

The Nature of Farming

Low Intensity Farming Systems in
Nine European Countries



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Contents

Acknowledgements

Introduction	5
Chapter 1: What are Low Intensity Farming Systems?	7
Chapter 2: A Typology of Low Intensity Farming Systems in Europe	10
Chapter 3: The Importance of Low Intensity Farming Systems for Nature Conservation	15
Chapter 4: Methods for Identifying the Location of Low Intensity Agricultural Systems	22
Chapter 5: The Extent and Location of Low Intensity Farming Systems in the Study Countries	25
Chapter 6: Changes affecting Low Intensity Farming Systems	43
Chapter 7: The Nature Conservation Implications of Changing Systems	52
Chapter 8: Conclusions and Recommendations	58
References	65

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This summary report draws heavily on the nine national studies which formed the core of this project.

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Introduction

The alpine pastures of northern Italy, grazing marshes of the French Atlantic coast, hay meadows of the Yorkshire Dales and the open expanses of dryland wood pasture in western Spain have at least one feature in common. Each is the product of a system of farming quite distinct from intensive modern agriculture. Often, but not invariably, traditional in character, these systems can be described as "low intensity" because they tend to be low yielding and modest in their use of agricultural inputs, such as fertilisers.

Low intensity farming systems have been out of fashion in Europe for half a century or more. In order to increase production, raise farm incomes and take advantage of successive waves of new technology, intensive methods have been introduced into almost every form of agriculture in Europe. Most food is now produced in this way, leaving only a modest role for lower input systems of farming.

Yet there are large tracts of land which are still under less intensive agricultural management, especially in Southern Europe. Indeed, many of the wildest and most remote parts of the continent are farmland, particularly pastoral farmland. Landscapes and habitats which we have come to value have developed hand in hand with agricultural activities over many hundreds of years. Because of physical, socio-economic and geographical constraints, many of these areas are only now being significantly affected by the post-War modernisation of agriculture which has changed the character of most of the countryside so profoundly. In some localities land is being abandoned, in others it is subject to agricultural intensification or entirely new uses such as commercial afforestation. Inevitably, many long established systems are breaking down or disappearing.

These changes are occurring over large tracts of rural Europe and it is difficult to envisage the full environmental and social consequences. The social and cultural value of low intensity systems is gaining greater recognition but it is clear that many are of particular environmental value as well. This is not only because they are less polluting and demanding in their use of resources than intensive agriculture, but also because of their major role in conserving habitats and their dependent wildlife communities of recognised European importance. Many are also central to maintaining regional cultural landscapes. Only a small proportion of land farmed in this way is protected as National Parks, nature reserves or other specially designated areas.

There is still no pan-European assessment of the character and distribution of low intensity farming systems in Europe, or of the changes which they are undergoing. Such an analysis is necessary and timely for at least two reasons:

a) it is increasingly apparent that social, environ-

mental and budgetary costs have stemmed from encouraging intensive systems on a large scale. Intensification has contributed to the over-production of many commodities in the European Union (EU), necessitating a change in the goals of agricultural policy. There is now a requirement for the Common Agricultural Policy (CAP) to take more account of the environment and the control of production. Measures to promote "extensification" have become part of the CAP and subsidies are being introduced for farmers who reduce their use of inputs. So, those forms of agriculture which already are of high environmental value and produce relatively low yields are relevant to the future of European farming; they are not simply a relic of the past. Their current role and the prospects for their development merit special attention if the commitment to "green" the CAP is to have real meaning.

b) these systems are of strategic nature conservation value, especially for species found mainly on farmland and those which range over a large area and cannot be protected within the confines of small nature reserves. In order to understand their role and to plan for the effective conservation of European biodiversity, it is important both to evaluate different systems, and to examine individual management practices and their implications for different species and habitats. Securing appropriate forms of farm land management is likely to remain a priority for nature conservation in Europe for the foreseeable future. For example, the EU habitats and species Directive (92/43), due to be implemented over the next decade, places the emphasis on the management of important habitats, as well as their protection. For more common species, unprotected by the Directive, the maintenance of low intensity farming may be even more important.

Ironically, much of the emphasis of environmental advice to date has been on

influencing practice on intensive farmland where wildlife value is often low and conservation management difficult to effect. Part of the explanation for this is the paucity of information available, both on the character of extensive farmland and its nature conservation value.

Some of the impetus for this study came from the Third European Forum on Nature Conservation and Pastoralism meeting at Pau in 1992. Amongst the recommendations were:

1. the European Community should recognise that extensive systems, many of them agro-pastoral, constitute a distinct category of agricultural land use in Europe and require a special suite of policies reflecting their nature conservation

importance

2. all the remaining areas of extensive agro-pastoral systems must be identified, and procedures to monitor threats and changes to these systems put in place (Bignal and McCracken, 1992).

Objectives of the study

The main objective of this study is to compile information on the character and distribution of low intensity farmland systems in Europe, from a primarily nature conservation perspective.

A second objective is to assess, as far as is possible, the way in which these systems are changing and some of the implications for nature conservation.

A final objective is to comment on prospects for the future and to suggest whether there are ways of influencing the development of these agricultural systems so that their nature conservation value is protected or enhanced.

Scope of the study

This report is based on a study of nine European countries, France, Greece, Hungary, Ireland, Italy, Poland, Portugal, Spain and the United Kingdom, conducted in 1993 and early 1994. A very brief review of low intensity farming in Switzerland was undertaken as well. Seven of these countries were selected as they contain some of the largest areas of low intensity agriculture in the European Union. Farming systems of this kind also can be found on a significant scale in Central Europe and both Hungary and Poland were included in the study in order to make it more representative of Europe as a whole. A report was drawn up for each country, either by independent consultants or by members of the Institute's staff. A full list of the principal authors of the national reports is given on the title page. It is intended that at least a selection of these reports will be made available separately. Most of the information utilised in this report is drawn from these national studies, unless it is referenced otherwise. On occasions, we have drawn on information from other European countries, including Belgium for example.

Methods

Working to a specification provided by the project coordinators, a number of consultants,

at least one in each study country, were asked to carry out a desk study. The object was to review the type and distribution of the relevant national farming systems and to describe their most important features, both in agricultural and nature conservation terms.

The availability, quality and quantity of information available for each country varied greatly. A range of source material and different indicators were used to identify low intensity agricultural systems or areas of land. In most countries a combination of sources was available but in some, such as the UK, national agricultural statistics were used as a primary source whilst in others, like Italy, use was made of descriptive material supported by detailed case studies.

In many cases, the relationship between the agricultural systems or farm types, and nature conservation value has been difficult to analyse because of a lack of compatible information and data. For example, agricultural statistics may be collected for different years than wildlife surveys. Surveys are available for relatively few species in any case. Even for birds, for which there is probably the best data available for any species group, it was difficult to relate national atlas data for key species with farming practices. In order to explore this issue further, a parallel research project has been supported by the Joint Nature Conservation Committee and the Royal Society for the Protection of Birds. This study examines the distribution of some key European bird species of conservation interest, which are known to be associated with extensive agricultural land and is referred to in several places in this report (Fain et al).

Structure of the report

The first three chapters of the report address fundamental issues - the basic characteristics of low intensity farming systems, the typology of systems found in Europe and their importance for nature conservation. The fourth chapter considers methods for identifying the location and distribution of these systems and precedes a brief summary of results, presented by country in Chapter 5. The changes affecting these systems and some of the implications for conservation are the subject of the following two chapters. The conclusions include some consideration of policy issues, particularly for the EU countries.

CHAPTER 1:

WHAT ARE LOW-INTENSITY FARMING SYSTEMS?

The term “low-intensity farming” is used in this report to refer to farming systems which are low in their use of external inputs, especially fertilisers and agrochemicals; in this and other respects they can be distinguished from the intensive forms of agriculture now dominating the more fertile regions of Europe.

The term “extensive farming” is often used in a similar sense. Arguably, it applies more accurately to a particular type of low-intensity farming which, in addition to a low use of external inputs, involves the exploitation of land on a large scale. One example is extensive sheep farming in the Scottish uplands.

The concept of “farming systems” is used to identify broadly similar types of farming, such as livestock rearing based on hay-meadows and semi-natural pastures, or Mediterranean dryland arable farming. Apart from the obvious differences between such systems, there is, of course, also considerable variation in the farming practices which are found within each system.

Low intensity systems span both crop and livestock production and various mixtures of the two. In northern Europe, the grazing of alpine pasture, heather moorland and semi-natural grassland, mainly by sheep and cattle, is perhaps the most familiar. Rarer now are hay meadows, once an important part of many livestock systems and often rich in botanical interest. In southern Europe, it is not only pasture that is grazed under low intensity systems, but also a range of more shrubby habitats, such as macquis and garrigue. In Iberia large areas are devoted to a form of wood pasture with a scattered cover of trees, usually holm oak in the Spanish *dehesas*, sometimes cork oak in the Portuguese *montados*. These systems can be rich in both fauna and flora.

Dry, low intensity arable land in the Mediterranean countries still include a sizeable proportion of fallow and the stubble is often grazed by sheep; the mainly arable Spanish steppes are now recognised as a habitat of crucial importance for many birds. The catalogue of low intensity agriculture also includes some “permanent” crops, such as olives, orchards and vines, mainly those under traditional management such as older olive groves.

Classifying intensive and low-intensity farming systems

There is no universally recognised classification of different farming systems. Although it is usual

to divide them into broad groups, such as intensive, semi-intensive, low-intensity and very extensive, these terms are relative. Furthermore, classifications tend to reflect the particular interests of the organisation, group or individual concerned. Thus, geographers may classify intensity mainly by reference to climate and land capability while agriculturalists may be more concerned with crop yield per hectare or the value of production per unit area. One convenient omnipurpose measure of intensity is the aggregate sum of all inputs, including labour and capital, per hectare of production (Duckham and Masefield, 1970).

However, tidy classifications based on quantitative criteria tend to simplify what takes place on real farms. Low-intensity farming systems take many different forms and vary greatly from one part of Europe to another; we have not set out to propose a formal definition. In between the extremes of high-input intensive agriculture and the least intensive types of farming there is a wide range of intermediate systems. The aim of this chapter is to identify the broad characteristics of low-intensity systems and practices, rather than trying to define precise criteria.

Individual farms do not always fit neatly into any one category of intensity, since they may follow more than one system and a range of different practices from the traditional to the most modern. Essentially traditional, low-intensity farms often make some use of manufactured fertilisers and animal feeds. Extensively managed land may be found within an essentially intensive system and vice versa. For example, farms in the Pays d’Auge area of Normandy made up mainly of intensively cultivated arable land often retain a small patch of grassland kept under low-intensity management, typically where access is poor or there is steeply sloping land. In northern England, predominantly extensive livestock farms, mainly comprising rough grazing, may include a few intensively managed meadows along the bottom of a valley.

General characteristics of low-intensity farming systems

One of the principal characteristics of low-intensity systems is a low use of inputs per hectare, particularly of nutrients, agrochemicals and irrigation water. In livestock systems, stocking densities frequently are regarded as a measure of intensity. Low output per hectare is another key characteristic of low-intensity systems.

Low intensity farming often is associated with “traditional” practices, dating from before the introduction of modern farm machinery, agrochemicals, seed varieties and management techniques, such as artificial insemination. Indeed, the use of external, manufactured inputs is an important difference between modern and traditional agriculture. However, low-intensity farming is not necessarily traditional as was confirmed by studies in the nine countries. Many of the systems discussed here are significantly modified forms of traditional practice; a few are relatively new systems which have arisen in recent decades.

The use of labour may be intensive in otherwise low-input systems. Many traditional farming practices are labour intensive, including shepherding, hay-making, silviculture and the control of weeds manually, rather than by using herbicides. On the other hand, some contemporary low-intensity systems have adapted to rising labour costs. For example, traditional practices, such as the regular pruning and replanting of farm trees and hedges, have been abandoned. In many regions from Spain to Scotland sheep are allowed to range over a variety of natural vegetation where in the past several different types of livestock would have been guided more systematically to the most appropriate sources of forage.

We have not investigated the differing approaches to farm management which underlie the use of low-intensity practices on farms in any depth. It is clear that some systems retain these practices out of tradition, particularly where farmers are elderly. In some cases, low-intensity farms are in the process of being run down or abandoned, often because of the poor income which they are able to generate and the lack of an obvious successor to the present farmer.

However, we must be wary of interpreting certain changes in management as an indication of imminent abandonment. Several of the national studies revealed that some farms practising largely traditional, low-intensity systems are undergoing a process of simplification or “extensification”. For example, fields previously managed under a fairly complex regime of hay-making and grazing and manuring may now receive no management other than grazing at very low stocking densities. The traditional management of trees and hedgerows for fodder, or the cultivation of traditional fodder crops, may be abandoned as more use is made of extensive grazing supplemented by purchased feeds. New models of extensive farming seem to be developing in response to changing economic circumstances, new technologies and the need to cut labour costs.

TYPICAL CHARACTERISTICS OF LOW-INTENSITY SYSTEMS

Low nutrient inputs

Low output per hectare

Livestock systems

- * low nutrient input, predominantly organic
- * low stocking density
- * low agrochemical input
- * little investment in land drainage
- * relatively high percentage of semi-natural vegetation
- * relatively high species composition of sward
- * low degree of mechanisation
- * often hardier, regional breeds of stock
- * survival of long established management practices, e.g. transhumance, hay-making
- * reliance on natural suckling
- * limited use of concentrate feeds

Crop systems

- * low nutrient input, predominantly organic
- * low yield per hectare
- * low agrochemical input (usually no growth regulators)
- * absence of irrigation
- * little investment in land drainage
- * crops and varieties suited to specific regional conditions
- * use of fallow in the crop rotation
- * diverse rotations
- * more traditional crop varieties
- * low degree of mechanisation
- * tree crops, tall rather than dwarf- not irrigated
- * more “traditional” harvesting methods



Crofting in Connemara, Ireland

Credit: D. Stround

An important consideration for this study is that low-intensity systems are more limited by natural constraints and make use of the diversity of local resources, rather than seeking radical changes in the natural environment, for example by reseeding grassland. Greater acceptance of natural restraints accompanies a tendency to rely less on external inputs. Partly because they are more constrained by physical conditions, it can be argued that low-intensity systems tend to be “looser” than intensive ones. For example, the timing of mowing and the period during which livestock graze a particular field may vary significantly from year to year according to conditions. More intensive systems tend to require more rigid management practices and to be run to a tighter calendar (Baudry, J. et al, 1994).

Not surprisingly, the intensity of farming systems in Europe is often a reflection of natural conditions such as soil, climate, slope and accessibility. Most of the farmland which is still extensively managed can be found in areas where there

are severe physical constraints on intensification, particularly in upland and mountainous areas, drier zones and the relatively small area of wet soils that have not yet been drained. In some regions the constraints are less physical than socio-economic, for example the land may be inaccessible, remote from the market or in such fragmented ownership that intensification is impractical.

Some of the typical characteristics of low-intensity farming systems are summarised below. These are divided into characteristics typical of livestock systems and those typical of arable systems, but it should be emphasised that many traditional low-intensity systems are mixed. The combination of livestock raising and cropping is itself an important characteristic of certain systems, and it creates a diversity of land uses which may be valuable for nature conservation (see Chapter 3). Some of the particular characteristics of low-intensity livestock and crop systems are discussed in more detail in Chapter 2.

CHAPTER 2:

A TYPOLOGY OF LOW-INTENSITY FARMING SYSTEMS IN EUROPE

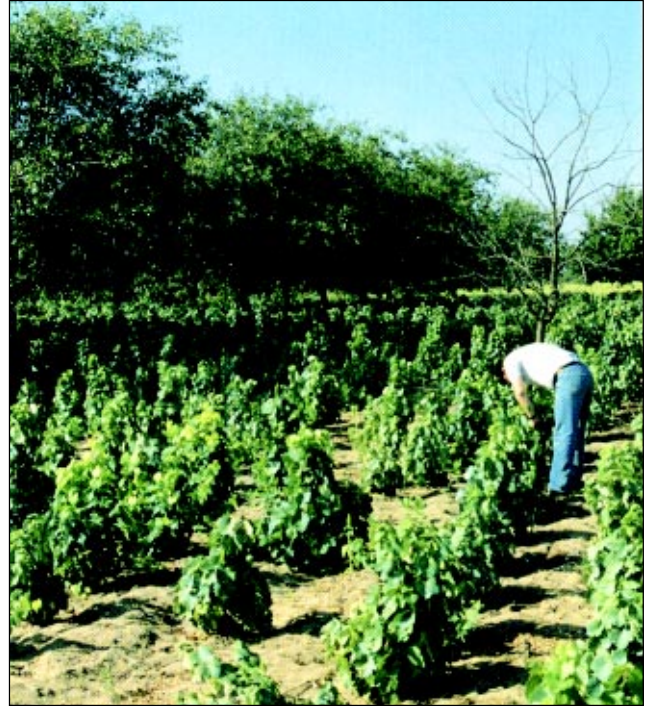
This chapter introduces the broad categories or types of low-intensity farming found in western and central Europe. These are grouped according to livestock, arable, mixed and permanent crop systems. For each grouping, the different types of system identified in the national studies, and their main characteristics, are summarised in a table. In some cases, additional sources have been used to try to provide a more complete coverage. A relatively simple typology has been used in order to present the different low-intensity systems according to broadly defined categories of agricultural land use.

