Status of family members living and/or working on the farm (please insert number of full-time equivalent units; e.g. if agriculture accounts for 50% of full-time work, write 0.5)

Family members

Family members (age class)	Members <i>living</i> on the farm (total)	Members <i>working</i> on the farm (total)	Working activity of members living on the farm (number of full time equivalent units)					
			Agriculture		Non Agriculture	Student or Retired	Unemployed	Housewife
			On the farm	On other farms				
> 60 years old								
18 to 60 years old								
14-18 years old								
< 14 years old								

1.2. Number of workers other than family members

Number of full-time employees

Number of part-time employees Number of full time worker equivalent

Number of seasonal workers Average number of days per worker

1.3. Year of birth of farmer:

1.4. Education: How many years have you attended school (including professional schools and higher education systems ? years /

1.5. Is there a successor for the farm (in case of farmer being older than 60)?

YES NO

1.6. Do you (the farmer) have any other income creating activities outside your farm?

YES NO

a. If YES, what is the nature of this activity:

- Commerce
- Agriculture
- Tourism
- Employee
- Other (please specify:)

b. What is the part in your total revenue coming from activities outside your farm?

- 0 - 25%
- 25 - 50%
- 50 - 75%
- 75 - 100%

1.7. Do you receive direct income support through agricultural subsidies?

YES NO

1.8. If YES, how much of your total revenue depends on this direct income support:

- 0 - 25%
- 25 - 50%
- 50 - 75%
- 75 - 100%

1.9. What is your approximate annual total gross revenue from agriculture (excluding support/subsidies)?

- < 5000 €
- 5000 – 10 000 €
- 10 000 – 20 000 €
- 20 000 – 50 000 €
- 50 000 – 100 000 €
- > 100 000 €

2. Agricultural and structural information

2.1. Characteristics of the farm

- Privately owned farm
- Cooperative
- Other (please specify:)

2.2. Size of the farm

Utilized Agricultural Area (total) hectares (1ha =10,000 square meters),
of which hectares are owned
..... hectares are rented.

2.3. Crop activities to indicate in percentage of total agricultural land holding

Forage crops:%
Other crops:%
Permanent grassland:%
Fallow land:%
Orchards (e.g., fruit trees etc.):%
Gardening (vegetables, small fruits):.....%
Woodland:%
Others (please specify):%

2.4. Number of tractors: total number of horsepower

2.5. Number of buildings for animals/stables:
(total square meters, if available

2.6. What types of animal breeding are present on your farm?

Sheep Goat Cattle
Pig Others (please specify)

2.7. Please specify the percentage of total revenue originating from sales of the following agricultural products:

Percentage of revenue coming from sales of	
Crops	%
Goat milk (or cheese)	%
Goat meat	%
Sheep milk (or cheese)	%
Sheep meat	%
Sheep wool	%
Other animal products	%
Other products and/or services	%
TOTAL	100 %

2.8. Destination of farm production:

	Sales	Consumption and/or on-farm use	TOTAL
Crops	%	%	100 %
Goat milk (or cheese)	%	%	100 %
Goat meat	%	%	100 %
Sheep milk (or cheese)	%	%	100 %
Sheep meat	%	%	100 %
Sheep wool	%	%	100 %
Other animal products	%	%	100 %

2.9. Are you a member of a co-operative or a farmer association?

a. YES ; NO

b. If YES, what type of association

Plant production Animal production Farmers' Union

c. In the case of animal production association, on what activities does it concentrate:

- Production aspects (technologies)
- Marketing aspects (buying/selling)
- Production and marketing aspects
- Others (please specify)

3. Sheep and goat breeding

3.1. Please specify the number of sheep and of goats

3.2. In the next 3 years the number of the following animals will:

- **Sheep** Increase Decrease No Change
 - **Goats** Increase Decrease No Change

3.3 Number of different breeds on the farm

a. Number of sheep breeds: /

b. Number of goat breeds: /

4. Sale and marketing strategies

a. Do you have a particular marketing strategy: YES NO

b. If YES, what is it:

Product	Marketing	If you crossed 'others', please specify
Milk and related products	<input type="checkbox"/> Certified product (Label) <input type="checkbox"/> Product cooperative <input type="checkbox"/> On farm sale <input type="checkbox"/> Other	
Wool	<input type="checkbox"/> Certified product (Label) <input type="checkbox"/> Product cooperative <input type="checkbox"/> On farm sale <input type="checkbox"/> Other	
Meat products	<input type="checkbox"/> Certified product (Label) <input type="checkbox"/> Product cooperative <input type="checkbox"/> On farm sale <input type="checkbox"/> Other	
Reproductive animals	<input type="checkbox"/> Certified product (Label) <input type="checkbox"/> Product cooperative <input type="checkbox"/> On farm sale <input type="checkbox"/> Other	

5. Education and Extension

5.1 Have you participated in any particular information/education programmes on this type of animal breeding (sheep/goat/traditional breeds)?

- a. YES NO
- b. If YES, who organized them?
 State Private organization others (please specify:)

5.2 These programmes have emphasized aspects of:

- Feeding
 Reproduction
 Sanitary/veterinary problems
 Other (please specify)

6. Perspectives on the future

6.1 How do you see YOUR agricultural activity developing in the future (in the next 10 years)?

- a. Agricultural activities:
 Continue as now Expand Reduce Abandon
- b. Non-agricultural activities:
 Continue as now Expand Reduce Abandon
- c. Breeding of traditional goat/sheep breeds present on your farm:
 Continue as now Expand Reduce Abandon
- d. Other types of animal breeding (please specify:):
 Continue as now Expand Reduce Abandon

6.2 Please indicate in the following table the importance of alternative policy measures that a rural development policy trying to assure the continued use of traditional goat/sheep breeds should address in your opinion (1 = not important; ... ; 5 = very important):

APPENDICES

Issue	<div style="display: flex; justify-content: space-between;"> Not important Very important </div>				
Extension service on breeding and animal husbandry (information and consultancy)	1	2	3	4	5
More (higher) subsidies for breeding traditional breeds	1	2	3	4	5
Specialized marketing/ Support for regional products	1	2	3	4	5
Alternative development/employment options in the region	1	2	3	4	5
Investment aids	1	2	3	4	5

B. Breed (please fill in one form –page 7 to 9 - per breed raised on the farm)

1. General Information

1.1 Species: Sheep Goat

1.2 Breed name (International):

.....