This approach greatly simplifies the different conditions and systems found in the nine countries covered by the study. Farming systems in a given category but in different regions often vary considerably in terms of the environment in which they operate, the type of production, the management practices employed, typical farm size, etc. For example, some upland sheep farms specialise in milk production, others in meat, some rely heavily on communal land, others not at all.

Livestock systems

The great majority of low-intensity livestock systems in Europe involve the exploitation of grass or semi-natural vegetation by sheep, cattle or, less frequently, goats or horses. The character of these systems varies enormously, ranging from semi-wild and largely unmanaged cattle and horses in remote mountain regions of Spain to highly commercialised dairy cattle systems based on closely managed meadows in the French Jura where specialist cheeses are produced. Low-intensity sheep systems are the most widespread and can be found in almost every country. In several countries, including Spain, Greece and the UK, sheep farming covers very large areas of upland, mountain or dry pasture. However, there are low-intensity systems within which other farm animals play a role, including horses, asses and pigs. In the *dehesas* of Spain and *montados* of Portugal, extensive grazing by pigs feeding mainly on acorns was once widespread, although this practice has declined drastically, partly because of African swine fever.

The sources of forage include not only pasture, grass meadows and coarser forms of semi-natural vegetation, but also woodland in some areas. It is not unusual for low intensity grazing systems to have survived in areas where there is a high proportion of land subject to communal, rather than private, grazing. This might include commons, and land



Vineyards in the Kiskunsag, Hungary

Credit: F. Markus

owned by the village, or state or an institution such as the church. A typology of the low-intensity livestock systems identified in the study is presented in Table 1.

Some of the common characteristics and management practices of the low intensity livestock systems covered by the study are set out below. It is difficult to define precisely when a set of practices ceases to constitute a low intensity system of farming; the list below is merely a guide.

Common characteristics of low-intensity livestock systems

- **Livestock types.** Mostly sheep, beef cattle, horses or goats, or some combination of these. Dairy cattle and pigs usually are associated with intensive systems, but are found in certain low-intensity systems, eg pigs in *dehesa/montado*, alpine dairy cattle.
- **Livestock breeds.** Sometimes, but not always, hardier or “traditional” or local well adapted regional breeds. A few systems involve pure breeds. However, in many cases these have been crossed with more productive modern breeds, or even replaced entirely.

Table 1 : Typology of low intensity livestock systems

Broad farming system	Low-intensity livestock raising in upland and mountain areas	Low-intensity live-stock raising in Mediterranean regions (open pasture, scrub)	Low-intensity live-stock raising in wooded pastures	Low-intensity live-stock raising in temperate lowland regions
<p>Land use</p> <p>Grazing of rough grassland, moorland, heaths and forest. Such land is often communal or public. Grazing may be seasonal, such as alpine or sub-alpine pastures. In more fertile, often lower altitude areas, grazing may be supplemented with meadows or other traditional forage crops (e.g. oats). Sometimes meadows provide the main source of forage and grazing land can be considered supplementary.</p>	<p>Typically sheep (meat and/or milk), some beef cattle and horses. Farms with only rough and common grazing and no meadows generally produce breeding stock and sell lambs/calves for fattening on more productive land. Farms with meadows are more likely to fatten their own stock and may keep dairy cattle. Specialist cheeses are important in many areas.</p>	<p>Based on Mediterranean dry grassland and rough grazing, including types of Mediterranean scrub such as maquis (on acidic soils) and garrigue (calcareous soils).</p>	<p>Extensive grazing on permanent pasture with dispersed tree cover (includes New Forest in England). Largest area is the dehesas and montados of the south-west of the Iberian Peninsula.</p>	<p>Based on permanent meadows and/or pastures. Also grazing marshes (salt and freshwater), with or without more productive meadows, and grazed orchards, in specific areas.</p>
<p>Production sectors</p>	<p>Rough grazing and moors usually are unimproved and stocked at very low animal densities. Traditionally, livestock were largely shepherded. There is a tendency towards more "ranching" or free-ranging livestock in many regions. Meadow management varies considerably and may be quite intensive in fields near to the farm. In Spain (e.g. Cantabria, Pyrenees), farms are often small-scale, traditional and barely viable.</p>	<p>Predominantly sheep and goats. Specialist cheeses are important products in some areas.</p>	<p>Sheep, pigs and cattle, generally for meat. Dehesas in Spain are associated with traditional production of high-value "jamón serrano" (cured ham). Some fighting bulls (Salamanca and Andalucía). Some deer herds for hunting. Small areas in Hungary are mostly for beef production.</p>	<p>Include beef, sheep and some dairy production. Specialist cheeses in Normandy. Bulls and horses in Camargue.</p>
<p>Farming practices and characteristics</p>	<p>Transhumance and other seasonal movements of livestock between grazing areas are an important characteristic of these livestock systems in many areas of southern Europe. Traditionally this took many different forms, from short movements of livestock between different types of grazing land within a region according to the season, to very long distance movements between lowland (winter) and upland (summer) regions. Long distance transhumance is usually sheep, and now often undertaken by train (Spain) or lorry (Italy). Shorter distances involve sheep, goats, cattle and sometimes horses.</p>	<p>Grazing land often rented or communal. Supplementary forage provided by arable crop residues and fallows. Traditional system involved transhumance of livestock to mountain pastures in the summer.</p>	<p>In dehesas and montados, supplementary forage sometimes is provided by shifting cultivation of forage cereals. Traditionally, livestock were of mixed types and were taken to mountain pastures in the summer.</p>	<p>Remnants of traditional systems based on low-input pasture and meadows.</p>

- **Feeding patterns.** Natural suckling of young is a widespread characteristic, as is low dependence on purchased feeds. A variety of different forage crops may be grown for supplementary feed, sometimes resulting in mixed farms with high geographical and seasonal diversity.
- **Meadow management.** Low or zero use of artificial fertiliser. Usually, this is associated with hay making rather than silage. Mowing is carried out later for hay than for silage. This also favours a more diverse sward.
- **Other forage production.** Some systems involve the cultivation of certain forage crops, such as lucerne in Mediterranean regions, traditional cereals, root crops in northern Europe, etc. Maize forage is usually associated with more intensive systems.
- **Other vegetation management.** Management of semi-natural vegetation by cutting, burning and/or grazing in order to favour certain types of plants. In some cases, there are graminaceous, in others ericaceous plants.
- **Grazing management.** Traditionally, livestock were shepherded in unfenced areas. There is a tendency under present-day extensive systems to let animals range more freely (“ranching”).
- **Stocking densities.** Lower than under intensive systems, but varying widely according to local conditions. Generally, the stocking level under a sustainable low-intensity system is that which can be supported by the forage available under the type of management conditions summarised here, with minimal purchase of off-farm feed.
- **Land tenure.** In many regions extensive livestock systems make use of (or even depend upon) some form of common or public grazing land. Although usually of low productivity, this land may represent a large area and generally is available at a low cost (or free).
- **Housing of livestock.** Depending on climate, there are many systems where livestock are not housed; either they are moved seasonally (transhumance) or hardy breeds are used. Exceptions include mountain dairy herds.

Table 2: Typology of low-intensity arable systems

Broad farming system	Low-intensity dryland arable cultivation in Mediterranean regions	Low-input arable cultivation in temperate regions	Low-input rice cultivation
Land use	A proportion of land (up to 80%) usually is left fallow each year. Arable systems in Mediterranean regions (and Hungary) are often combined with seasonal grazing by sheep of stubbles and fallows. There may also be patches of permanent grassland. In southern Portugal and parts of Extremadura in Spain, quite large areas of arable land have dispersed tree cover similar to wooded pastures, but usually less dense.	Arable cultivation sometimes combined with livestock grazing grassland and forage crops.	Flood irrigation.
Production sectors	Crops are mainly cereals (barley, wheat, durum wheat, oats, rye, triticale). Where livestock are present, forage crops such as lucerne are grown. In Hungary and Spain, the commonest sheep breeds are Merino crosses. Some local breeds raised for milk.	Cereals, sometimes with beef, sheep, dairy. Rice.	Rice.
Farming practices and characteristics	Input use is low, especially herbicides. Nitrogen use is low overall, but may be high on the non-fallow area. Other features include shallow ploughing and relatively widely spaced crops.	Principally organic, biological and other restricted input systems. Low use of artificial fertilisers and pesticides, although use of organic fertiliser may be high. Mostly in north-western Europe, especially Germany; nowhere widespread. Also some traditional cultivation in isolated areas.	Organic systems in Spain; traditional systems in Portugal. Modern rice cultivation tends to involve

Table 3: Typology of low-intensity permanent crop systems

Broad farming system	Low-input tree crops	Low-input vineyards
Land use	Orchards of apples, pears, plums, etc. Usually larger, more mature trees. Often with grazing and hay-making. In southern regions, also carobs, almonds, apricots, etc. Olive groves, with traditional trees, rather than new small varieties. In Spain, smaller, traditional groves near to villages may be grazed, and resemble wood pasture. In Italy, olive groves with permanent grass are reportedly widespread.	Often in mosaic with arable cultivation and tree crops, e.g. Italy. In Hungary, vineyards found in mosaic of "tanya" system.
Production sectors	Fruits, nuts, olive oil.	Grapes, wine.
Farming practices and characteristics	Low use of chemical inputs. Harvesting often by hand. Full height "standard" trees retained in many orchards and groves. More commercial plantations are harvested mechanically and may be ploughed several times a year.	Low use of pesticides and fungicides. In "tanyas" pesticides are not used. Old varieties of vine.

Arable systems

Although they are much less widespread than low-intensity livestock systems, various forms of low-intensity arable cropping can still be found in Europe. The most important in terms of area, and one of the most significant for nature conservation, is the group of dryland arable systems found mainly in Spain, Portugal, parts of southern Italy and, on a smaller scale, in Greece. A combination of soil and climatic conditions precludes intensive management in many areas unless irrigation is used.

Dryland arable systems in less fertile and very dry regions of southern Europe tend to be low yielding and to involve relatively small applications of fertiliser, partly because of the lack of rainfall. Fallowing, which has declined steeply as an element in crop rotations in northern Europe, is still an important component of these drier systems. In Spain, about 30 per cent of all arable land is left fallow every year, rising to over 80 per cent in some regions; the proportion of fallow land is a broad indication of the intensity of production. Stubbles and fallows are often grazed by sheep and other stock; this helps to maintain soil fertility and organic content. The extremes of temperature experienced in regions with a typically continental Mediterranean climate can result in a low incidence of crop pests in the more temperate regions, thus reducing the need for insecticides (Bello and Gowen, 1993). One exception is locusts, which are controlled by agrochemicals in some regions such as Extremadura in south west Spain. In a few areas, traditional crop varieties are still used.

Other low-intensity arable systems found on a very much smaller scale are organic or biological systems and traditional forms of rice cultivation. A

typology of the low-intensity arable systems identified in the study is presented in Table 2.

Permanent crops

The management of permanent crops, such as olives, fruit and vines, has undergone major changes in recent decades. Intensification has been associated with a change in varieties, different cultivation practices, higher fertiliser and pesticide use and different harvesting techniques. Nearly all the remaining low-intensity systems are those



Traditional Barley harvest in Serradilla, Spain

Credit: J. Garzon

where adherence to traditional practices has been stronger, for example, where olive groves are grazed, rather than ploughed, and older trees (which can only be harvested by hand) have been retained. In some areas, permanent crops are grown in a mosaic, combining a variety of trees such as almonds, olives and carobs, with arable crops. In a few places, traditional inter-cropping is still practised, for example combining vineyards with olives.

A typology of the low-intensity permanent crop systems identified in the study is presented in Table 3.

Mixed systems

The national reports indicate that there are several regions in Europe where small-scale mixed systems utilising far less than conventional input

levels still survive. Some of these are a form of near subsistence agriculture, often practised in adverse geographical conditions, such as crofting in north-east Scotland. In Mediterranean regions many of these clusters of mixed systems are in mountainous areas; very often terracing was fundamental to the management of steeply sloping land, although it has been abandoned in many places. In the lowlands, small mixed systems are more likely to have become intensive. For example, the small “minifundia” farms of northern Portugal are now mainly irrigated and fertiliser use has risen substantially. Nevertheless, largely traditional, low-intensity systems survive in certain regions, such as the tanyas in Hungary (see Chapter 5).

A typology of the low-intensity mixed systems identified in the study is presented in Table 4.

Table 4: Typology of low-intensity mixed systems

Broad farming system	Low-intensity mixed Mediterranean cropping	Low-intensity, small scale, traditional mixed farming
Land use	Mosaic of low-input arable and permanent crops.	Small-scale, integrated crop and livestock production.
Production sectors	Cereals, vines, olives, almonds, carobs, etc.	Cereals, vegetables, vines, fruit trees, livestock (dairy, beef, sheep, pigs, poultry).
Farming practices and characteristics	Farming practices and characteristics Found in many areas of Spain, Portugal, Italy and Greece where crop production has not been highly rationalised and intensified.	Traditional, usually subsistence/part-time farming. For this reason, mostly mixed systems. Usually little use of external inputs, although use of land and labour may be intensive. Diverse use of resources, such as woodlands, trees, dung. Seasonal grazing on common land is practised in some areas (Scottish crofts, northern Portugal).

CHAPTER 3:

THE IMPORTANCE OF LOW-INTENSITY FARMING SYSTEMS FOR NATURE CONSERVATION

Given the diminished scale of more natural habitats in Europe, it is not surprising that farmed habitats have acquired such importance for many of Europe's characteristic species. As intensification has progressed, there has been an erosion of the nature conservation value of habitats under agricultural management. Low intensity farmland has assured greater importance, especially for more common species which inhabit the wider countryside outside protected areas.

Even in relatively wild protected areas, there are often stretches of land under some form of low intensity agriculture management. The large Biebrza valley wetland in eastern Poland, for example, includes there are patches of grazed land and the prospect of abandonment by farmers is threatening to reduce the conservation value of the site.

Since it is unlikely that large tracts of rural land will be made available purely for nature conservation in the next decade, the management of low intensity farmland will remain of central importance for a large number of species. However, very little agricultural land is managed primarily for nature conservation; usually the benefits for fauna and flora are incidental to a land use determined largely by production goals. Often these benefits could be increased by small changes in management.

The relationship between agricultural practice and species requirements is a large and complex subject, especially on a European scale. This chapter aims simply to introduce some of the characteristics of low intensity farming which appear of most significance from a conservation viewpoint. The focus is mainly on pastoral systems, with only brief reference to crop production.

Characteristics of low-intensity systems which benefit biodiversity

The basic purpose of agricultural intensification is to increase economic returns by raising production of a limited range of fast-growing species, such as modern varieties of arable crops or grass. Fertilisers and manure are applied to stimulate the growth of these species and pesticides are used to reduce competition and predation from other species. Intensive agriculture thus tends to be associated directly with reduced farmland biodiversity.

Low-intensity systems have certain inherent characteristics which tend to create conditions which favour a larger range of species than intensive sys-

tems. The principal characteristics which benefit biodiversity are summarised below under two closely related categories:

A) Management practices which create beneficial conditions for fauna and flora over the long-term.

- Particularly in low-intensity livestock and mixed systems, the proportion of semi-natural vegetation tends to be significantly higher than is usually present in intensive systems. Examples include permanent pastures, spontaneous vegetation on fallow land and features which tend to be eliminated from more intensively managed land, such as hedges, trees and ponds. A large proportion of the surviving area of semi-natural vegetation in Europe is found on low-intensity farmland.
- Low levels of nutrient input, or in the case of many extensive grazing systems, a long-term extraction of nutrients, have created conditions of low nutrient "capital" in the soil. Such conditions are essential for the survival of a sizeable proportion of European flora, including many rare and threatened species.
- Management practices and, in some cases, natural conditions, are more likely to result in a structural diversity of vegetation (whether semi-natural or crops) and hence of ecological niches than in intensive systems; again, this is particularly true of low-intensity livestock and mixed systems.
- The rate of change in some systems has been slow, thus producing long periods of relative stability within which many species of wildlife have been able to adjust and adapt to prevailing conditions.

B) Shorter-term management practices which are associated with low-intensity systems and which allow a diversity of wildlife to co-exist alongside the farming activity.

- Low levels of annual nutrient input permit the survival of a significant group of plant species which are intolerant of high nitrate and phosphate levels in the soil. This applies particularly to semi-natural grasslands but nutrient levels also affect the diversity of flora on arable land.
- The absence or low use of agro-chemicals, including insecticides and herbicides, benefits a wide range of flora and fauna throughout the food chain. This applies especially to arable land.
- Many "traditional" management practices, such as the late harvesting of meadows and arable crops, or the shepherding and seasonal move-

ments of livestock, create favourable conditions for particular species of wildlife, such as grassland flora and nesting birds.

It should be emphasised that the ecological relationships involved are complex and should not be over-simplified. However, in very broad terms, we can say that these features are complementary; each of them is likely to contribute to the overall conservation interest of land under low-intensity agricultural management.

Low-intensity livestock farming and biodiversity

Low-intensity livestock farming has created substantial areas of semi-natural grassland, scrubland, heather moorland and other grazed habitats of nature conservation value. There are millions of hectares of such land, particularly in the less-favoured regions of Europe, which receive no artificial fertiliser or pesticide applications and no agricultural management other than grazing and, in some cases, burning.

Farming systems which have created and sustained semi-natural grasslands of high biodiversity have two important ecological properties in common:

- i. the nutrient "capital" of the ecosystem is low by comparison with artificial grasslands or other agricultural ecosystems and is either stable or gradually decreasing.
- ii. the standing crop of vegetation remains stable from year to year (allowing for climatic fluctuations) (Hopkins, J., 1991).

However, apparently low-intensity livestock systems do not invariably result in the creation of stable semi-natural vegetation of high natural value. This will depend on the practices involved and the way in which they are carried out. Stocking densities and grazing patterns are particularly important. Stocking densities which appear very low compared with modern, intensive systems may nevertheless be too high in conditions of very low fertility or low rainfall. Over-grazing in such conditions may lead to an impoverishment of sward diversity and even severe soil erosion.

Some of the management factors affecting the species diversity of grasslands are discussed below. The national studies revealed that many changes are taking place in low-intensity livestock systems. These developments and their implications for nature conservation are explored further in Chapters 6 and 7.

Farming practices and floral diversity in grassland

Fertilisation, grazing and mowing are the main farming practices affecting species dominance and thus diversity. Overall, research in temperate re-

gions shows that the highest species diversity generally is associated with agricultural systems that reduce dominance of vigorous species (e.g. low fertiliser use and relatively high but sustainable grazing pressure), allow a large number of species to flower and set seed (e.g. adequate recovery periods from grazing or mowing) and allow species to establish (e.g. as a result of disturbance caused by heavy grazing pressure and mowing).

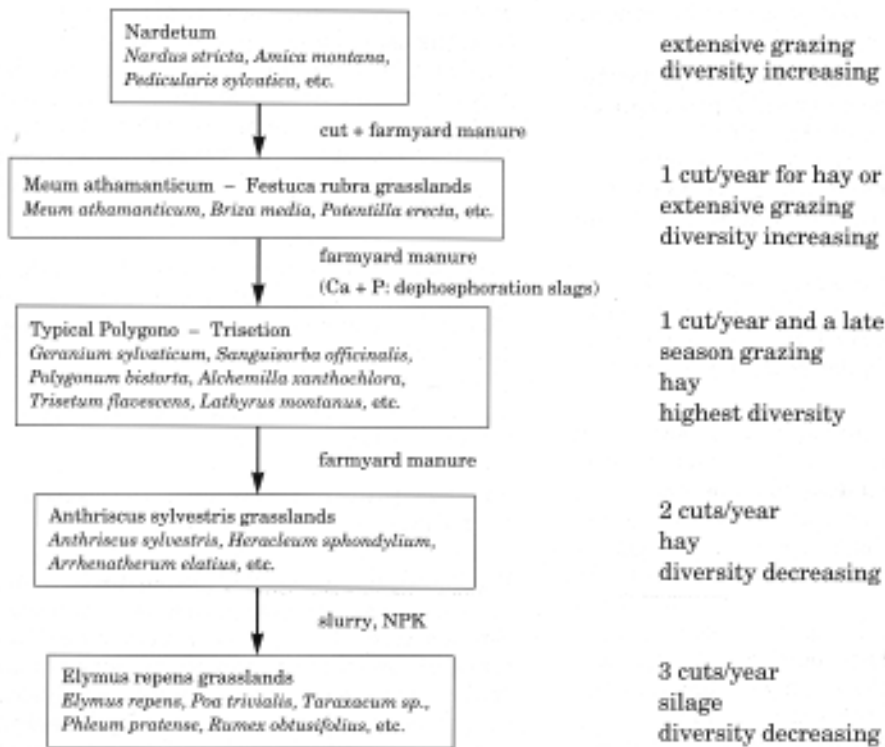
Grazing and mowing can promote different results depending on timing, intensity, the type of animal involved, and other factors. Drawing on recent work on farms in the Haute Ardenne in Belgium, Peeters et al (1993) have shown how a range of grassland communities respond to changes in these management practices. The evolution of nardetum grassland is shown in Figure 1. In this case, the highest species diversity is achieved with a low-intensity regime of one cut per year for hay followed by late season grazing. Similar results were observed by García in hay meadows in the Picos de Europa, in Spain (García, 1992).

In studies of grasslands in the UK, various authors have concluded that high grazing pressure under a rotational grazing regime, together with winter grazing, seems to result in the highest level of floral diversity (Jenkins, 1987). Clearly, the relationship between sward diversity and farming practices varies according to the prevailing physical conditions. Different ecological responses are associated with different soils, climate, altitude, etc. For example, in the UK, recovery periods on richer chalk soils seem not to be as important as heavy grazing pressure in maintaining species diversity. By contrast, on poorer, acidic upland soils, rotational grazing seems to be more important than heavy grazing pressure, as it offers valuable recovery periods (Jenkins, 1987).

The application of nutrients, principally nitrogen and phosphorous, generally promotes greater productivity through the dominance of a few more vigorous plant species. The high nutrient inputs used in most forms of intensive agriculture are damaging for a large number of plant species which can tolerate only low soil nutrient levels. One authority suggests that maximum diversity only occurs over a small range of productivity (with standing crop litter at around 500 g/m²). Below this range, conditions are too infertile, or otherwise stressed, for the needs of most species; above it, competitive exclusion eliminates all but the more vigorous species (Grime, 1979). This relationship can be expressed more generally in a simple graph, as in Figure 2.

Species diversity in grassland is limited both by nitrogen and phosphorous levels in soils, although their relative importance varies and is not always clear. Recent research work at a range of different sites in Belgium indicates that species-rich grasslands are unlikely to survive when the level of soil

Figure 1. Evolution of nardetum grassland i Haute Ardenne as management intensifies



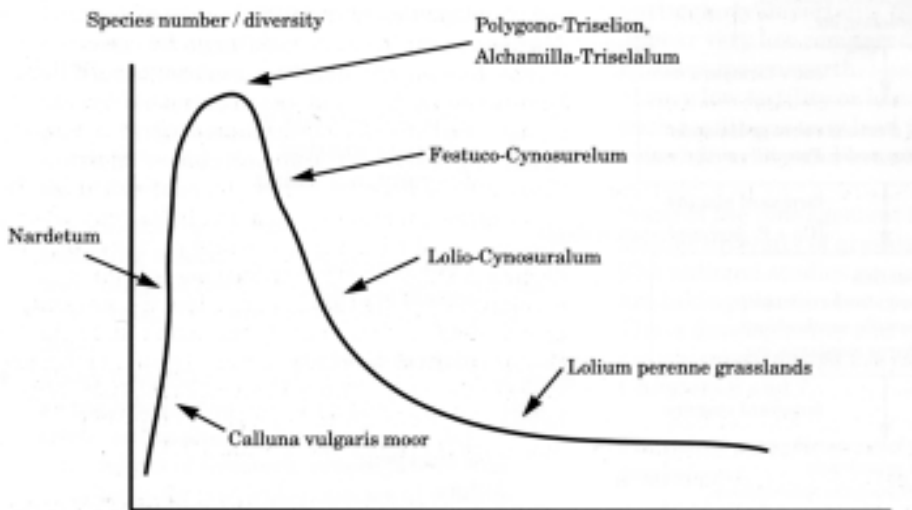
Source: Peeters, 1993

extractable phosphate is lower than 5 mgs/100 gms, using an extraction methods known as EDTA-Acetate (Peeters et al, 1993). However, in the Park Grass Trials at Rothamsted, phosphorous is reported to have relatively little effect on species diversity compared with nitrogen (Green, 1990). Hopkins (1993) suggests high rates of nitrogen application rapidly result in a sward of similar high productivity and low species diversity as reseeded temporary grassland. Nonetheless, reseeded of semi-natural grassland with one or two productive species will have a more immediate effect on diversity.

of annual species that germinate after the first heavy autumn rains (October-November), flower and set seed during the spring and die at the beginning of the summer, passing this hot and dry season as seeds in the soil (Fernández Alés et al, 1991). Thus they are different in character from grasslands in more northerly latitudes which are composed mainly of perennial species. Agriculturally unimproved Mediterranean grasslands tend to be very rich in flora. Species counts may be as high as 120-180 per 100m² (Naveh and Whittaker, 1979) although this varies considerably according to space and time, soil fertility, grazing pressure, etc.

Mediterranean grasslands are composed mainly of annual species which survive as seeds in the soil, Mediterranean grasslands can withstand intensive grazing better than other types and can recover quickly from "zero" grazing, with no adverse effect on productivity. However, highly intensive grazing encourages a limited number of coarse grasses and thus reduces pasture quality as well as species diversity. Moderate grazing pressure, on the other hand, favours species diversity and results in a more nutritious pasture with a high proportion of legumes (Fernández Alés et al, 1992).

It has been suggested that, because they are composed mainly of annual species which survive as seeds in the soil, Mediterranean grasslands can withstand intensive grazing better than other types and can recover quickly from "zero" grazing, with no adverse effect on productivity. However, highly intensive grazing encourages a limited number of coarse grasses and thus reduces pasture quality as well as species diversity. Moderate grazing pressure, on the other hand, favours species diversity and results in a more nutritious pasture with a high proportion of legumes (Fernández Alés et al, 1992).



Source: Peeters, 1993

Occasional cultivation greatly reduces diversity in Mediterranean grasslands, although some very important flowering plants do occur on long fallows in Iberia. The following species counts were recorded in grasslands of El Pardo (Madrid) on four different plots at various stages of recovery following cultivation (Pineda et al, 1981):

	Years following cultivation			
	1	2	4	>20
Number of species	25	33	34	49
Diversity (Shannon index)	2.76	3.52	4.42	4.94

In northern Europe sizeable areas of poorer grassland have been subject to cultivation and re-seeding, often preceded by drainage in wetter areas. Such agricultural "improvement" invariably lowers the botanical interest of grassland, although sward diversity may increase over a period of years, particularly if the farm is unsuited for intensive management. In parts of France, the UK, Ireland and elsewhere there are large areas of grassland which have been improved at some point in recent decades but continue to be under a relatively extensive form of management. These grasslands may be of considerable conservation interest but should not be confused with the very much smaller area of species rich grassland where no "improvement" has occurred.

Diversity of non-plant species associated with grassland

Apart from its inherent biodiversity and conservation value, floral diversity also contributes to the diversity of insect communities. Certain invertebrates have special feeding requirements, such as the Adonis (*Lysandra bellargus*) and chalk-hill (*Lysandra coridon*) butterflies which depend on horseshoe vetch (*Hippocrepis comosa*). Certain species of plant, invertebrate and bird favour short, closely grazed swards, for example the large blue butterfly (*Macaulinea arion*), various orchids and the wheatear (*Oenathe oenathe*). In the UK, these have all declined (to the point of extinction in the case of the large blue butterfly), as a result of the loss of this particular habitat (Green, 1990). Studies show that other groups such as earthworms, collembola and particularly myriapods have reduced population levels even at nitrogen application rates as low as 48 kg/ha (Edwards 1984, quoted in Green 1990).

It is important to recognise that different management regimes benefit different taxa, species and communities of species. For example, ground-nesting birds are vulnerable to increased stocking rates. O'Connor and Shrubbs (1986) report the following findings from British data:

	% nests lost to trampling at stocking of 2.4 cows per hectare	% nests lost to trampling at stocking of 4.8 cows per hectare
Lapwing	40	60
Snipe	60	80
Redshank	72	93

Nitrogen levels which are too high for the maintenance of floral diversity may be positively beneficial for some meadow birds. Bakker has shown that, on mesotrophic farmland soils in the Netherlands, a complete cessation of fertilisation or even removal of the topsoil is necessary in order to allow the restoration of the full diversity of plant communities associated with these soils (Bakker, 1993). However, such a regime will result in a reduction in the presence of meadow birds due to soil impoverishment and the reduction in grass growth. In this Dutch example, cutting of grass for hay in late June, together with a fertiliser application level of 50 kg N/ha/year encouraged rarer meadow bird species, such as redshank (*Tringa totanus*), snipe (*Gallinago gallinago*) and ruff (*Philomachus pugnax*). Applications of 200 kg N/ha/year favoured more common bird species, such as lapwing (*Vanellus vanellus*), oystercatcher (*Haematopus ostralegus*) and black-tailed godwit (*Limosa limosa*).

However, relatively few species benefit from the conditions found on intensively farmed land. Although certain rarer birds do make use of intensively farmed habitats, analogous with their traditional nesting and feeding areas, these may be a poor substitute for more extensively managed fields. In France, for example, stone curlews (*Burhinus oedicephalus*) have been recorded nesting in intensive maize crops, leaving fields only when one growth of foliage hinders flight. However, the decline of this and other species have been accelerated by the rapid change in management, characteristic of intensively farmed land. In the Saône valley, where large areas of green maize are now cut for silage, it has been reported that early harvesting has resulted in a rise in lapwing mortality (Lecomte and Voisin, 1991).

Low-intensity crop farming and biodiversity

Several features of low input crop farming potentially create more favourable conditions for wildlife than intensive systems. Amongst these are the greater use of fallows, retention of field margins, hedgerows and ditches, more varied rotations and cropping patterns, which may include some spring sown crops, less comprehensive water management, less efficient harvesting methods and lower use of fertilisers and agrochemicals. Some less intensive systems continue to include a role for livestock, grazing areas of pasture, stubble or field margins and rough ground.



The Canada Real Leonesa passing through *dehesas* in the province of Caseres, Credit: M. Ruiz Spain. Unusually, the boundaries of the drovers` road are not clearly defined

The low use of pesticides and other agrochemicals benefits some species directly, including arable “weeds” which are now amongst the rarest species of flora in many northern European countries, including Germany and the UK. Other species are affected indirectly, including certain birds which depend on invertebrates and seeds for a significant proportion of their diet.

Irrigation also has both direct and indirect effects on many species. Where it is introduced into dryland arable areas, there are likely to be reductions in biodiversity. If the source of irrigation water is a lake or wetland, or involves the flooding of a mountain valley, a large number of habitats may be adversely affected, with some changes occurring over a long time period.

In Mediterranean conditions, cereal crops grow relatively slowly and are planted at wider spacings than in northern Europe, potentially providing more opportunities, both temporal and spatial, for birds and small mammals. The presence of often considerable areas of fallow land, which may remain free of agro-chemical inputs for several years, is also extremely beneficial, providing habitat for fauna and flora.

Birds have been the focus of most of the research which has been carried out into the nature conservation aspects of dryland arable farming. Some extensively cultivated areas in Mediterranean regions have been identified as supporting bird communities comparable to those of the steppes of central Europe (e.g. sandgrouse, bustards, larks, etc.). Indeed, many steppe areas which historically were characterised by natural (or semi-natural) vegetation now include considerable areas of cultiva-

tion (Suárez et al, 1992). Where the management is low intensity, particularly involving fallows and patches of permanent grassland, bird populations may be as diverse and rich as those on grass steppes; indeed, certain species may benefit from increased food supply provided by arable crops. On the other hand, without sufficient areas of semi-natural vegetation, much of the characteristic steppeland flora may be lost.