1.3 Number of animals

a. Total Number:/ of whichare private property of farmer/

b. Number of breeding females:/

c. Number of breeding males:...../

1.4 For how many years has this breed been raised on the farm

More than 10 years Between 5 and 10 years Less than 5 years

1.5 Trend in the stock of animals of the breed:

Growing Declining Stable

1.6 Please choose the most important reason for this recent trend in the size of your flock:

- Economic rentability
- Market conditions (price, marketing, etc.)
- Personal reasons (retirement, farm recently taken up by a new farmer etc.)
- Substitution with other animal breeding activities
- Climate conditions
- Others: please specify

2. Principal characteristic utilization of the breed

2.1 Principal utilization (indicate order of importance: 1-2-3-4)

Order of importance (1, 2, 3, 4, 5)	Product	Yield
	Milk and milk products	kg/year
	Meat	----
	Wool	kg/year
	Breeding/reproductive animals	
	Other: please specify	

2.2 Does the breed have any other quality attributes than those described above that you consider particularly interesting?

- Quality of the product for human consumption
- Resistance against disease pathogens
- Adaptation to bio-physical conditions
- High degree of productivity
- Others (please specify:.....)

3. Form of reproduction

3.1 Average age of females at first lambing:month/

3.2 Average age of reproductive females at last lambing:years/

3.3 Origin of reproductive males:

- Coming from the farm itself
- Bought
- Others (please specify:

3.4 Criteria determining the choice of the reproductive male:
...../

3.5 In case that there are more than one breed of the same species (sheep or goat) on the farm, are the breeding programs kept separate? YES NO

3.6 Control of inbreeding:

a. Is the reproductive male paired to his ascendants, descendants or ‘siblings’?

YES NO

b. If YES why:

3.7 Type of mating:

- Free mating – various males with females, male parenthood unknown
- Controlled mating – one particular male with particular females, male parenthood known

3.8 Mating period(s)

...../

3.9 Main period of lambing:

3.10 Other indicators for the herd:

- a. Lambing %:
- b. Mortality until weaning (%):

3.11 Usage of modern reproduction technologies

- Artificial insemination
- Embryo Transfer
- None
- Flushing
- Hormones

3.12 Destination of reproductive animals:

Sold _____%

Utilized in herd _____%

4. Feeding

4.1 Animal rearing conditions

- In stable all year round
- Stable and grassland: months per year on grassland _____
- Transhumance: months per year in valley _____
months per year in mountains _____
- Nomadic: months per year _____

4.2 Are the feeding rations differentiated according to animals' age/physiological conditions?

YES NO

4.3 If YES, does this rationing concern

- Females in gestation
- Females in lactation
- Animals in reproduction
- Lambs
- Others (please specify:.....)

4.4 What fodder types do you use?

Fodder	Months/year of use	Source (%)	
		On farm production	Bought
Hay			
Concentrates			
Others (please specify)			
...			
...			

5. Sanitary and Veterinary Aspects

5.1 What are the most often encountered disease problems encountered for this breed in your exploitation?

- Digestive problems
- Respiratory problems
- Hepatitis
- Mastitis
- Brucellosis
- Others (please specify):

5.2 Do you undertake regularly control measures regarding the health of the animals and do you undertake vaccination programs against contagious diseases?








YES NO










5.3 In the case of disease outbreaks, do you:

- treat the animals yourself
- call a veterinarian

5.4 On average, how much are your expenses for sanitary and veterinary treatments of the breed per year? € / year.

Appendix 3 - CORINE Land Cover 16-Class Legend (Figure 3.2)

0. not inventoried	
1. Urban, industry and transport infrastructure (1 to 6) → 1.1.1 Continuous urban fabric 1.1.2 Discontinuous urban fabric 1.2.1 Industrial or commercial units 1.2.2 Road and rail networks and associated land 1.2.3 Port Areas 1.2.4 Airports	
2. Other artificial areas (7to 9) → 1.3.1 Mineral extraction sites 1.3.2 Dump sites 1.3.3 Construction sites	
3. Artificial non-agricultural vegetated areas (10 and 11) → 1.4.1 Green urban areas 1.4.2 Sport and leisure facilities	
4. Arable land areas (12, 13, 14) → 2.1.1 Non-irrigated arable land 2.1.2 Permanently irrigated land 2.1.3 Rice fields	
5. Permanent crops areas (15, 16, 17) → 2.2.1 Vineyards 2.2.2 Fruit trees and berry plantations 2.2.3 Olive groves	
6. Pasture areas (18) → 2.3.1 Pastures	
7. Heterogeneous agricultural areas (19, 20, 21) → 2.4.1 Annual crops associated with permanent crops 2.4.2 Complex cultivation patterns 2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation	

<p>8. Agro-forestry areas (22) → 2.4.4 Agro-forestry areas</p>	
<p>9. Forests areas (23, 24, 25) → 3.1.1 Broad-leaved forest 3.1.2 Coniferous forest 3.1.3 Mixed forest</p>	
<p>10. Natural grassland areas (26) → 3.2.1 Natural grassland</p>	
<p>11. Moors, shrubs and scrubs (27, 28, 29) → 3.2.2 Moors and heathland 3.2.3 Sclerophyllous vegetation 3.2.4 Transitional woodland-scrub</p>	
<p>12. Open spaces with little or no vegetation (30, 31,32, 33, 34) → 3.3.1 Beaches, dunes, sands 3.3.2 Bare rocks 3.3.3 Sparsely vegetated areas 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow</p>	
<p>13. Wetlands (35 to 39) → 4.1.1 Inland marshes 4.1.2 Peat bogs 4.2.1 Salt marshes 4.2.2 Salines 4.2.3 Intertidal flats</p>	
<p>14. Water bodies (40 to 44) → 5.1.1 Water courses 5.1.2 Water bodies 5.2.1 Coastal lagoons 5.2.2 Estuaries 5.2.3 Sea and ocean</p>	
<p>15. Missing data (ex 49) →</p>	
<p>16. Sea (ex 50) →</p>	