The largest areas of natural grass steppe are in Hungary, Turkey, Russia and other parts of central and eastern Europe. In western Europe, this is a rare habitat type with only small scattered remnants outside the Iberian Peninsula (e.g. in France and Italy), hence the importance of “pseudo-steppes”, currently under low intensity arable cultivation, for the conservation of certain characteristic steppe species.

While there is a growing volume of research on the nature conservation value of grassland and certain types of arable land. Permanent crops receive less attention. Nonetheless, some long established tree crops are of considerable conservation interest. These include traditionally managed olive groves concentrated mainly on Mediterranean hillsides, low-input almond plantations in Hungary, old cherry orchards in Switzerland, etc. In each case, the trees tend to be larger, grow to a greater height and provide a more complex growth form for bird species, lichens, etc. than more intensively managed tree crops; the density of planting tends also to be less, benefiting ground flora. Often, old orchards receive less management generally, particularly less use of inorganic fertilisers. Many species may benefit from this “benign” neglect.

Conclusion: Conservation priorities and low-intensity farming systems

Low-intensity farmland includes a range of habitats which are of fundamental importance for the conservation of many European species. This is a nature conservation resource of great value which has been created by a broad continuity of management often stretching over many centuries. During this time, complex ecological relationships have developed between plants, invertebrates, birds and mammals, resulting in the dependence of many highly specialist species, such as the large blue butterfly, vultures and choughs, on a relatively stable, albeit man-modified environment. Many of the habitats listed as priorities for conservation in the EU species and habitats Directive, due to start coming into force in June 1994, consist of semi-natural vegetation, usually managed by low-intensity forms of agriculture. Outside the EU, the position is likely to be similar. In Hungary, for example, about a third of the animal species listed in the national Red Data Book depend on steppe grassland communities; today most of these are grazed by domestic animals.

At present, the precise relationships between farming systems and the needs of most species are little understood. Sometimes we can make a direct link between a particular form of land use, or farming system, and the wildlife present. This is usually the case in specific areas that have been studied in detail because of the presence of endangered species. Examples from the national studies include Environmentally Sensitive Areas (ESAs) which have been proposed or established for the conservation of the great bustard (*Otis tarda*) on farmland steppes in Spain and Hungary; grazing marsh ESAs in France; and mountain livestock systems in National Parks in Italy.

In other cases, we can identify habitats and species which are present in areas of low-intensity farming, although without being able to specify precisely why conditions favour these species. One complication is that many regions with a high proportion of low-intensity farming also include significant areas of unfarmed habitat, such as forest, scrub and wilderness, which adds considerably to the diversity of the local ecosystem. Typically, this is the case in remote areas where species such as bear (*Ursus arctos*), lynx (*Lynx spp*) and a diversity of raptors are still present.

Some of the best information for terrestrial species is available for birds. Current work by BirdLife International suggests that many species of European conservation concern depend on farmland habitats for at least part of their lifecycle (Tucker et al, 1994 and Pain et al). The RSPB study undertaken in parallel to the present project (Pain et al) looked at the distribution of a suite of

bird species of high conservation priority which are associated with low-intensity pastoral systems and which are listed in Annex 1 of the EU birds Directive as requiring conservation at a European level. These included the corncrake (*Crex crex*), lammergeier (*Gypaetus barbatus*), hen harrier (*Circus cyaneus*), stone curlew (*Burhinus oedicephalus*) and red-backed shrike (*Lanius collurio*).

The study found that the requirements of these species are met in areas that are diverse both in terms of vegetation structure (as a result of geology, topography or management) and biologically (as a result of low-input farming practices) and where pastoralism at relatively low overall stocking densities is an important component of the land use system. The study also discusses some of the main threats to these species, including the loss of traditionally managed mixed/mosaic systems, the intensification of arable land and the loss of traditional field margins.

Even when our understanding of the relationships between agricultural practice and wildlife is incomplete, it is clear that changes to farming systems will affect the habitats and species present in regions with a significant area of low-intensity agriculture. It is therefore important to improve our knowledge of how farming systems are changing, and the long term consequences for nature conservation.

As a first step, it may be useful to try to classify different farming systems from the point of view of nature conservation along the following lines:

- Farming systems, which use a high priority for nature conservation because of their role in maintaining endangered or rare species or types of habitat. These include the grazing of flower-rich meadows and the mixed grazing and cultivation of steppes, with their associated bird populations. Fundamental land-use change, such as intensification, conversion to forestry or total abandonment, would be very damaging for the conservation of the species associated with these systems. Nonetheless, the conservation value of land under such farming systems often could be improved greatly by selective changes in management.
- Low-intensity systems which are indirectly associated with the presence of important species but the abandonment of which may not lead to a total loss of priority habitat types or species, and may benefit some others. For example, mountain livestock systems currently maintain large areas of alpine pasture, but in regions with large wild herbivores and predators, these might continue to maintain a diverse ecosys-



Male Little Bustards (*Tetrax tetrax*), a species typical of extensive dry grasslands

Credit: F. Petretti

tem in the event of domestic livestock being withdrawn.

- Systems which, because of their low-intensity and/or other characteristics, are of higher biodiversity than intensively farmed areas and probably contribute considerably to the maintenance of existing European biodiversity, although they are not associated directly with currently threatened species. Examples of systems include low-intensity arable, livestock and mixed mosaic systems, olive groves, orchards, etc. Species might include hares,

voles, many passerines, butterflies, diverse farmland flora, etc.

This classification is not intended to be a simple hierarchy. The final group, although not associated directly with threatened species, plays a central role in the management of large areas of semi-natural habitat without which there would be a severe impoverishment of biodiversity in Europe. If conservation efforts are directed exclusively at sites associated with rarer species there is a danger that those will become islands surrounded by land managed with little sympathy for nature conservation.

CHAPTER 4:

METHODS FOR IDENTIFYING THE LOCATION OF LOW-INTENSITY AGRICULTURAL SYSTEMS

One purpose of this study was to examine the feasibility of identifying the extent and location of low-intensity farming from readily available maps and statistics. At present, there is no convenient method of identifying or mapping these systems at a European level and they are not clearly identified in national statistics either. However, a relatively simple way of locating them would be particularly useful if they are to be targeted for a greater research effort or for special policy measures. At present, there is no convenient method of identifying or mapping these systems at a European level and they are not clearly identified in national statistics either. Various types of potentially useful data were encountered during the project and some different methodologies were considered.

the reports had to rely on less refined methods for defining national areas of low-intensity arable and livestock farming.

Agricultural and Land Use Statistics

In many countries, a simple analysis of agricultural land use statistics reveals certain broad types of land cover which suggest the presence of low-intensity farming systems. Some of the most important of these are permanent pastures, rough grazing, pastures with trees, arable land with a high proportion of fallow, associations of crops such as vines with olive trees, etc. In Mediterranean regions particularly, an important distinction is often made between irrigated and non-irrigated crops. Where

Potential sources of information for identifying low-intensity agricultural systems

Land use and vegetation types	Indicators of agricultural management intensity	Agricultural input/output indicators (statistics)	Wildlife indicators (ecological requirements)
Proportion of certain vegetation types, e.g. maquis, moorland steppe pseudo-steppe permanent grassland	Irrigation Drainage Fallow periods Breed of livestock Crop varieties and associations Age, size of trees (in orchards and olive groves)	Level of use of: Fertiliser and manure (phosphate and nitrogen) Pesticides Herbicides Stock density Value of output per hectare Employment (full time, part time)	Species and habitats of European, national and regional importance "Indicator species", for example, from the birds and habitats Directives

The availability of relevant information and data in the study countries varies greatly. For most of the countries covered, the distribution of low-intensity systems could not be directly established on the basis of published statistics and maps; instead, an "expert knowledge" approach was taken, in which specialists in the field of nature conservation, agriculture, or both, interpreted a range of available sources. Some of these are shown below.

In practice, not all of the sources shown above were drawn upon in each national report. Different approaches were used in each of the nine countries, depending on the format and accessibility of data and the particular expertise of researchers. For example in France and the UK, the availability of certain databases made it possible to produce tentative maps illustrating the broad distribution of land which could be expected to be under extensive forms of livestock grazing. However, most of

the statistics are disaggregated at a regional or relatively local geographical level, it is possible to identify areas (such as provinces or counties) with a high proportion of these types of land cover. Potentially, such information could be presented in map form to produce a crude representation of the distribution of low-intensity land uses.

However, agricultural statistics rarely provide much information on the nature of the farming systems under which such land currently is managed. For example, data concerning input use are often only available at a highly aggregated, even national level (e.g. national annual consumption of inorganic fertilisers and pesticides). In some cases, there are statistics which indicate a broad pattern in the development of farming practices. In the UK between 1965 and 1982, average nitrogen application rates on permanent grassland increased by 380 per cent and the total area treated by 108 per cent. The average application rate by 1982 was 96 kg N per

hectare (Green, 1990). But even where data are available at a regional or provincial level, such figures inevitably mask great differences at a more local level between farming systems, individual farms and fields. Data on nutrient inputs tend to show input per hectare from inorganic fertilisers, rather than from all sources including livestock wastes and aerial deposition. Another difficulty is that there may be dramatic differences in input use from year to year, as demonstrated in Poland, where fertiliser consumption fell drastically after 1990 across the whole country.

Broad land use statistics do not reveal much about particular farming systems and practices on livestock farms, such as how the land is grazed, how often grass is mown and whether it is made into hay or silage. For example, information on actual stocking densities on particular types of vegetation is not readily available. Even where data are provided on stocking densities, this information alone gives only a partial picture of the nature of grazing management (see box); it is precisely this information which is important from a conservation viewpoint. Only in France was a detailed national survey of grassland management practices encountered (see Chapter 5).

In the case of arable systems, average crop yields may be taken as a crude indicator of the intensity of a system, although clearly this approach must take account of prevailing conditions, such as soil fertility and rainfall. Average annual arable yields in western Europe range from less than one tonne/ha in the least productive parts of the Mediterra-

nean region to ten tonnes/ha in the most intensively cultivated lowlands of northern regions and highly fertile irrigated areas.

Another indicator of the intensity of an arable system, particularly in Mediterranean dryland cultivation, is the proportion of arable land left fallow each year. For example, in the province of Almería in south-east Spain, almost 60 per cent of the total arable area is left fallow each year, whereas in Cantabria it is less than two per cent. Under the implementation of the recently reformed CAP arable regime in Spain, the average fallow area for each agricultural region has been calculated. This information has not yet been published, but should provide a useful indicator of the distribution of low-intensity systems.

Maps of agricultural land use

The date, scale and information shown on national agricultural land use maps varies considerably in Europe. Of those consulted, some of the most useful for the purposes of the study show a detailed breakdown of agricultural land uses and distinguish explicitly between intensive and less intensive systems. Spain, Portugal and Italy are unusual in having published maps of this sort. Perhaps the most comprehensive of these are the "Crops and Land Uses" (Cultivos y Aprovechamientos) maps produced by the Ministry of Agriculture in Spain. These are based on aerial photographs taken in 1975/76 and updated from census information in 1984-85. Three series of maps have been published: a national map at a

Stocking densities as an indicator of low-intensity systems

Stocking density statistics are useful but are not always a reliable guide to the intensity of a pastoral system. Whether a given stocking density can be considered "low-intensity" depends on the natural conditions in the area concerned. Ecologically "appropriate" stocking densities have been defined only in areas that have been the subject of research.

A stocking density index provides a measure of the average number of stock in a region or on a farm during the course of the year. However, the number may vary considerably between seasons or years and stocking density indices give only a limited guide to the management practices in the region. The methods of managing both stock and forage have a major bearing on the resulting pattern of vegetation and the value of the land as habitat for different species. This point was demonstrated clearly for the UK and Ireland in the national report for those countries.

The method of computing grazing Livestock Units (Lus) varies significantly between countries. Within the European Union, many Member States have their own conventions for domestic purposes, which do not necessarily coincide with the system used for EU legislation. The EU system denotes a ewe as 0.15 livestock units, regardless of breed, while in France there is a range of 0.13 to 0.18 LU (Julien, 1991), and in the UK 0.06 to 0.11 (MAFF, 1977). In practice, forage consumption varies significantly between species and breeds and a differentiated LU conversion ratio may be more appropriate. In Britain, hardy hill breeds of ewe, such as Herdwick or Ronaldsay, are considered as equivalent to 0.1 LU, whereas larger, more productive lowland breeds are counted as 0.15 LU (Nix, 1993).

Similar variations in the size, productivity and forage consumption of other livestock types can be noted. For example, in Hungary and Poland the mass of grazing animals is taken into account in calculating Livestock Units, with 1 LU equivalent to 500 kg liveweight. There may also be significant differences in the way in which forage hectares are calculated. Although we have not examined these in detail, the French report reveals that some statistics on the total forage area of regions do not include communal or public grazing land. Given the existing variations in methods of measurement, as well as in the dates of surveys and the scale of geographical units for which data has been collected, comparisons between countries must be undertaken with great caution.

scale of 1:1,000,000, provincial maps at 1:200,000, and local maps at 1:50,000. Examples of these maps are reproduced in the national report on Spain.

The national and provincial maps are not sufficiently detailed for the purposes of this study, although they do illustrate some relevant categories of land use, such as irrigated and non-irrigated land, permanent pasture, which is almost always semi-natural vegetation, and meadows, which may be irrigated and fertilised and possibly reseeded in some cases.

The 1:50,000 maps provide a far more detailed breakdown of agricultural land use. For example, they show several different categories of low-intensity arable cultivation (according to the number of years land is left fallow). The 1:50,000 maps also distinguish between irrigated and non-irrigated olive plantations, vines and fruit trees and indicate mountain pastures. This series is potentially very useful as a means of identifying areas of less intensive farming locally. In many localities agriculture has changed significantly since the survey work was completed and the available maps probably are not an accurate guide to the current situation. Nevertheless, they provide an interesting example of an approach to agricultural land-use mapping which could be expanded to include nature conservation parameters.

In the absence of comprehensive and up-to-date land use maps, the alternative is to consider those providing other relevant information. For example, in many countries maps are available indicating the proportion of agricultural land which is permanent grassland, usually on the basis of administrative areas, such as French départements. These provide a useful broad guide to the most likely areas of low-intensity pastoralism, since more intensive systems generally are characterised by a significant proportion of temporary grassland and other forage crops.

However, some permanent pasture is highly productive and receives large inputs of fertiliser. It is therefore desirable to combine maps of permanent grassland with other data, for example on average levels of fertiliser use, animal stocking densities or other management practices. This approach was taken in the French study, on the basis of census data from 1988 combined with a detailed survey of forage production carried out in 1982 by the Service Central des Enquêtes et Etudes Statistiques (SCEES) of the Ministry of Agriculture. The methodology and the resulting map are presented in the French overview in Chapter 5.

In the UK study, it was decided to map vegetative land cover using data from the Land Cover Map of Britain, which is derived from satellite images of the country for the period 1989-1991. This exercise was based on the assumption that the vegetation of a particular block of agricultural land broadly reflects the intensity of management practised but broad stocking density indices for different regions were then used to qualify the distribution derived from the land map cover. The methodology and the resulting map are presented in the UK overview in Chapter 5.

Combining different data sources

There are various ways of identifying and mapping areas of predominantly less intensive agricultural land on the basis of readily available published information, although each has its drawbacks. At present, the type of information available in each country varies enormously and data from one country often is not compatible with that from another. Furthermore, some of the most useful information identified in the study, such as the land use maps in Spain and Portugal and the survey of grasslands in France, are rather out of date.

New sources of data will result from measures introduced under the reform of the CAP in 1992 concerning the area of forage available to farmers and their livestock numbers for example and, in Spain, showing the proportion of arable land traditionally left fallow in each district. Some of this data may be useful, although generally it will only relate to crops and livestock that receive support from the CAP.

Given the limitations of the information available, there does not appear to be any single method which is adequate for identifying the extent and location of low-intensity agricultural land. Methods based on agricultural statistics and a limited range of criteria, such as land cover, input use, average stocking densities, etc., inevitably provide an incomplete picture. Local patches of low-intensity land are likely to be overlooked and the details of current farming practices will not be revealed by such an approach. Ground surveys, aerial photography and detailed local land use maps are potentially very valuable for locating smaller areas. Expert knowledge is an essential complement to any data-based system, particularly as it is often the only way to gain an insight into the functioning of farming systems. A coordinated European research effort, drawing on these different methods, would allow low intensity systems to be identified and characterised more precisely. This should be a priority both within the EU and in central European countries.

CHAPTER 5:

THE EXTENT AND LOCATION OF LOW-INTENSITY FARMING SYSTEMS IN THE STUDY COUNTRIES

This chapter provides an overview of the distribution of the principal categories of low-intensity farmland in the nine study countries. The overviews are based on the national reports, supplemented with information from other sources; included in each is a table and, where available, a map summarising the location and/or broad distribution of low-intensity farming in the country concerned.

These should be taken as guidelines only. Considerable further work is required to estimate the area and precise location of each category of low-intensity farming. However, it can be seen that a larger number of different systems are found in Mediterranean countries and France, compared with northern Europe. The number of systems present in Spain is particularly striking.

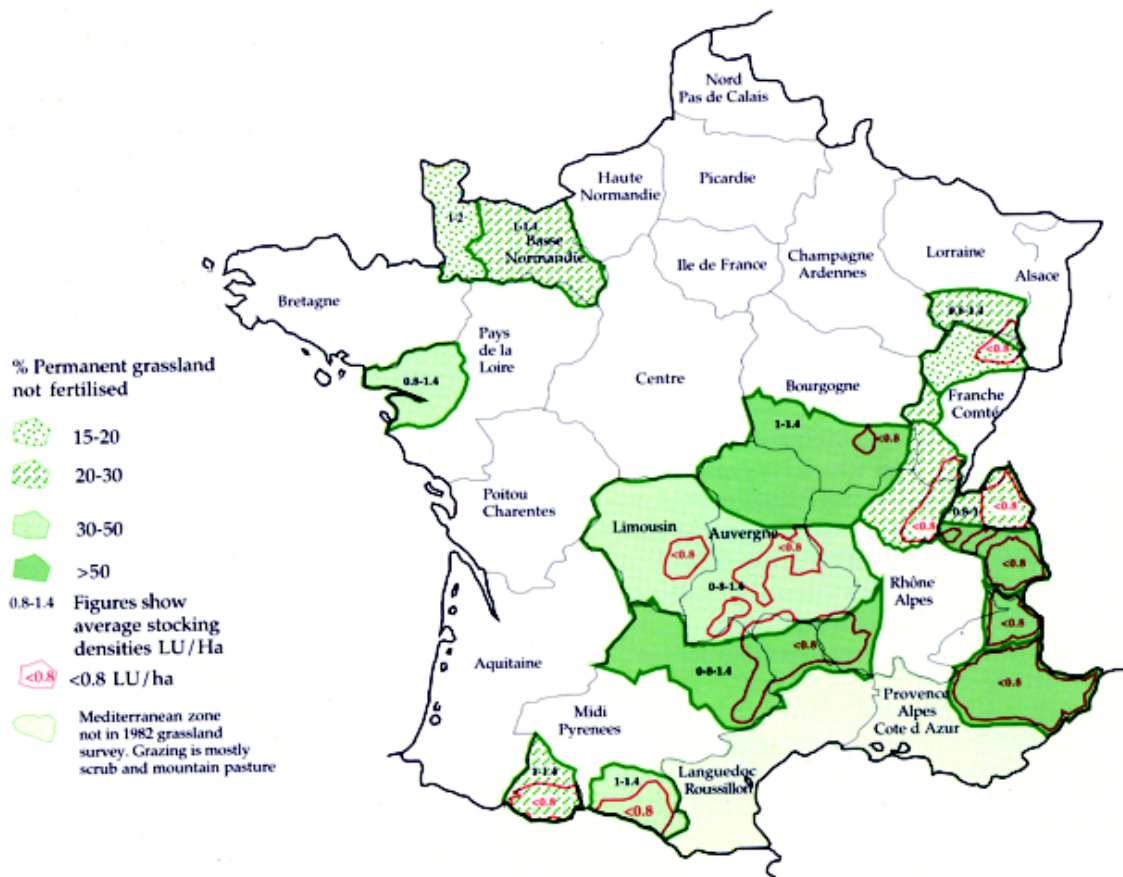
France

Low-intensity systems in France predominantly involve livestock raising on permanent pastures and

rough grazings. Around 30 per cent of the land area consists of semi-natural and improved grassland. Low-intensity livestock systems are concentrated particularly in the southern regions and in the upland and mountain areas. Many of these are designated as Less Favoured Areas under EU Directive 75/268.

Particularly in the south, low-intensity livestock raising is characterised by the use of extensive tracts of semi-natural vegetation which receives no management other than grazing, and sometimes burning. This includes heaths, maquis and garrigue (which account for around five-six per cent of France's territory) and high mountain pastures. Sheep and goats are the main livestock types although the latter are becoming less common in many mountainous districts. Horses are being used on an increasing scale to graze semi-natural habitats including marshes and mountain pastures.

Maquis and other semi-natural vegetation is generally outside private holdings, in some form of



Map 1: Tree criteria have been combined in this map to show departments with a high concentration of grassland under low intensity management.

common or open access ownership. Not infrequently, these grazings complement grassland on the holding; elsewhere, they may be the only forage resource, for example under some pastoral systems in the Mediterranean region. Mostly they receive no external inputs, other than animal dung. Common grazing off the holding constitutes an important forage resource in mountain areas and also in some coastal marshes, especially during the summer.

The most important areas of marsh include the Camargue, where there is extensive grazing by herds of semi-natural wild local horses and cows, the taureau de Camargue, the "Marais de l'Ouest" on the Atlantic Coast in Vendée, and Charente-Maritime, where both cows and horses are grazed and the pré salés in Normandy, where sheep predominate.

Low-intensity sheep farming currently tends to be located south of the Loire in the LFAs of the centre and west, particularly Midi-Pyrénées, Aquitaine, Corsica and Languedoc-Roussillon. Sheep are raised mainly for meat, although high quality cheese is an important product in some areas (south of the Massif Central, western Pyrenees and Corsica). Ninety three per cent of sheep producers in France fatten their own lambs. Goats also are raised for milk in three regions: Poitou-Charentes, Rhône-Alpes and Centre (Bonnemaire and Raichon in Capillon ed., 1989). The production of sheep and goat cheeses of appellation d'origine contrôlée (AOC) is of considerable economic importance within these areas.

In other regions, low-intensity cattle (and some sheep) raising is based primarily on the exploitation of permanent grassland by grazing and mowing for forage. Less intensive beef cattle breeding is found in and around the Massif Central (e.g. Limousin, Aveyron) and parts of the south-west.

Dairy production is usually intensive but in some areas (e.g. Franche-Comté and on some grazing marshes), dairy cattle are raised on semi-natural grassland, managed at low intensities. Dairy cattle largely have disappeared from regions such as the pays basque and "Béarn" in the Pyrénées atlantiques, partly because of EU milk quotas. Subsequently, many pastures have been converted to maize cultivation which can lead to soil erosion and other environmental damage (Terrasse, 1994).

Many of the areas managed under low-intensity livestock systems are of high botanical and zoological value, and are especially important for migrant and nesting bird species. Within France, there are approximately 1.25 million hectares of wet grassland classified by the International Council for Bird Preservation (ICBP) as "Important Bird Areas" (IBAs), worthy of protection under the birds Directive. Whilst not confined solely to wet semi-natural grassland, the hen harrier and Montagu's harrier (*Circus pygargus*) favour wet grass managed at low intensities for nesting and feeding. For these two species, 50 and 30 per cent respectively of Europe's populations are found in France. Many of the endangered bird species associated with dry grasslands frequent low-intensity farmland also (e.g. lapwing, pin-tailed sandgrouse (*Pterocles alchata*) and stone curlew). Other species closely associated with grazed habitats include the Griffon vulture (*Gyps fulvus*), the little owl (*Athene noctua*), corncrake (*Crex crex*), rock thrush (*Monticola saxatilis*) and rock sparrow (*Petronia petronia*).

Most forms of crop production are too intensive to be of relevance here, although there are some areas of arable and mixed cultivation which continue to support flora and fauna usually associated with low-intensity farming systems. There are also local examples of low-intensity permanent crops, particularly olive groves. These are found generally in the south on frost-free land, particu-

Table 5.1: Main types of low-intensity farming in France and their distribution

Livestock raising in upland and mountain areas	Midi Pyrénées, the western Pyrénées, parts of Limousin and Auvergne, Franche-Comté, Alps. Grazed forests in upland and mountain areas, especially in the south.
Livestock raising in Mediterranean regions	Some quite large areas of the south, e.g. Causse, Corsica.
Livestock raising in temperate lowland regions	Grazing marshes, including the Camargue, and some river valley wetlands, patches of chalk grassland and less intensive bocage in Normandy, coastal dune heaths of Aquitaine.
Transhumance	Alps, Pyrénées, Corsica. Some sheep flocks graze alpine pastures in Spanish Navarra.
Dryland arable cultivation	Small areas of less intensive arable cultivation remain, particularly in the south.
Permanent crops	Apple orchards in Normandy. Olive groves in Drôme and Mediterranean provinces.
Mixed Mediterranean cropping	Parts of the south.

larly in the Mediterranean regions of Languedoc-Roussillon and Provence-Alpes-Cote d'Azur. They are also common in the Drôme. Extensively managed olive groves tend to harbour large numbers of invertebrates and attract passerine birds. Subsidies for grubbing up older, less productive trees are a significant threat to traditional olive groves.

Map 5.1 combines three different criteria in an attempt to identify the distribution of extensive pastoral systems in mainland France, excluding the départements along the Mediterranean coast. The areas outlined in green are made up of those départements where at least half of the utilised agricultural area comprised permanent grassland in 1988 and where the proportion of such grassland not receiving fertiliser in the 1982 grassland survey was 15 per cent or above. Figures showing ruminant livestock densities per hectare of forage, including common grazing land, have been added from 1988 data. Recognised weaknesses in this map include the need to rely on relatively old data from two different years, and the omission from the 1982 survey of the Mediterranean départements and Corsica. Nevertheless, it can be expected to give a better indication of the location of low-intensity pastoral systems than reliance on single indicators.

Greece

Since accession to the EU in 1986, some elements of Greek agriculture have undergone marked intensification, including the poultry, pig and dairy sectors. However, traditional agricultural land use has generally remained unaffected. The most common form is extensive rearing of sheep and goats for milk and meat, with the livestock often herded in large mixed flocks. This system covers much of the mainland and is especially significant for the nature conservation value of mountainous areas. Together with early woodland clearances and sporadic forest fires, low-intensity livestock rearing is responsible for the mosaic of evergreen scrub, conifer forest and rough pasture

which characterises much of the mainland and some of the islands.

In total, around five million hectares of land are used in low-intensity livestock systems, chiefly as seasonal grazings. Most grazings occur at a high altitude in the hinterland; 51 per cent of rough grazings are at 600 metres or higher. Transhumance remains important in many areas because of a variety of physical and economic limitations on land use, including the fragility of soils, lack of rain and public ownership of four-fifths of all pasture and rough grazing.

Despite a recent decline in stock numbers, about one million animals were involved in seasonal migrations in 1991. The pattern of movement in the mid 1980s is shown in Map 5.2.1. In summer, the largest concentration of migrant animals is on the high alpine pastures of the Pindos mountains on the mainland. Flocks descend to the surrounding foothills and lowland plains of Thessaly and Epiros in autumn. Map 5.2.2 shows the regions and the Pindos mountains where the most important winter pastures are found.

It is difficult to sketch a very full picture of the species associated with less intensive farming systems in Greece because of a shortage of research studies. However, some pastures above the treeline have great botanical interest, which is sustained by high grazing pressure for a relatively short period. The sward may include species such as *Avena sativa*, *Fetuca Arundinacea*, *Trifolium* spp and, less



Map 2: Sheep transhumance on mainland Greece in autumn 1984. The width and shading of arrows varies with the number of animals moved and the location of the pasture. The map shows the importance of the Pindos mountains as a source of spring and summer grazings.

commonly, *Bromus cathaticus*, *Dactylon cynodon* and *phleum platense*. Such summer grazings are often frequented by raptors, including the lanner (*Falco biarmicus*), the Egyptian vulture (*Neophron percnopterus*) and golden eagle (*Aquila chrysaetos*); a portion of the central Pindos has been classified as a Special Protection Area (SPA) under the birds Directive. Further south and at lower altitudes, goats graze wooded pasture with plane (*Platanus orientalis*) as the dominant species.

Many Greek mountain areas are characterised by steep forested slopes and extensive tracts of maquis and poor grass. Fires can be very destructive; each year, 25,00-120,000 hectares of forest are destroyed (IUCN 1991). Although there are overgrazed areas, especially in open woodland, often the presence of well managed livestock benefits forests, curbing the incidence of fires by removing combustible material.

On the Ionian islands, mixed farming carried out on a subsistence basis is still widespread accounting for about 29 per cent of agriculture activity. Farms tend to be small, with grazing of arable stubbles and post-harvest residues playing an important part in foddering patterns. Animals may be folded at night on crop lands in order to improve fertility through dunging, and this is particularly important on marginal arable land, e.g. cultivated areas on steep slopes, fields prone to high rates of soil leaching and erosion, etc.



Regions showing the Pindos Mountains

In contrast to livestock and mixed systems, there is little low-input arable farming. Certain tree crops, such as olives, medlar, pomegranate, almond and mastic varieties, are still traditionally managed, with pruning and grafting in winter, picking by hand in autumn and weed control during the year. About 95 per cent of Greece's olive groves (around 600,000 hectares) are managed this way, mostly in southern parts of the mainland and on the islands. Until the mid 1960s, low-input horticulture or perivolvia (small holdings growing vegetable and citrus crops for domestic needs and selling any surplus) was common throughout the country; however, it has been undermined by the expansion of intensive cit-

Table 5.2: Main types of low-intensity farming in Greece and their distribution

Livestock raising in upland and mountain areas	Common to large areas of the country, especially northern mountain ranges
Livestock raising in Mediterranean regions	On lowland plains generally; in the littoral zone, although declining in importance
Transhumance	Focused on Pindos mountains. Summer grazings: alpine pastures in the Pindos (sheep chiefly overwintered in plains of Thessaly, river deltas and plains of Epiros) and southern Macedonia (winter pastures along Black Sea). Grazing of woods and extensive areas of scrub, mostly by goats. More localised movements in Peloponnisos and Crete
Dryland arable cultivation	Cereals in marginal agricultural areas. Pulses, fodder crops, aromatic plants
Permanent crops	Olives, particularly in Peloponnisos, Central Greece and Crete. Other crops such as plums, pomegranates, almond and medlar
Mixed Mediterranean cropping	Perivolvia in parts of the mainland, on Lesbos, Samos; Ionian islands generally

rus growing. *Perivolia* is now confined largely to islands, including Lesbos and Samos.

The country has some of the largest wetlands in the Mediterranean. Some contain internationally important populations of endangered bird species (e.g. Nestos and Evros deltas, see Map 5.2.2). Traditionally, many of these wetlands have been managed by low-intensity agriculture. For example, in the Evros delta on the border with Turkey, wet grassland has been used to raise beef cattle for decades, creating a coarse textured sward which attracts breeding species such as the little bittern (*Ixobrychus minutus*), collared pratincole (*Glareola pratincola*) and stone curlew. Nonetheless, on many of these pastures farmers have not maintained the previously high water levels, thus allowing cattle to graze and trample some of the most important bird habitats.

Hungary

Hungary's low-intensity livestock and arable systems tend to be highly fragmented and are found chiefly on more marginal agricultural land. In total, they cover around 15 to 20 per cent (c. 1.5 million hectares) of the country's area.