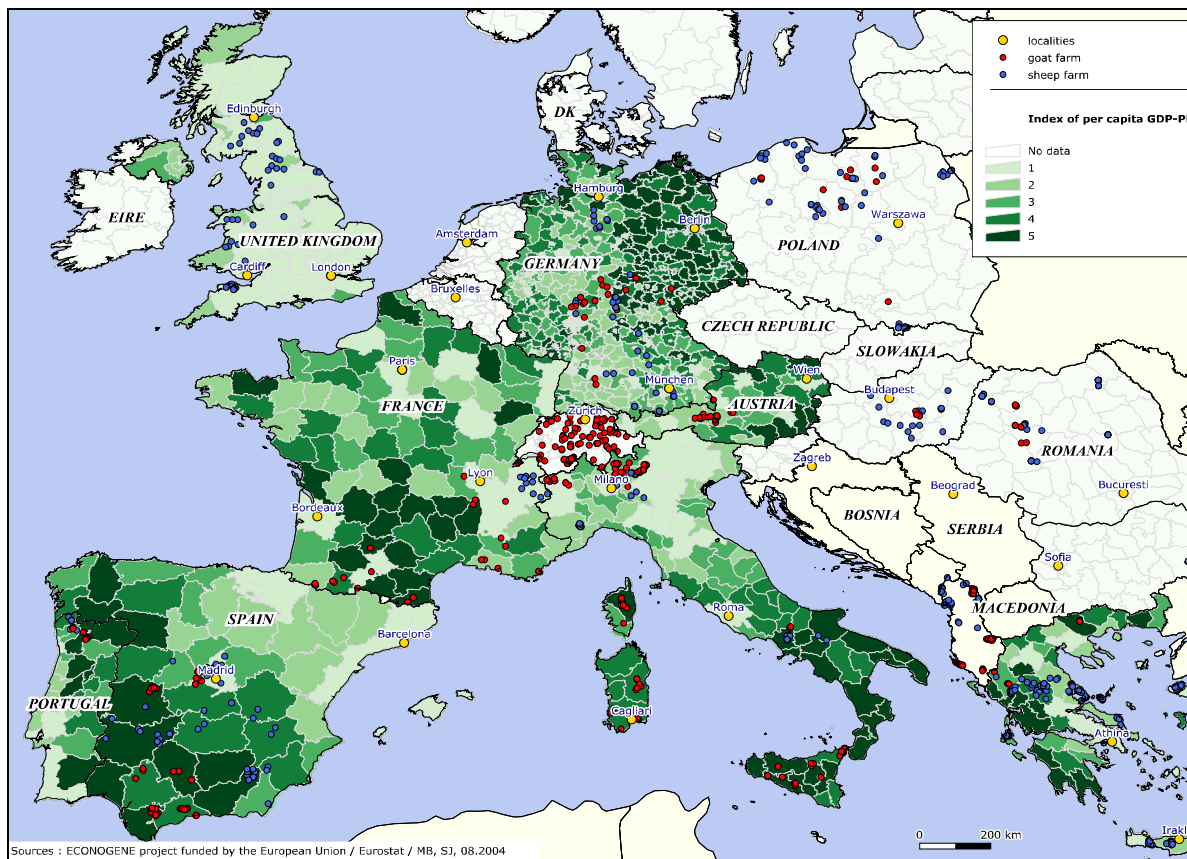
Appendix 4 – Maps of indicators of relative marginality

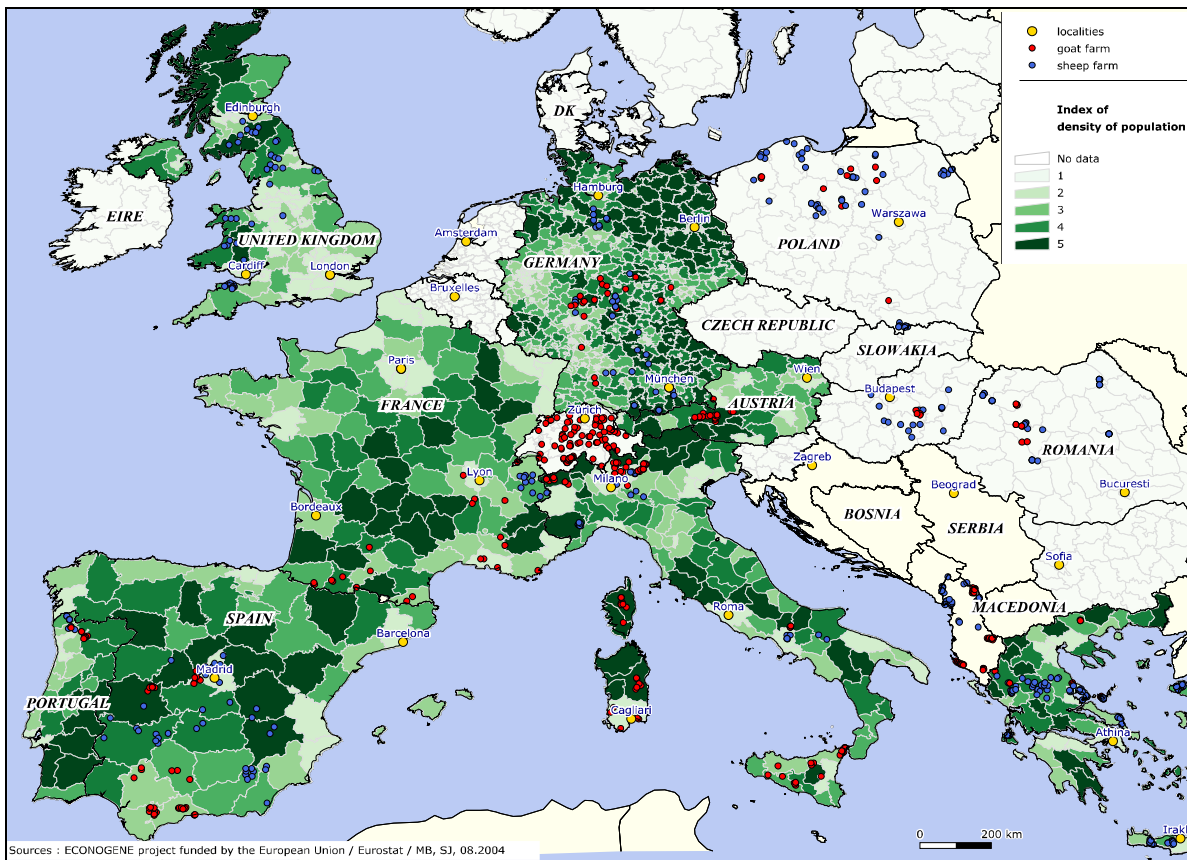
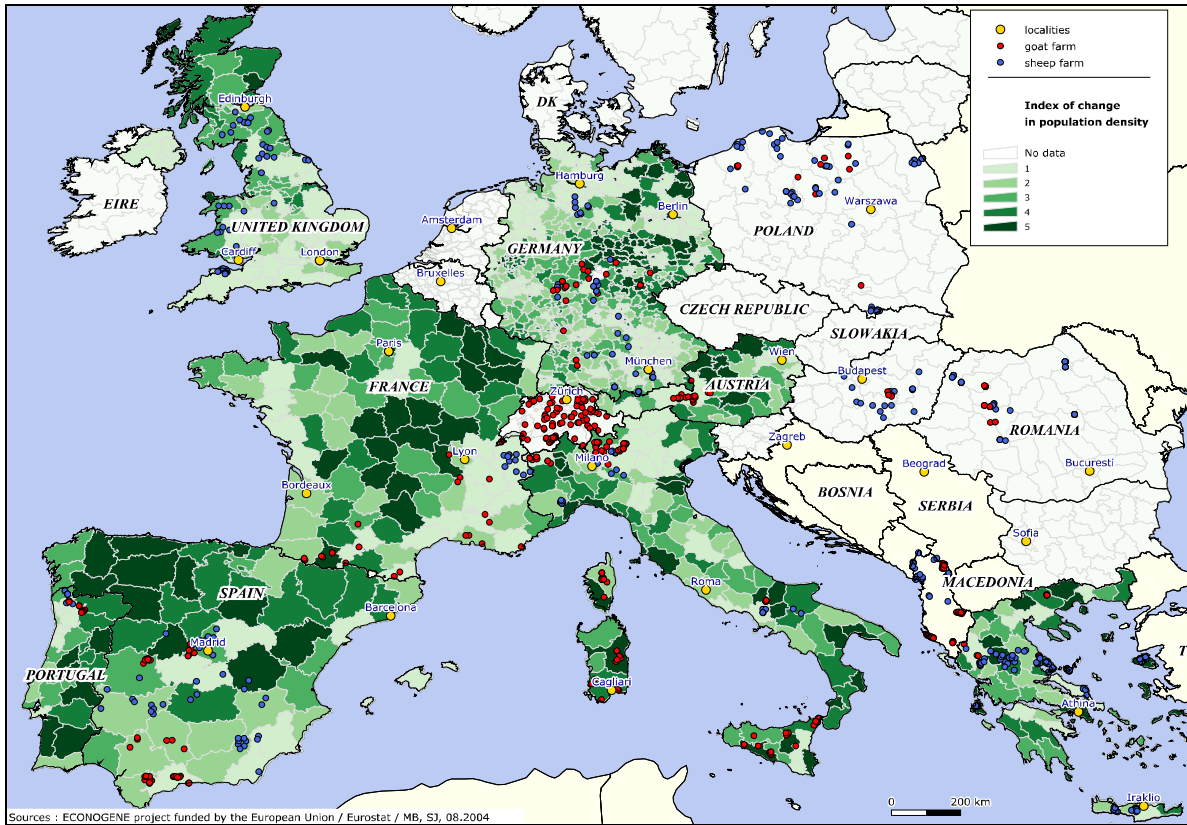
The maps of all indicators but those already in the main text of the Thesis are shown below.

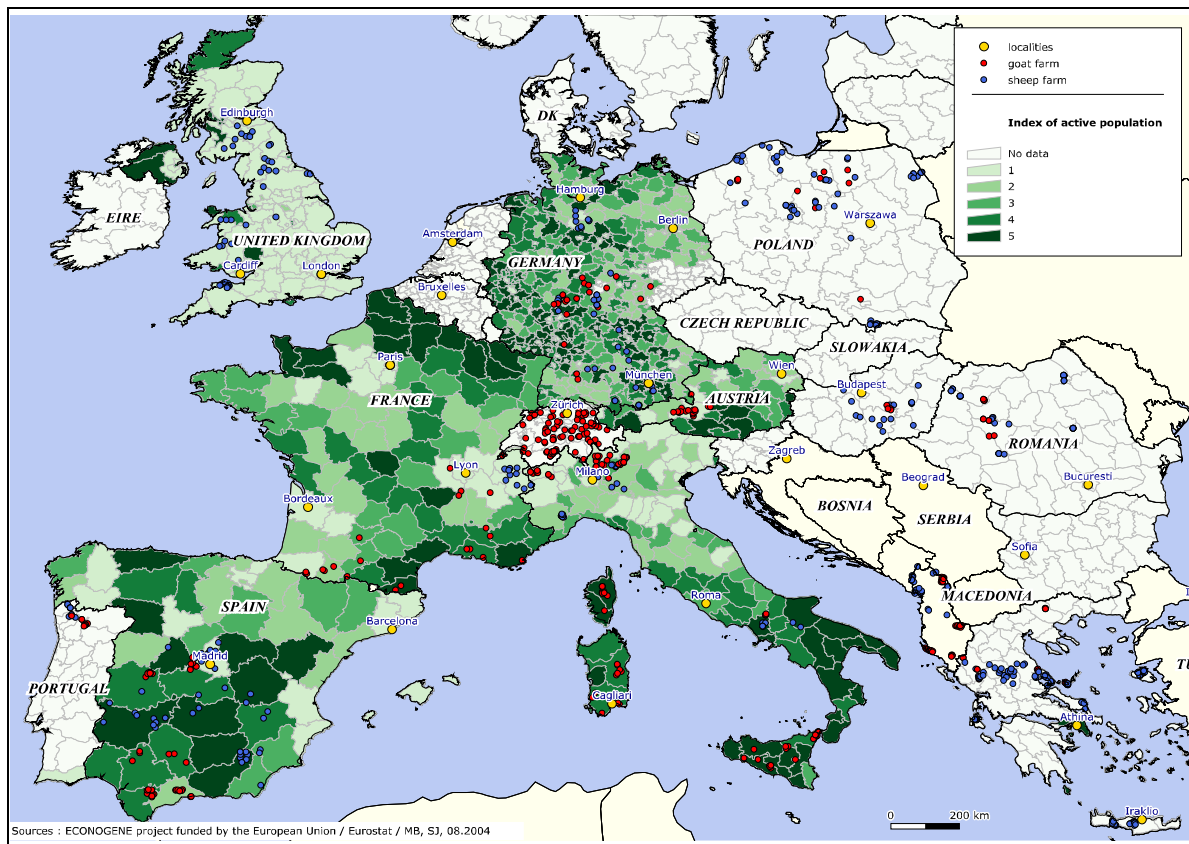
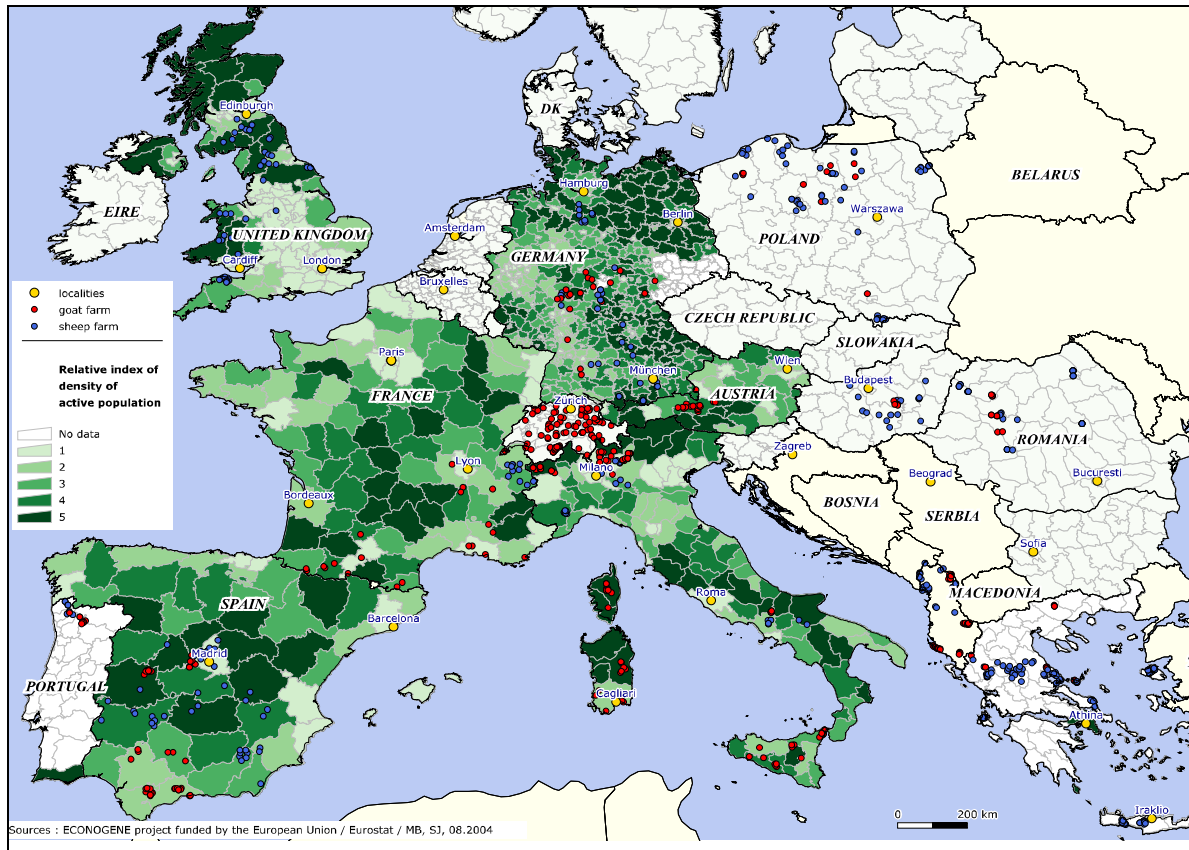
The indicators in the main text are the indicator of relative unemployment, IEMPL (Figure 3.4 p. 76) and the indicator computed as a ratio of land use, as explained in section 3.3, ILAND (Figure 3.5 p. 78).