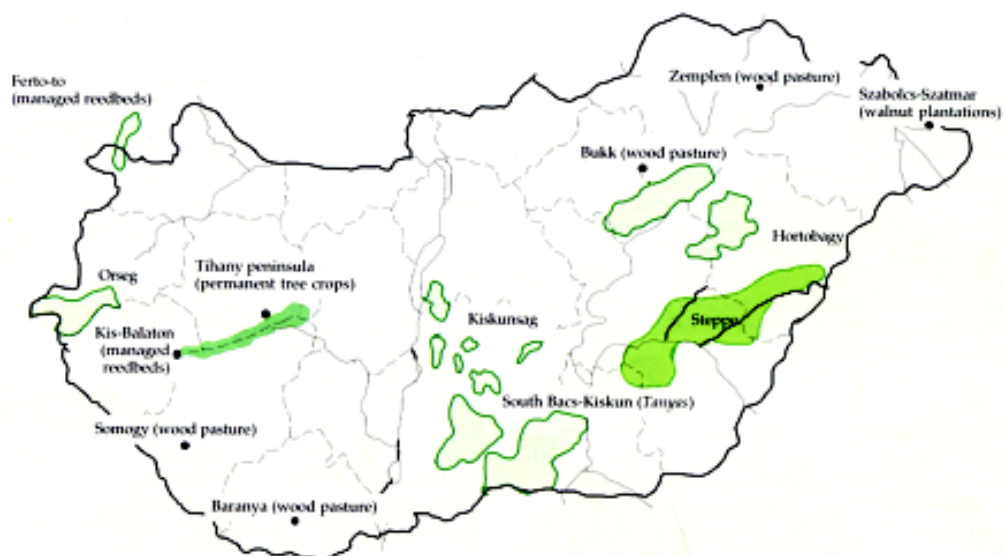
There are more than 500,000 hectares of traditionally managed grasslands, mainly unimproved grass or *puszta*, grazed by sheep and cattle (either free-ranged or shepherded), and by draught horses. Usually *puszta*s are alkaline, salt-rich habitats, containing a wide range of perennial herbs and grasses. The evolution of agricultural landscapes and the conservation interest therein has depended crucially on pastoral farming. For example, generally only sheep graze the strongly flavoured dry alkaline *puszta*s, creating a close cropped species-rich sward. More productive pastures with access to watering points traditionally were used to raise dairy and beef cattle, giving a more uneven vegetation structure. Livestock raising of this sort still survives in Hortobágy and on areas of steppe on the Great Plain (see Map 5.3). Stocking rates of one livestock unit per hectare per year (i.e. around one beef steer or dairy cow, or four sheep), or sometimes more, are common here. However, on the easily eroded siliceous grasslands of Kiskunság, animals are kept at much lower concentrations, typically 0.3-0.5 LU per hectare.

In two protected areas of the country, Kiskunsági szikes-tavak and Pusztaszer, wetlands of high conservation value are now maintained exclusively by traditional pastoralism. Other forms of agriculture are banned. Kiskunsági szikes-tavak is a Ramsar site covering 4,000 hectares, consisting of steppe interspersed with alkaline lakes, reedbeds, marshes and woodland. Grass is cut for hay on the wetter meadows, which are rich in invertebrates. Grazing by cattle leaves tufts of taller grasses intermixed with more closely grazed patches, providing nesting sites for a number of wetland birds, including the avocet (*Recurvirostra avosetta*) and black-tailed godwit. The old system of dykes installed by farmers has been renovated.

Unimproved grasslands generally are of great conservation importance. Almost a third of the country's protected plant and animal species depend on grasslands, including the white-fronted goose (*Anser erythropus*), imperial eagle (*Aquila heliaca*), slender-billed curlew (*Numenius tenuirostris*) and mammals such as the lesser mole rat (*Microspalax leucodon*). There is still a great variety of unimproved grazings including wet grassland, alkaline and siliceous sward in south Bács-Kiskun and wood pasture at Bék, Zemplén, Baranya and Somogy. Almost 375,000 hectares were classified as IBAs in the ICBP inventory (1989).

Low-intensity arable systems are more fragmented and smaller in scale. On these farms, use of manufactured fertilisers seldom exceeds 50 kg/ha per annum. Weed control is usually by shallow soil cultivation using draught horses or small tractors. A number of protected bird species frequent low-input arable land, including the stone curlew, Montagu's harrier and roller (*Coracias garrulus*).

There are small pockets of other traditional arable land uses, amounting to about 60,000 hectares in total, including reedbanks on Lake Fertő-



Map 4: Approximate distribution of low intensity farming systems in Hungary

Mixed farming in Hungary: the tanya system

Tanyas are small scale, usually privately owned, mixed holdings which survive on predominantly sandy soils in the central parts of Bács-Kiskun county. Some 200,000 hectares are farmed in this way. Typically, each tanya consists of a house, outbuildings and around 2-25 hectares of land.

On arable land, rye, wheat and maize are the main products. Intercropping, which is rarely seen elsewhere in the country, is common, typically maize, beans and marrows, or oats, vetch, lucerne and barley. Organic manures are used and pesticides are seldom needed. Horses still play an important part in cultivation and transport of agricultural produce.

On most holdings, two or three cattle or a small flock of perhaps ten sheep are kept; larger herds and flocks are uncommon. Heavier stock can erode the fragile soils through trampling and they are often kept within defined areas and not moved unnecessarily. Much of Bács-Kiskun's siliceous grasslands are unimproved meadows and hay crops are often taken for winter fodder. Dried maize stems and cobs are used as well.

Typically, the tanya landscape consists of grass and arable land, intermixed with vineyards and old orchards. This mosaic of differing habitats and land uses attracts a variety of fauna, including the tawny pipit (*Anthus campestris*), roller and stone curlew; the endangered Ursini's viper (*Vipera ursini rakosiensis*) favours the wetter dune grassland found on some farms. Large amounts of semi-natural habitat have survived on tanyas. Bács-Kiskun is the largest county in Hungary and 5.5 per cent of its land area is under protected designations, on grounds of conservation or landscape importance. Much of this is concentrated on tanya land.

Source: Hungarian national report



Apple picking in a traditional orchard, Orseg, Hungary

Credit: F. Markus

Table 5.3: Main types of low-intensity farming in Hungary and their distribution

Livestock raising in upland and mountain areas	In upland regions of Órség, western Hungary
Livestock raising in temperate lowlands	Beef and sheep production on the Great Plain (central Hungary)
Livestock raising in wooded pastures	Fragments in the north-east, e.g. Bükk, Zemplén and the south west, e.g. in Baranya and Somogy
Dryland arable cultivation	Chiefly on parts of the Great Plain
Permanent crops	Orchards and almond groves, e.g. Tihany peninsula. Vines as part of the mosaic of land uses on tanyas
Small scale traditional mixed farming	Tanyas in Bács-Kiskun. Traditional mixed farming in Órség

t?, orchards on the Tihany peninsula, and vineyards (see Map 5.3). One of the most common forms of low-intensity agriculture in the country is the tanya, or small mixed farm, characterised by its great variety of land uses and practices such as intercropping (see box below).

Ireland

There is little detailed information published about the extent and distribution of different low-intensity farming systems. A map of areas within which low intensity farming systems can be found has been drawn using information from experts from An Taisce (the Irish National Trust), and the government's National Parks and Wildlife Service. These are shown together with existing designated ESAs in Northern Ireland as Map 5.4. Land in these areas is not necessarily under low-intensity management at present. Indeed, the main low-intensity farming systems are found in much smaller pockets in the midlands or the west. However, the map is an interesting starting point for identifying areas which are both of environmental interest and farmed less intensively.

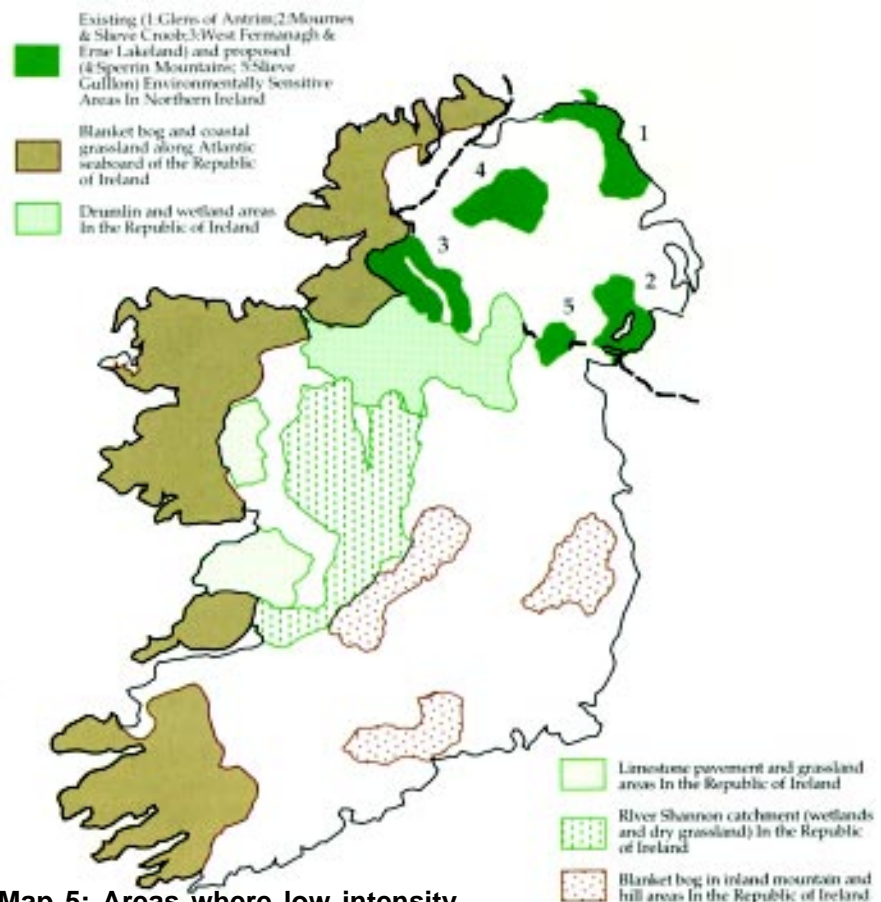
Livestock grazing is the dominant land use. Approximately 80 per cent of farmland is permanent grassland or rough grazing. Generally speaking, arable land and intensive dairy farms are concentrated in the south and east on drier and more easily farmed soils, whilst low-intensity grazing occurs mainly in the western half, on wet mineral soils, lowland and mountain blanket peatlands, karst limestone areas (eg the Burren) and coastal grasslands. However, most unimproved grasslands and peatlands along the western seaboard are subjected to intensive sheep grazing, at stocking rates which are often higher than the carrying capacity of the land. Nationally, sheep numbers increased from 3.3 million in 1980 to over nine million in the early 1990s, encouraged by the EU Ewe Premium Scheme.

Low intensity farming methods are still relatively common on large areas of agricultural land, especially in the west. For example, hay making is still quite widely practised, although the use of silage doubled during the 1980s, partly encouraged by national and EU policy measures. Forage grown on the farm is widely favoured over manufactured feed and stocking rates are generally lower than in comparable livestock

areas in the UK. The use of inorganic fertilisers and pesticides is also considerably lower than the EU average.

However, the National Parks and Wildlife Service has estimated that only five per cent of grassland (not including heaths and peatlands) remains genuinely unimproved, through reseeding with rye grass and clover and the associated applications of manufactured fertilisers. A progressive change from hay-making to silage, which generally accompanies the reseeding of grassland, has accelerated a decline in farmland species such as the corncrake (*Crex crex*). Corncrake populations are becoming increasingly fragmented and one source has predicted its extinction in Ireland by the year 2000 (Whilde, personal communication). Even where hay-making is still practised, a move towards cutting earlier in the season creates problems for many ground-nesting bird species and elimination of wild grasses and herbs from hayseed mixtures has reduced botanical diversity.

Wetlands are of particular importance for nature conservation in Ireland and often are under some form of grazing management. Wet grasslands cover 33 per cent of the land area and peat bogs a further eight per cent. They include vital feeding, roosting and nesting grounds for a number of threatened bird species. Half of the world's population of the Greenland white fronted goose (*Anser albifrons*)



Map 5: Areas where low intensity farming system can potentially be found in Ireland

Table 5.4: Main types of low-intensity farming in Ireland and their distribution

Livestock raising in upland and mountain areas	Substantial areas of the western uplands (mostly moorland and blanket bog). Mainly grazed by sheep.
Livestock raising in temperate lowland regions	West coast and Shannon river catchment. Sheep, beef cattle and some horses grazed along the Shannon
Small scale traditional mixed farming	On some peatlands in central Ireland; in County Donegal. Some machair on the north and west coasts

flavirostris), overwinter in Ireland. Overgrazing is damaging some peatlands but livestock are the principal means of managing the riverside callows or water meadows, which cover a considerable area of the Shannon flood plain. Turloughs (seasonal lakes in limestone areas of Clare, Galway and Roscommon) are also important habitats which are grazed in summer and are wintering grounds for waterfowl when flooded in winter. The intensification of agriculture, especially by means of drainage and increased grazing pressure, has removed wet grasslands, scrub, moorland and bog, reducing the variety and abundance of species of wild flora, invertebrates and farmland bird species.

About 20,000 hectares of bare land, mostly extensively farmed grassland, heather moorlands and blanket peatland, are afforested each year, financed until 1993 by aid from the EU Structural Funds and from 1994 by the CAP drawing on the new forestry Regulation 2080/92. This has removed habitat for a number of open ground bird species such as red grouse, hen harrier, dunlin and golden plover.

In the north-west and in parts of central Ireland, low-intensity mixed farms are still relatively common. These are small, with crops such as barley and potatoes and a few paddocks grazed by sheep or occasionally cattle, with some land reserved for subsistence production. Where rights of turbary exist on commonages, or where farmers own drier bog, peat is cut also. This form of low-intensity farming is quite similar to Scottish crofting and depends heavily on common land (particularly for grazing).

Italy

Most of the low-intensity agricultural systems are found in the mountains, hills and drier areas in the southern parts of Italy and Sardinia. The area under such systems has decreased in recent decades, mainly as a result of falling farm incomes and depopulation. However, in 1993 it was estimated that there were still 7.1 million hectares (31 per cent of total agricultural area) managed in low-intensity arable and livestock systems; their distribution is shown on Map 5.5. The majority (3.9 million hectares) of such land consists of unimproved mountain pastures and meadows.

Extensive raising of cattle, sheep and goats still affects large areas of the Italian landscape, although

management patterns vary significantly. One of the most important in terms of area is alpine cattle breeding or alpeggio (see map). The conservation importance of this system is described in more detail in the box below.

Transhumance of sheep and goats also takes place in the central Apennines. Some animals are only moved short distances in late spring and early summer, for example from nearby lowland plains, but other flocks are driven from winter pastures on the coast of Latium and Apulia. Mixed sheep and goat flocks use around 1.5 million hectares of montane and alpine grazings during the summer months. Scrub and woodland are also used, especially for goats. Soils tend to be arid and stony and, despite low average stocking rates, overgrazing has occurred over large areas. A wide range of breeding and overwintering birds is associated with sheep walks in the Apennines; the region also has continental wildlife importance as one of the last refuges of the European wolf (*Canis lupus italicus*) with about 400 animals censused in 1992. Bears also frequent the area.

Low-intensity livestock systems are not confined to the uplands. There are also significant lowland areas managed traditionally, particularly on Sardinia where sheep and goat grazing maintains almost half the country's area of steppe (c.206,000 hectares). This provides one of the continent's most important nesting and breeding grounds for the little bustard (*Otis tetrax*). Pastures have a range of valued flora, including iris, lilies and some orchid species.

Rearing of the traditional Maremmana beef breed is confined to an area of land between Latium and Tuscany (see Map 5.5). Stock range over c.250,000 hectares of varied grazings, including hill pasture and coppice. They are overseen by butteri (cowherds) through the year, but aside from releasing bulls on the herd in April and rounding up calves for slaughter at eight months of age or later, there is very little intervention. Grazing and browsing by cattle results in a mosaic of scrub, woodland and wooded pasture, creating a landscape of high biodiversity. Of particular interest are coppice woods of holm oak (*Quercus ilex*) and turkey oak (*Quercus cerris*), which have a varied age structure and a large number of associated shrub, ground flora and invertebrate species. There are sizeable areas of maquis also, with shrubs such as strawberry tree



Approximate distribution of low intensity farming systems in Italy.

Map 6: Approximate distribution of low intensity farming system in Italy.

(*Arbutus unedo*) and broom (*Cystus* spp.). Because stock range over large distances, dead animals are seldom buried, and carcasses can attract Egyptian vultures (*Gyps fulvus*) and kites (*Milvus* spp.). This area is the main breeding ground in central Italy of the short-toed eagle (*Circaetus gallicus*) and honey buzzard (*Pernis apivorus*).

Low-intensity arable systems include wheat cultivation, which extends to about 500,000 hectares, mainly in the central Apennines. Traditionally important, but now increasingly fragmented, is small scale low-intensity mixed farming on marginal land with a variety of crop types, including fruit, wheat, vegetables and lucerne. Called *coltura promiscua*, this has high aesthetic and conservation value. It is not untypical for small parcels of cereals and fodder crops to be scattered among coppice woodland and species-rich grasslands.

There are around one million hectares of olives grown along the coast and in frost-free pockets further inland; large areas are managed "extensively". These include older groves, such as those in Calabria, where trees have been left to grow to 10 metres or more in height. These have similar wildlife interest to long-established oak woodland, with breeding birds such as the Scops owl (*Otus scops*) and certain passerine species common to many sites. Individual trees are host to a diverse array of invertebrates.

Low-intensity mixed plantations are relatively common in Apulia where olives are grown together with fig trees and almonds. Traditional management involves winter pruning and manual harvest (*brucatura*) in the autumn months; trees may be picked by hand or by shaking, with the fruit collected in nets.

Alpine cattle breeding in Italy

In the mountainous north of Italy, cattle breeding is based on the seasonal movement of stock to mountain pastures during the late spring and early summer, and their return in winter to the valleys. This form of transhumance is called *alpeggio*; there are broadly similar systems in montane regions of other countries, including Spain, France and Switzerland.

Traditionally, *alpeggio* is associated with particular breeds of dairy cattle, the most common of which are the Valdostana and Grey Alpine. Three types of pasture are used, alpine meadows in mid-summer, lower mountain pastures in spring and valley lands at the turn of the year, amounting in total to about one million hectares. During the winter, stock feed is supplemented with corn, and hay cut from meadows close to farms. In the Val d'Aosta, the main product of the system is now milk, but in the past most milk was used to produce a number of hard cheese varieties.

Almost all the grazings used are in various forms of common ownership, including land owned by the *Comunita montana* ("mountain communities", co-operative groups representing a number of different villages). On average, each holding has a herd of around 15-25 cattle. Stocking levels tend to be appropriate to the environment, with densities rarely exceeding one cow per hectare on the most productive pastures. In the Val d'Aosta stocking rates are much less, averaging one cow per four or five hectares. This practice maintains species-rich pasture and ensures regeneration of certain flowering plants and herbs in the sward.

Alpine cattle ranges are rich in breeding bird species, such as whinchat (*Saxicola rubetra*), accentor (*Prunella collaris*) and ptarmigan (*Lagopus mutus*), as well as mammals including the marmot (*Marmota marmota*), weasel (*Mustela erminea*) and wild herbivores (e.g. Chamois (*Rupicapra rupicapra*) and ibex (*Capra ibex*)).

The *alpeggio* system has a number of tangible benefits. Conservation of endangered plant and animal species is perhaps most important, but there are substantial gains for the landscape also. *Alpeggio* ensures that a traditional pastoral landscape is maintained over large areas of the lowlands, foothills and alpine regions of northern Italy. However, between 1970 and 1990, numbers of alpine cattle fell by 15 per cent. The area of pasture which is grazed is shrinking annually and some alpine pastures now face abandonment.

Source: Italian national report

Table 5.5: Main types of low-intensity farming in Italy and their distribution

Livestock raising in upland and mountain areas	Alpine pastures and valley meadows in Trentino Alto-Adige, Piemonte, Lombardia, Veneto, Friuli and especially Val d'Aosta. Cattle raised for beef and milk; dairy products in Val d'Aosta
Livestock raising in Mediterranean regions	Extensive areas of maquis grazed by sheep and goats e.g. central Appenines, Sardinia
Livestock raising in wooded pasture	Maremmana cattle in Latium, Tuscany. In some communal forests
Transhumance	Summer pastures: concentrated in central Appenines, grazed by sheep at higher altitudes. Some animals overwintered in coastal areas of Latium and Apulia. On Sicily and Sardinia, more localised movement of stock between coastal plains and mountains in hinterlands
Dryland arable cultivation	Dryland arable cultivation Wheat grown on some areas of marginal agricultural land, chiefly in the foothills of the Appenines
Permanent crops	Low-intensity olive groves quite common, especially in Calabria. In some places, mixture of olive, fig and almonds, e.g. Apulia
Mixed Mediterranean cropping	Coltura promiscua, mostly on more marginal agricultural land at lower altitudes near the coast

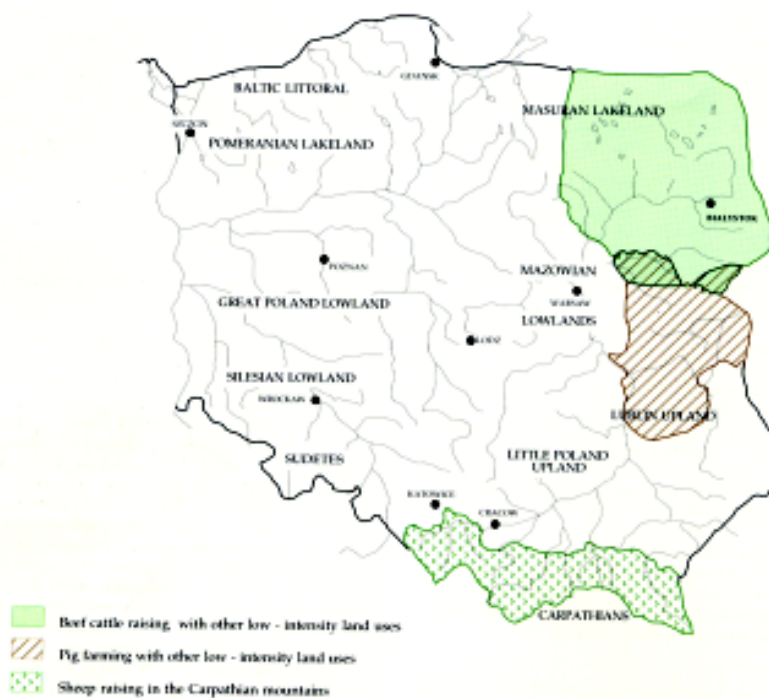
Poland

Extensive forms of both livestock and mixed arable-livestock systems can be found in Poland, but specialised low-intensity arable holdings are exceptional. There are possibly two million hectares of semi-improved and unimproved grassland still intact out of a total of about four million hectares of grassland, mainly concentrated in the lowland river valleys. Most grassland is managed as pasture or hay meadow. However, the area of wet grassland is declining; major irrigation or drainage work has been carried out on 1,900,000 hectares of pasture since 1945. More generally, it has been estimated that about 36 per cent of farmland has been subject to substantial agricultural intensification.

Polish grasslands can be divided into three broad groups. Perhaps the largest groups is the drier grasslands, accounting for about 45 per cent of the total in the lowland areas and about 56 per cent in the mountains (Denisiuk et al, 1991). The second group is the humid grasslands, most of which are periodically flooded and often associated with rich floral communities of highly productive grassland. Most of these are concentrated in the lowlands. They are rarer in southern parts of the country. The third group consists of swampy or very wet grasslands typically flooded for long periods by river water. Vegetation is dominated by tall sedges and they are little used for agriculture, other than for some hay production. Birds associated with Polish meadows include quail (*Coturnix coturnix*) and kestrel (*Falco tinnunculus*).

There remain fragments of unimproved dry steppe on marginal agricultural land. Certain specialised forms of vegetation are confined to these residual areas, including halophytic plants, for example patches of salty steppic grassland found along the Baltic coast.

Whilst there are large collective arable and livestock farms in Poland of the kind found elsewhere in central Europe, a typical holding is small-scale (average size five hectares) and owner occupied, with a mixture of crop types farmed on a subsistence basis. In 1989, freehold farms accounted for 75 per cent of all cultivated land. These smallholdings stem from a national land reform



Map 7: Approximate distribution of low intensity livestock farms in Poland

Table 5.6: Main types of low-intensity farming in Poland and their distribution

Livestock raising in upland and mountain areas	Sheep rearing in Carpathian mountains; in Nowy-Sacz in the south-east
Livestock raising in wooded pastures	Sheep grazed on wood pastures on lower slopes of the Bieszczady mountains, in the south-east
Transhumance	Summer grazing of alpine pastures by sheep in Bieszczady mountains
Permanent crops	Alongside other agricultural land uses, orchards of traditional apple and pear varieties
Small scale traditional mixed farming	Mixed subsistence farming across large areas of the country: for example, beef suckler herds raised in the north-east, pigs on sandy soils in eastern Poland etc. Common complementary arable land uses include potatoes, cereals (e.g. rye, wheat) and root crops, mainly beet

programme, introduced after the second world war. Almost all have some domestic animals, such as pigs, sheep, cattle or chickens. Orchards of the older apple and pear varieties are also common.

The division and reform of holdings resulted in many farms having substantial amounts of unused boundary land relative to their overall area. Often, these undisturbed verges and boundary strips are colonised by comparatively rare grass and herb species, and may provide shelter for small mammals and some nesting birds, e.g. partridge (*Perdix perdix*).

Low-intensity cattle, pig and sheep farms are concentrated in the south and east (see Map 5.6). Usually, these are not specialised; instead, livestock are left to graze the least productive portion of land, whilst fields close to the farmstead, or on more fertile soils, are managed as arable land.

In the north east, many farms operate beef suckler systems on rough grazings, with crops such as rye, wheat and potatoes grown on better land. On average, 25-40 per cent of farmland in this region is unimproved meadow and pasture receiving little or no management, other than occasional hay cutting for winter feed. Small quantities of fertilisers are used, but these seldom exceed 50 kgs of nitrogen per year per hectare on pasture or 30 kg/ha/yr on meadows. This has encouraged a wide diversity of temperate meadow grass species including tussock grass (*Poa pratensis*), crested dog's tail (*Cynosurus cristatus*), Yorkshire fog (*Holcus lanatus*) and herbs such as yarrow (*Achillea millefolium*).

In the central eastern region, low-intensity pig farms are common. Soils are light, sandy and free-draining; crop rotations are essential in order to retain nutrients. Typically these follow a three year cycle of potatoes, oats and rye. Cereals are still harvested using reaper-binders, with chaff kept to feed pigs during winter and tailings spread deliberately for bird species including skylarks (*Alauda arvensis*). Whilst these practices have wider environmental benefits, the main advantages for fauna

arise from the mosaic of different land uses on farms, and the largely intact nature of the landscape fabric (i.e. copses, woodland etc). Breeding birds in this area include the endangered black stork (*Ciconia nigra*).

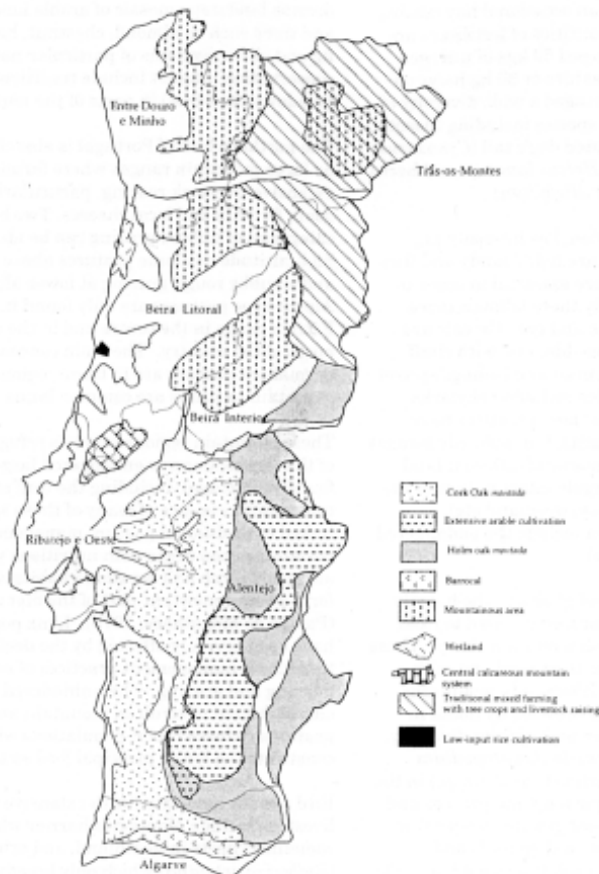
In the south east, woodland glades in the heavily forested Carpathian mountains are used to raise small flocks of hardy Polish mountain sheep. These are traditionally raised for their wool and milk, rather than meat. In the Bieszczady mountains especially, alpine pastures browsed by flocks in June and July tend to have high species diversity, with rarities such as edelweiss (*Leontopodium alpinum*) and stemless carline (*Carlina* spp.) in the sward, alongside more typical upland grasses and herbs. Farmers usually rent grazing ranges from landowners (bacias), who hire shepherds and undertake to replace any stock lost to wild animals; both wild cats (*Felis silvestris*) and lynx (*Lynx lynx*) are common. There are also a range of other wild herbivores, including chamois, red deer and roe deer (*Capreolus capreolus*).

Portugal

The most productive and intensively managed farmland is found on the coastal plain and around the main river valleys and estuaries, particularly of the river Tagus. Elsewhere, agriculture is characterised by large areas of relatively traditional, non-intensive farming. Map 5.7 shows some of the main categories of low-intensity land use and the zones within which these land uses are dominant.

In the northern interior regions of Trás-os-Montes and Beira Interior there are large areas of traditional, mostly low-intensity farming. Mixed systems are widespread, often creating a highly diverse landscape mosaic of arable land, pastures and trees such as almond, chestnut, hazel, walnut, fig and olive. Systems of particular nature conservation interest include traditional flooded meadows (lameiros) in parts of the north west.

The northern half of Portugal is also characterised by large mountain ranges where farm-



Map 6: Broad categories of low intensity land use in Portugal.

Source: derived from Vieira, 1993.

ing is mostly extensive livestock rearing, particularly sheep and goats for milk and local cheeses. Two broad categories of upland grazing can be identified: high-altitude or alpine pastures above the tree line and scrubby rough grazing at lower altitudes. Alpine-type pastures are only found in the Serra da Estrela range in the centre and in the mountainous

north of the country. The main concentrations of permanent pasture are in these regions. Many mountain pastures are common lands.

These mountain regions serve as refuges for many of the less common or endangered large mammals found in Portugal, including the wolf and lynx. The continuing presence of many of these species is linked to traditional pasture management which maintains open areas with nutritious vegetation alongside scrub and woodland habitats. Livestock form a very important part of the diet of wolves (Paixão de Magalhães, 1975). Lynx populations have been severely affected by the decline in the traditional management practices of rotational burning and grazing. The unhindered encroachment of scrub on mountain and hill pastures reduces rabbit populations which constitute the lynx's principal food source.

Bird species associated with extensive mountain livestock include Montagu's harrier which sometimes nests in heathland, and ortolan bunting (*Emberiza hortulana*) which only breeds over 800-900 metres. The latter two are linked closely with extensively grazed mountain pastures. The calcareous hills in Ribatejo e Oeste provide one of the remaining feeding grounds for the chough (*Pyrrhocorax pyrrhocorax*) in Portugal. Populations of this bird are showing signs of severe decline. This has been linked to losses of feeding grounds in this region, due to the abandonment of extensive grazing by sheep and goats in olive groves.

Low-intensity cereal cultivation covers a large proportion of the sparsely populated Alentejo in the southern half of Portugal (excluding the Algarve). Cereals are produced on long rotations, often involving three years fallow or more, creating a steppe-like habitat of great nature conservation importance, particularly for bird species such as the

Table 5.7: Main types of low-intensity farming in Portugal and their distribution

Livestock raising in upland and mountain areas	Based on meadows and grazing of rough pastures and forests in central mountain range (Serra da Estrela) and northern mountains (Ger?s, Minho).
Livestock raising in Mediterranean regions	Interior regions in the north and south.
Livestock raising in wooded pastures	Montados, particularly in the Alentejo.
Dryland arable cultivation	Especially in interior regions of Alentejo and Trás-os-Montes
Low-input rice cultivation	Remnants of traditional systems, e.g. lower reaches of Mondego river in the centre.
Permanent crops	Olive groves widespread, but concentrated in interior. Carobs and other fruit trees in Algarve and Trás-os-Montes.
Mixed Mediterranean cropping	Many parts of the country, particularly in Trás-os-Montes.
Small scale traditional mixed farming	Minifundia in centre and north.

great bustard (*Otis tarda*). Cereal steppes are estimated to cover some 700,000 hectares of Alentejo (Vieira et al., 1993). Particularly important areas include Castro Verde, which is an open-field landscape, Ourique and Almodovar, both of which have scattered trees.

Large areas of Alentejo are dominated by wooded pastures (with some occasional cultivation) known as montado. These are similar to the Spanish dehesa. Such systems occupied a total area of 1,024,000 hectares in 1989 (DGF, 1992). Although montados are predominantly located in the southern half of Portugal, they are also found in the central region and the interior of the far north. Montados are valuable in conservation terms and are associated with several endemic, rare and threatened species such as the black-winged kite (*Elanus caeruleus*) and the Iberian imperial eagle (*Aquila heliaca adalberti*) (Palma et al., 1985). Overwintering bird populations such as the crane (*Grus grus*), whose diet includes the acorns from the holm oak, and the black stork (*Ciconia negra*) also use the montados.

The coastal charneca is a large, undulating wetland area along the Atlantic coast of Alentejo, with poor sandy soils and a combination of rough grazing and cork and pine woods on slopes. Traditional management was based on extensive grazing of cattle and goats. The area is important avifauna (e.g. white stork, *Ciconia ciconia*) and is designated as a SPA under the birds Directive.