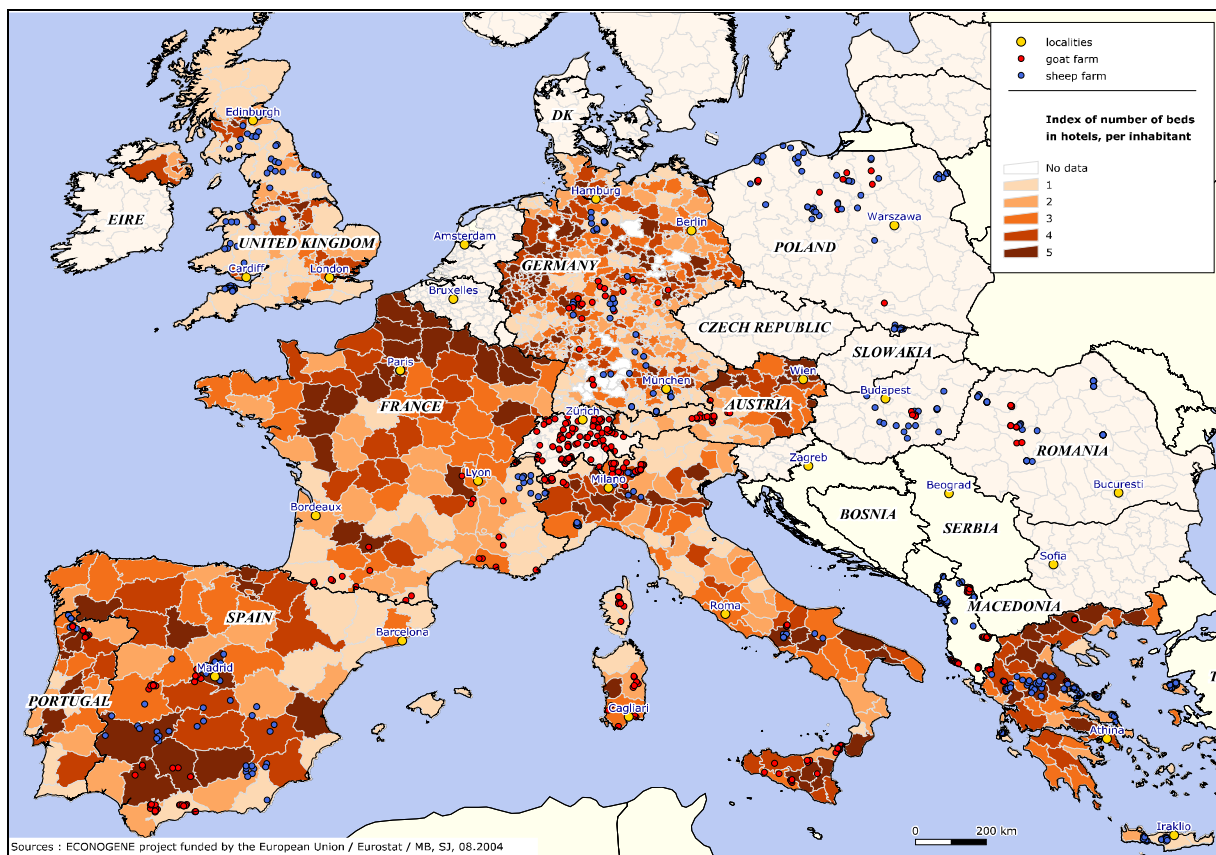
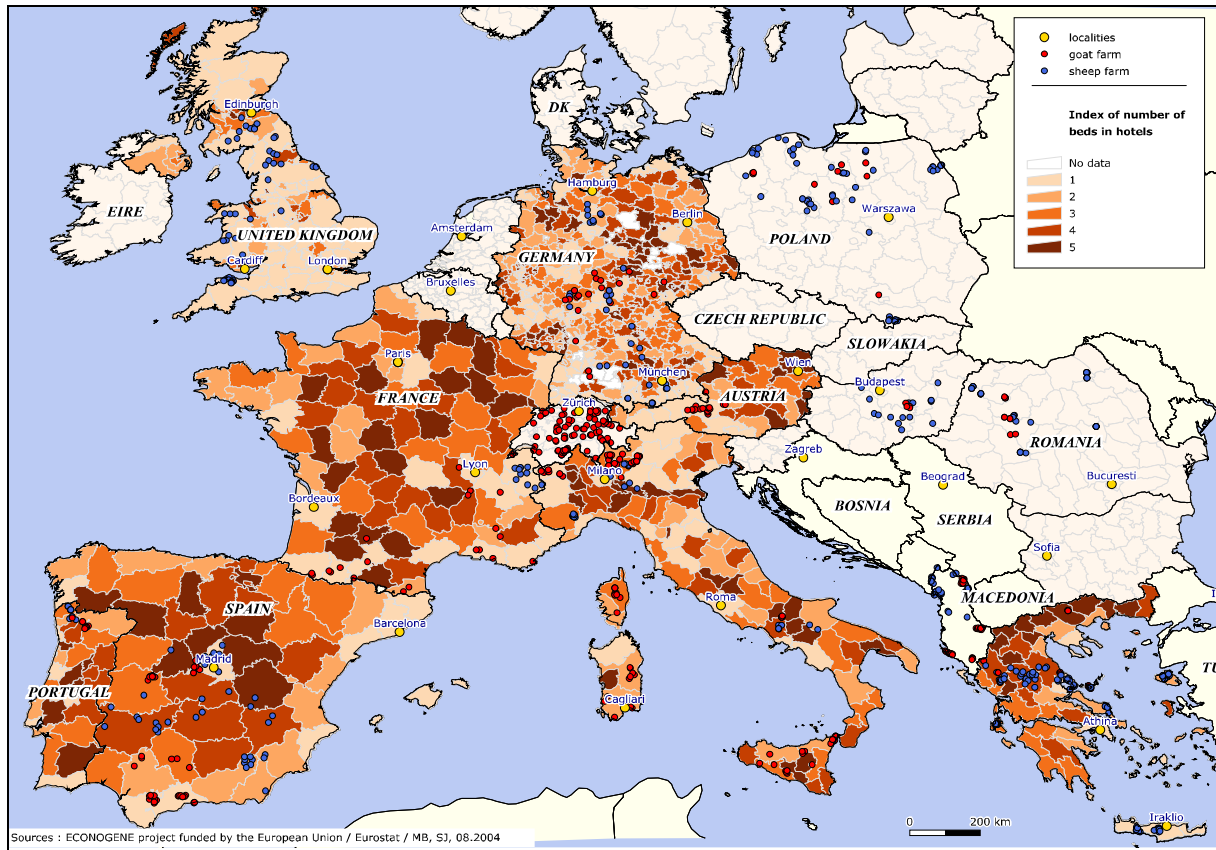
The maps presented below are, in the order:

- the indicator of relative richness, based on GDP at purchasing power parities, IPPPHAB;
- the indicator of change in population density between 1995 and 1998, ID98IDX5;
- the indicator of population density, IDENS98;
- the indicator of density of active population, IADJACT0;
- the indicator of percent of active population on total population, IPERCACT;
- the indicators of the number of beds in hotels, total number, IBEDS, and per inhabitant, IBEDPH.









Appendix 5 –Guidance of the qualitative interviews of Chapter 5⁸³

Starting question:

You are a breeder rearing the Rove/Provencale. Can you please tell me about it, how you started, a bit of your personal story, what you did, if something different, how it all happened?

- choice to raise the breed?
 - what is/are the reason(s) that explain(s) the importance or interest of the breed (conservation)
 - resist, continue – what collective and what individual action?
 - what is behind the choice? – possible provocative question "why not rearing the Alpine, after all?"
 - what does the breed mean to you?
 - if newcomer setting-up, why choose this particular location?
- history of the breed society
- breeder of a traditional breed, (with/without sheep): how is it today?
 - professions: breeder/shepherd, cheese-maker, marketing specialist,...
 - shepherd,... link to the land, rangelands,...
 - specificity of your activity
 - products
 - quality?
 - making a living, surviving
 - being accepted (surrounding community?) – relationships with the "world outside"
- what perception do you think people/society/outside have of you/your activities?
- what perception do you think people/society/outside have of the breed?
- difficulties problems etc. in your activity;
 - with respect to your own profession
 - in relation with others, society, ...
 - financial aspects
 - land

⁸³ It is to be remembered that questions are not asked strictly (with exceptions when needed) but rather that this is an help for the interviewer to be sure that important things are dealt with. It is a (very loose) minimum structure. The actual dialogue and questions in the flow of the interview is much richer. This is explained in the main text of Chapter 5. Also, please notice that the English translation provided here fails to some extent to convey all the nuances of colloquial French.

- the other actors (local authorities, extension experts, land owners, etc.)
- actions you'd take to overcome obstacles? What impediments?
- how are you doing with respect to your produce, marketing,... ?
 - which product? Which sale channel?
 - difficulties?
 - marketing? importance, which strategy, etc.
 - what about protected denominations?
- how do things go within the association?
 - contacts with the other breeders?
 - evolution, your own implication, problems if any...
 - conflicts – origin of them
- what about relations with extension experts? other institutions?
- some history? how come these breeds are endangered? what about Alpine/Saanen?
- how do you see the future of traditional breeds?
- How do you think we might be able to safeguard traditional breeds?

Appendix 6 – Curriculum Vitae (English)

Marco Bertaglia

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Office +32.10.473676 Fax ext. 3675
E-mail: marco.bertaglia@skynet.be

Born in Italy on 29/06/1970
Married, one child

Education**M.Sc. Environmental Science and Management**

Jan. 1998 – Jan.. 2000 Université catholique de Louvain Louvain-la-Neuve
Final results "Distinction".

M.Sc. Thesis: *"Technical and Environmental Analysis of a Selective Treatment System for Domestic Wastewater as a Sustainable Alternative to Centralised Options"* (in French). Supervisors Pr. P. Gerin, Unité de Génie biologique, Pr. J. Roosen, Unité d'Économie rurale (now at University of Kiel), Pr. Jozsef Országh, Professor Emeritus, Faculté des Sciences, Université de Mons-Hainaut. **17.5/20.**

Honours Degree in Forestry and Environmental Sciences

Nov. 1991 – Jul. 1997 Università degli Studi di Torino Turin (Italy)
Final results 104/110.

Final Thesis: *"Aspects of the Pastoral Conversion of a Livestock Farm in Mountainous Alta Langa"* (in Italian).

Written works

"Economic and Environmental Analysis of Domestic Water Systems: A Comparison of Centralised and On-Site Options for the Walloon Region, Belgium" Paper presented at an international conference « Science for Water Policy », School of Environmental Studies, University of East Anglia, Norwich, United Kingdom, 2 – 4 September 2002 (co-authors J. Roosen, J. Országh, P. Gerin).

"Applying Multigenic Methodologies to Complex Social-Environmental Problems: the Valuation and Conservation of Animal Genetic Resources in European Marginal Areas" Paper presented at an international conference on Agriculture and the Environment University of Patras, Grèce, 14 – 16 June 2002 (co-author J. Roosen).

Workshop paper in **Environmental Pollution**: *"Water Pollution from Non-Agricultural Use of Pesticides: A Case Study"*.

Workshop paper in **Renewable Energies**: *"Methane Production by Anaerobic Digestion of Municipal Solid Waste"*.

Other Trainings

- *Training in Nonviolent CommunicationSM and Conflict Management*
- *Oral and scientific communication*
- *Field work in dendrometry and silviculture.*

Work Position**Research Assistant**

Oct. 2002 – Aug. 2004 Institute of Food Economics and Consumption Studies
University Of Kiel

Dec. 2001 – Aug. 2002 Unit of Rural Economics UCL, Louvain-la-Neuve

- Research within the framework of an European project on the protection of biodiversity of livestock breeds and rural development in marginal areas.

Previous Work Experience**Environment, Development and Communication Consultant**

Nov. 2000 – Sep. 2001 Various local NGOs Burkina Faso, Peru, India

- **Rural Surveys** and organisation of an emergency food aid project, Burkina Faso.
- Participation in the **organisation** and the presentation of **lectures** in a workshop aimed at peasant trainers in the fields of agriculture, environment et sustainable rural development, in Burkina Faso.
- **Education** of working children and teenagers (Science, Maths, English language, Environmental protection) as well as training of **NGO workers** in Nonviolent CommunicationSM, in Peru.
- Participation in an Awareness-building Project on **biodiversity preservation** as well as **water pollution prevention**, Uttaranchal, India.

Agri-environmental expert

Jul. – Oct. 2000 Ferme du Parc Maximilien asbl 1000 Brussels

- Conception and organisation of several varied didactical activities for children and adults within the pedagogical urban farm.
- Daily management of the park and the farm.

Adjoined Researcher (external collaboration)

Mar. – Apr. 2000 Unité de Génie biologique, UCL Louvain-la-Neuve

- **Bibliographic review** on the state-of-the-art of research in biodegradable polycaprolactones.

Agri-silvo-pastoral junior expert

Mar. – Oct. 1997 Dipartimento AGROSELVITER, Turin (Italy)
Università degli Studi di Torino

Languages

- *Italian mother tongue.*
- *French at near-mother-tongue level and advanced English (IELTS 8.0)*
- *Very good Spanish.*
- *Intermediate German. (Zertifikat Deutsch “Sehr gut”)*
- *Elementary Dutch.*
- *Passive Portuguese.*

Research interests

Social Change. Sustainability issues and lifestyles. Intentional communities. Social psychology. International cooperation and development issues.

Other interests and Hobbies

Conflict resolution. Permaculture. Pedagogy. Music. Travelling. Mountain hiking. Foreign languages, including less-common ones. Ethnology (pure and applied) and indigenous peoples knowledge.

Appendix 7 – Complete list of publications to date (English)

Publications in Peer-Reviewed Journals

Roosen J., Fadlaoui A., Bertaglia M., 2005. *"Economic Evaluation for Biodiversity Conservation of Animal Genetic Resources"* Journal of Animal Breeding and Genetics, forthcoming.

International Conferences and Congresses

a) In Proceedings

Bertaglia M., Roosen J., Országh J., Gerin P., 2002. *"Economic and Environmental Analysis of Domestic Water Systems: A Comparison of Centralised and On-Site Options for the Walloon Region, Belgium"* Proceedings of the International Conference « Science for Water Policy », School of Environmental Studies, University of East Anglia, Norwich, UK, 2-4 September 2002.

b) Contributed Papers (with Paper Review Process)

Bertaglia M., Mormont M., Trommetter M., 2004. *"Local breeds, pastoralism and breeders' worldviews. Resistance to globalisation in Southern France."* Presented to the XI World Congress of Rural Sociology, Trondheim, Norway, 25-31 July 2004.

Jones S., Bertaglia M., Ligda C., Georgoudis A., Roosen J., Canali G., Scarpa R., Econogene Consortium, 2004. *"Characteristics of traditional sheep and goat breeding in marginal European rural areas"* Poster Presentation at the 55th Annual Meeting of the European Association of Animal Production, Bled, Slovenia, 5-9 September 2004. [Presented by Jones S.]

Bertaglia M., Roosen J., 2002. *"Applying Multigenic Methodologies to Complex Social-Environmental Problems: the Valuation and Conservation of Animal Genetic Resources in European Marginal Areas"* Presented to the International Symposium "The Role of the Environment in Agriculture and Rural Development", Department of Economics, University of Patras, Cephallonia, Greece, 14-16 June 2002.

c) Abstracts

Bertaglia M., Roosen J., 2003. *"Assessing Policies for Biodiversity Conservation: Development of an Agent-Based Methodology"* 3rd International Symposium on Ecological Genetics. Katholieke Universiteit Leuven, Leuven, Belgium, 5-7 February 2003.

Papers in Progress

Bertaglia M., Roosen J., Econogene Consortium, 2005. *"Modelling Farmers' Decisions in the Husbandry of Traditional Sheep and Goat Breeds in Europe"* Submitted to the XI Congress of the European Association of Agricultural Economists, Copenhagen, Denmark, 24-27 August 2005.

Bertaglia M., Mormont M., Trommetter M., 2005. *"Conserving Local Goat Breeds and Traditional Pastoralism in Southern France"* Ready to be submitted for review/publication to the Journal of Rural Studies.

Workshops and Other Presentations

Bertaglia M., 2005. *"Water in the Household... Sources, Uses, Pollutions, Fate..."* Presentation at a Science Seminar in the framework of the *"Festival Science Infuse"* for teenage students/schools and continuing education projects, March 2005. [in French]

Bertaglia M., 2005. *"Protecting Farm Animal Biodiversity and Contributing to Rural Development in Marginal Areas. Combining GIS Tools, Econometrics and Rural Sociology to address Biodiversity, Sustainability and Rural Development Policies"* Invited Research and Teaching Seminar, Biodiversity Seminar, Interuniversity MRes in Development, Environment and Society, University of Liège, Department of Environmental Sciences and Management, Arlon, Belgium, March 2005. [in French]

Bertaglia M., 1999. *"Methane Production by Anaerobic Digestion of Municipal Solid Waste"* Presented at a workshop on Renewable Energies, Université catholique de Louvain, Louvain-la-Neuve, Belgium, October 1999. [in French]

Bertaglia M., 1999. *"Water Pollution from Non-Agricultural Use of Pesticides: A Case Study."* Presented at a workshop on Environmental Pollution, Université catholique de Louvain, Louvain-la-Neuve, Belgium, April 1999. [in French]

Bertaglia M., 1998. *"World Fisheries. Exploitation or Sustainable Use?"* presented at a workshop on Environment-Population-Development, Université catholique de Louvain, Louvain-la-Neuve, Belgium, December 1998. [in French]

Working Papers

Roosen J., Fadlaoui A., Bertaglia M., 2003. *"Economic Evaluation and Biodiversity Conservation of Animal Genetic Resources"*, FE Working Paper #0304, Department of Food Economics and Consumption Studies, Christian-Albrechts-Universität zu Kiel, Germany, 73p.

Appendix 8 – Curriculum Vitae (Deutsch)

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Büro+32.10.473676 Fax .../3675
E-mail: marco.bertaglia@skynet.be

Geburtsdatum u. -ort: 29. Juni 1970 in Novara / Italien

Familienstand: verheiratet, ein Kind

Staatsangehörigkeit: italienisch

Ausbildung/Studium:

Jan. 1998 – Jan. 2000 **M.Sc. Environmental Science and Management**
(Master in Umweltwissenschaft und Management)
Université catholique de Louvain, Louvain-la-Neuve
(Belgien)
Bewertung: „Distinction“
Master-Arbeit: "*Technical and Environmental Analysis of
a Selective Treatment System for Domestic Wastewater
as a Sustainable Alternative to Centralised Options*"
(in französisch)
Note: 17,5/20

Nov. 1991 – Jul. 1997 **Laurea in Scienze forestali e ambientali**
(Diplom in Forst- und Umweltwissenschaft)
Università degli Studi di Torino , Turin (Italien)
104/110 Punkte
Abschlussarbeit: "*Aspects of the Pastoral Conversion of a
Livestock Farm in Mountainous Alta Langa*"
(in italienisch).

Veröffentlichungen / Vorträge:

*"Economic and Environmental Analysis of Domestic Water
Systems: A Comparison of Centralised and On-Site Options
for the Walloon Region, Belgium."*
präsentiert auf der internationalen Konferenz
"Science for Water Policy", School of Environmental
Studies, University of East Anglia, Norwich, United Kingdom,
2. – 4. September 2002
(Ko-Autoren: J. Roosen, J. Országh, P. Gerin).

"Applying Multigenic Methodologies to Complex Social-Environmental Problems: the Valuation and Conservation of Animal Genetic Resources in European Marginal Areas."
präsentiert auf der internationalen Konferenz "Agriculture and the Environment" an der University of Patras, Griechenland, 14. – 16. Juni 2002 (Ko-Autor: J. Roosen).

Weitere Ausbildungen:

- Ausbildung in Nonviolent CommunicationSM and Conflict Management
(Gewaltfrei Kommunikation und Konflikt-Management)
- Oral and scientific communication
(Mündliche und wissenschaftliche Kommunikation)
- Field work in dendrometry and silviculture
(Praktische Anwendung in Waldwissenschaft und Waldbau)

Berufliche Tätigkeiten:

	Wissenschaftlicher Assistent
Okt. 2002 – Aug.2004	Institut für Ernährungswirtschaft und Verbrauchslehre der Universität Kiel
Dez. 2001 – Aug. 2002	Institut für Agrarökonomie. Université Catholique de Louvain, Louvain-la-Neuve / Belgien Forschung im Rahmen eines EU-Projektes über den Schutz biologischer Vielfalt von Nutztierassen und die landwirtschaftliche Entwicklung auf Grenzstandorten.

Vorherige Arbeitserfahrungen:

Nov. 2000 – Sept. 2001	Umwelt-, Entwicklungs- und Kommunikationsberater bei verschiedenen Nichtregierungsorganisationen in Burkina Faso, Peru, Indien
	<ul style="list-style-type: none">• Landwirtschaftliche Befragung und Organisation eines Nahrungsmittel-Hilfsprojektes in Burkina Faso• Teilnahme an der Organisation und Präsentation von Vorlesungen in einem Workshop für Ausbilder von Kleinbauern auf dem Gebiet Landwirtschaft, Umwelt und nachhaltiger landwirtschaftlicher Entwicklung in Burkina Faso• Ausbildung arbeitender Kinder und Jugendlicher (Naturwissenschaft, Mathematik, Englisch, Umweltschutz) sowie Training von Arbeitern aus Nichtregierungsorganisationen in Gewaltloser Kommunikation - in Peru• Teilnahme an einem Bewusstseins-Bildungs-Projekt zum Erhalt der Artenvielfalt sowie Verhinderung von Wasserbelastung in Uttaranchal / Indien

Juli – Okt. 2000: **Agrar-Umwelt-Experte**
Ferme du Parc Maximilien asbl, Brüssel

- Konzeption und Organisation mehrerer verschiedener didaktischer Aktivitäten mit Kindern und Erwachsenen auf dem pädagogischen Stadt-Bauernhof
- Tägliches Management des Parks und der Farm

März – Apr. 2000 **Wissenschaftler** (externer Mitarbeiter)
Lehrstuhl für Bioingenieurwesen - Université Catholique de Louvain, Louvain-la-Neuve / Belgien

- Literaturlauswertung von Schriften über Daten biologisch abbaubarer Polycaprolactone nach dem neusten Stand der Wissenschaft

März – Okt. 1997 **Land- und Fortwirtschaftlicher Junior-Experte**
Dipartimento AGROSELVITER, Università degli Studi di Torino Turin (Italien)

Sprachen

Italienisch (Muttersprache)
Französisch (fast muttersprachliches Niveau) und erweitertes
Englisch (IELTS 8.0)
Spanisch - sehr gut
Deutsch (zwischenzeitlich erlernt) – Zertifikat Deutsch „sehr gut“
Niederländisch – Grundkenntnisse
Portugiesisch – passiv

Referenzen

Prof. Dr. Jutta ROOSEN, Lehrstuhl für Haushalts- und Verbraucherorientierte Gesundheitsökonomik, Christian-Albrechts-Universität zu Kiel, Tel.: +49.431.8804567 e-mail: <jroosen@food-econ.uni-kiel.de>

Prof. Dr. Patrick GERIN, Unité de Génie Biologique, Université Catholique de Louvain, Tel. : +32.10.473646 e-mail:<gerin@gebi.ucl.ac.be>.

Ms. Anne-Claire DEWEZ, Ir. Agr., BE-1170 Bruxelles, Tel.: +32.2.6622790.

Wissenschaftliche Interessen:

Soziale Veränderungen - Probleme der Nachhaltigkeit und des Lebensstils - Internationale Gemeinschaften - Sozialpsychologie - Internationale Zusammenarbeit und Entwicklungsfragen

Weitere Interessen und Hobbys:

Konfliktlösungen – Permakultur – Pädagogik – Musik – Reisen – Bergwandern - fremde Sprachen, einschließlich weniger bekannter – Völkerkunde (reine und angewandte) - Kenntnisse und Wissen von Eingeborenen