In the Algarve in the far south there is mixed cultivation of almonds, carobs, olives, pistachio and figs with winter cereals and pasture. Originally these systems were distributed throughout the coastal

plain and in the barrocal, an intermediate, hilly zone that lies to the north. Today, as a result of the expansion of intensive, irrigated horticulture and citrus crops, non-irrigated mixed fruit farms are far less common in the littoral zone. Large parts of the barrocal area are classified as a "CORINE" Biotope. Fruit orchards usually are surrounded by areas with natural scrub vegetation. This provides shelter for wildlife while orchards provide food, particularly for small mammals and birds. Birds of prey that nest in the hills of the Algarvian Serra often depend on the Barrocal area for hunting. Examples include Bonelli's eagle (*Hieraaetus fasciatus*) and the increasingly rare Peregrine falcon (*Falco peregrinus*) (SNPRCN, 1992). The barrocal is also an important stopping point for migrating birds, especially passerines.

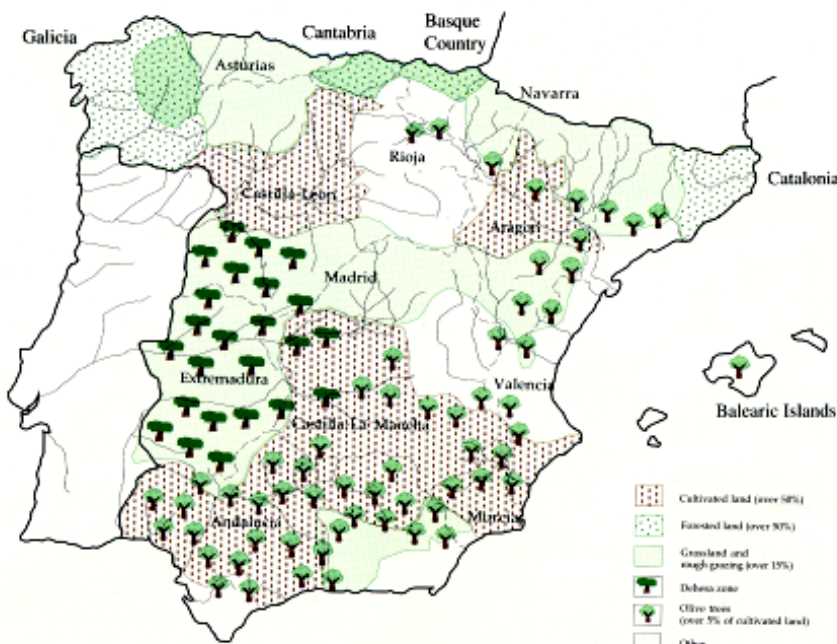
Traditional olive groves tend to be concentrated in the interior regions of Trás-os-Montes, Beira Interior and the Alentejo as well as in the calcareous mountain ranges of Serra d'Aire and Candeeiros in the Ribatejo e Oeste region (ISA and INIP, 1991). The conservation value of older, traditionally managed olive groves is believed to be high. They provide a relatively undisturbed habitat and rich food source for wildlife, particularly birds, including roller, Scops owl, woodchat shrike (*Lanius senator*) and short-toed treecreeper (*Certhia brachydactyla*).

Spain

A simple analysis of national statistics and maps indicates the presence of very large areas of essentially low-intensity agricultural land use, probably amounting to over 20 million hectares. Grazing land of various sorts covers about 14 million hectares, including incidental grazing on abandoned arable land, wooded pastures known as dehesas and almost five million hectares of scrub. A very large proportion consists of semi-natural vegetation which has not been improved for agricultural production. The general distribution of some of the dominant agricultural land uses is shown in Map 5.8.1.

Low-intensity livestock systems are responsible for creating and maintaining a great range of habitats. Very generally, livestock systems of nature conservation interest can be categorised as follows.

- Dehesas: essentially a low-intensity Mediterranean pastoral system with some arable cultivation, principally for the production of animal feed. Complementary silviculture at a



Map 9: Approximate distribution of the main agricultural land uses in Spain.

Source: Montserrat and Fillat, 1990.

density varying between open woodland and scattered individual trees is an integral part of traditional *dehesa* management. Where intact, the system maintains a diverse mosaic of habitats, including species-rich dry grassland, open woodland and scrub. See Map 5.8.1.

- Mountain pastoral systems, which are found at higher altitudes in the north, centre and south. Conditions and farming systems vary considerably both within and between these regions, as does the range of habitats (alpine pastures, hay meadows, heathland and scrub, grazed woodlands, etc.). The main mountain areas are shown in Map 5.8.2.
- Grazed steppes: although large areas of steppeland are under low-intensity arable cultivation, poorer land is often grazed by sheep and goats. A similar combination is found on páramos, usually differentiated from other steppe areas by their location on high plateaux and distinctive vegetation, consisting predominantly of coarse grasses and scrub with scattered juniper woods. Certain grazed steppes, such as La Serena in Extremadura, are of great importance for the conservation of birds such as Montagu's harrier, great and little bustard, stone curlew and sandgrouse (*Pterocles* spp.). Map 5.8.3 shows the broad distribution of grass and shrub steppes.
- Transhumance and more local *trasterminancia*, in which traditional livestock breeds are moved between all four of the above land types according to the season. Although much reduced from historic levels, transhumance still has an important influence on the way in which these types of land cover are managed. In particular,

it is essential to the continued maintenance of high mountain pastures. The main drovers roads and summer grazing areas are shown in Map 5.8.2. Local livestock movements are common in many parts of the country.

Dry, non-irrigated arable land covers almost 13 million hectares, or over 85 per cent of the total arable area. Around four million hectares of non-irrigated arable land are left fallow annually suggesting that dryland cultivation is predominantly of low intensity. The proportion of arable land left fallow varies considerably from one region to another.

Currently, somewhere between four and nine million hectares of arable cultivation are estimated to be under a form of low-intensity management and so of potential nature conservation interest (M.A. Naveso, personal communication). Large areas are semi-arid regions and are similar to steppeland in habitat terms, particularly for birds. Many steppe areas which historically were characterised by natural (or semi-natural) vegetation now include considerable areas of cultivation. Where this is less intensive in nature, particularly involving fallows, important populations of steppe bird species are still found.

Olives cover over two million hectares and dominate the landscape in parts of the south (see Map 5.8.1). The national statistics do not reveal what proportion of this area is under low-intensity management, although they indicate that about 120,000 hectares are irrigated and therefore probably under more intensive forms of cultivation. In fact, many non-irrigated olive plantations have also come under relatively intensive management since the 1970s. For example, pesticide use may be high and the land is often ploughed several times a year in order to remove competitive vegetation.

Nevertheless, there are many remaining areas with plantations under more traditional, low-intensity management. Under such conditions, olive trees support a high diversity and density of insect life. This and the fruit, which is of a very high energy value, provide an abundant supply of food for birds and mammals (Parra, 1990). The trunks of older trees develop hollows which are used by birds as well as by other fauna, such as the genet (*Genetta genetta*). Olive plantations are an important food source for millions of wintering passerines. Migrants from north and central Europe include chiffchaff (*Phylloscopus collybita*), song thrush (*Turdus philomelos*), black-cap (*Sylvia atricapilla*) and rufous bush chat (*Cercotrichas galactotes*) amongst many others.



Map 10: Main drovers' roads (canadas) in Spain, showing mountain grazing areas.
Source: La Canada, March 1994.



Map 11: Distribution of grass and shrub steppes in Spain.
Source: Suarez et al 1992.

There are almost 1.5 million hectares of vineyards distributed throughout Mediterranean Spain. During the course of this study, no written information was found on the intensity of vine cultivation in Spain, or on the nature conservation value of this land use. However, the management of vineyards is reported to vary considerably from those cultivated intensively to others managed with few inputs

of pesticides and fertilisers (F.Suárez, personal communication). Low-intensity vineyards are typically found on poorer soils, often in a mosaic with other dryland crops, such as cereals and olives.

Typical of many parts of central and southern Spain is a dryland mosaic of arable crops, vines, olives and other permanent crops, all of which may be grazed or browsed by livestock at certain times of the year. Sometimes traditional inter-cropping is still practised, for example vines with olives. Usually these production systems usually are considerably less intensive than more rationalised agricultural land uses involving a single type of crop. Although they may not be of interest for the conservation of specific endangered species (as are, for example, steppelands), nevertheless they continue to support a considerable variety of wildlife, such as hares, partridges, small mammals and numerous raptors.

Apple orchards are typical of the wet northern regions, particularly Asturias and Cantabria and to a lesser extent Galicia and Cataluña. Traditional orchards, combining trees with semi-natural pasture, cover a small area. In Asturias such orchards form part of a very mixed countryside of meadows, rough grazing, vegetable plots and various types of fruit tree.

Table 5.8: Main types of low-intensity farming in Spain and their distribution

Livestock raising in upland and mountain areas	North (Pyrenees and Cantabria), the Central System (Guadarrama, Gredos), the Iberian System (Soria, Teruel) and the Bética ranges in the south (Cazorla, Sierra Nevada, Sierra Morena). Rough grazing in drier areas of mountain chains (central Pyrenees, southern side of Cantabria, etc.) Meadows more common in wetter areas, such as the north side of Cantabrian mountains and wetter parts of the Pyrenees (west), Guadarrama and Gredos. Farms often small-scale and barely viable
Livestock raising in Mediterranean regions	Large areas throughout Mediterranean Spain
Livestock raising in wooded pastures	Around 3.6 million hectares of grazed open woodland (dehesa), mostly in the west and south-west
Transhumance	Summer pastures: Pyrenees (sheep from Ebro lowlands, some cattle from neighbouring valleys), León (sheep from neighbouring irrigated areas and some from Extremadura, some cattle and horses from Asturias and Cantabria), Gredos (cattle, some sheep and goats, to neighbouring lowlands of Toledo and Extremadura), Soria (to Extremadura, Ciudad Real) and several other areas (e.g. Sanabria)
Dryland arable cultivation	Large areas especially in Castilla y León, Aragón, Extremadura, Andalucía, Almería. Arable land with dispersed tree cover in parts of
Low-input rice cultivation	Some organic rice production in Cataluña.
Permanent crops	Orchards in Asturias, parts of Cantabria and Galicia. Olives throughout Mediterranean Spain, especially smaller groves often found adjacent to villages (usually semi-abandoned). Vineyards on less fertile soils or sites with poor access/poor farm structures.
Mixed Mediterranean cropping	Mosaics of vines, olives, cereals and other tree crops in areas outside the most intensive arable regions.
Small scale traditional mixed farming	Small-scale mixed farming in Galicia, parts of Asturias, north of León.



Traditional Avilena Negra cattle during annual transhumance to the Gredos mountains, Spain.

This hardy breed can walk up to 40 km per day.

Credit: C. Perez

Hedgerows are characteristic of this region, consisting of species such as hazel, willows, hawthorn, holly, etc., harbouring many of the species characteristic of natural woodlands of the region which, from their hedgerow base, are able to colonise or feed in the orchards (Parra, 1990). Bird species of conservation interest include little owl, wryneck (*Jynx torquilla*), green woodpecker (*Picus viridis*), black woodpecker (*Dryocopus martius*) woodlark (*Lullula arborea*) and nightingale (*Luscinia megarhynchos*).

Readily available data concerning the nature conservation value of farmland is limited to specific sites, such as cultivated steppe areas identified as important for bird conservation and certain areas of species-rich grassland which have been studied in detail. The most comprehensive national survey currently available of sites of conservation interest in Spain is the IBA inventory compiled by the ICBP. Spanish IBAs cover 9,374,019 hectares; some 80 per cent is estimated to be some sort of farmland (M.A. Naveso, personal communication). Leaving aside marine sites, the total IBAs break down as follows (de Juana, 1990):

- wetlands 55 IBAs: 577,864 ha
- Cantabrian and Pyrenean mountains 25 IBAs: 1,054,700 ha
- Mediterranean mountains 103 IBAs: 4,517,300 ha
- wooded Mediterranean plains 23 IBAs: 809,600 ha
- steppe (including cultivated steppe) 63 IBAs: 2,388,425 ha

United Kingdom

Farming in the lowlands is predominantly intensive. However, some small patches of less-intensively managed land have survived, such as grazing marshes, chalk grassland and isolated hay meadows and orchards. Often these are

under special management regimes within protected areas or ESAs. Management of unimproved lowland grass as haymeadow is now confined to only a few areas of the UK, such as parts of County Fermanagh in Northern Ireland. There are a few important grazing marshes at scattered sites around the coast, for example in North Kent. Some dune systems in the littoral zone have exceptional conservation value also and in places are maintained by low-intensity farming, for example machair farmland based on calcium-rich coastal sands, used for growth of hay, winter grazing and arable cropping on a small scale.

However, low-intensity arable regimes are no longer part of the lowland farmed landscape, except for a very small number of fields which have never received fertiliser and an expanding number of organic holdings (roughly 29,000 hectares are managed this way in the UK (Soil Association 1994)). There are a few orchards which are still traditionally managed, concentrated in the west of England in Herefordshire, Devon and Somerset.

The main areas of low-intensity farming are in the uplands of the north and north-west. These are illustrated in Map 5.9. This was produced using data from a Land Cover Map of Britain, based on satellite images of the country for 1989-1991. Eight land cover classes out of a total of 17 were used to predict the presence of "low-intensity agricultural land", based on the type of vegetation present.

Map 5.9 illustrates a predicted distribution of low-intensity agricultural land. Since the data are based purely on general vegetation characteristics, they do not provide any absolute measurement of management intensity, or take account of the condition of vegetation. In practice, it is known that relatively intensive forms of agricultural management are being practised within some

of these areas, particularly mid Wales, large parts of northern England and southern Scotland. This impression is reinforced by the average stocking density statistics which were obtained for these areas. It should also be mentioned that large tracts of northern Scotland are managed mainly for game, notably red deer and red grouse (*Lagopus lagopus*), or as conifer plantations. Consequently, the real area of less intensive farming will be substantially smaller than the map suggests.

Crofting and low-intensity sheep raising are the main surviving low-intensity systems. Crofting is small-scale, part-time farming, found on the Inner Hebrides and the north of Scotland. A typical holding has a few hectares of better land on which fodder crops are grown and a much larger area of acidic grass and/or heather moor, often owned in common, used for sheep and cattle grazing. The resulting mosaic of managed and semi-natural vegetation has high conservation value.

Over large areas of the uplands, low-intensity raising of sheep is still quite common. Usually flocks, possibly augmented by a small suckler cow herd for beef production, are ranged over an extensive area of mostly semi-natural pasture. In valleys and on lower slopes, enclosed grass is used for grazing, chiefly at lambing, and for hay or silage.

The uplands contain large areas extent of semi-natural vegetation of conservation interest, including some features of international significance. Tracts of blanket bog, heather moor and rough grassland are typical of upland landscapes, with moss heaths in alpine areas (e.g. Drumochter Hills, central Scotland).

The extensive areas of upland acidic grassland are of great environmental value. Species occur in community relationships not found elsewhere in Europe (Ratcliffe and Thompson 1988). In England, typical upland hay meadow flora in-



Map 12: Map showing those 1 km squares which contain (>20% cover of moorland/grassland heath, or >20% cover of open canopy shrub heath, or >20% cover of dense shrub heath, or >20% cover of bogs and flushes) in association with (<10% suburban and <5% urban and <5% tilled and <50% managed grasslands). Redrawn from output from ITE/DoE Land Cover Map (which is based on data from satellite imagery).

Table 5.9: Main types of low-intensity farming in the UK and their distribution

Livestock raising in upland and mountain areas	Large tracts of the uplands, particularly in the “Severely Disadvantaged” LFA. Mainly sheep, some beef cattle. Farms with only rough and common grazing, generally producing breeding stock and lambs or calves for fattening on more productive land. In more productive areas of the uplands (i.e. “Disadvantaged Areas” of the LFA) sheep, beef and some dairying.
Livestock raising in temperate lowland regions	Isolated patches, including wetlands (parts of Somerset, east Anglia and other coastal areas) and chalk downlands. Mostly remnants of traditional systems. Sheep, beef and dairying
Permanent crops	Remaining “traditional” apple and pear orchards in some southern and western counties of England, including Somerset, Herefordshire, Devon and Kent
Small scale traditional mixed farming	Crofting in the highlands and islands of Scotland, particularly on coasts (e.g. machair)



North country Cheviot sheep in the Inner Hebrides

Credit: D. Stround

clude species such as devil's bit scabious (*Succisa pratensis*), wood cranesbill (*Geranium sylvaticum*), marsh marigold (*Caltha palustris*) and bugle (*Ajuga reptans*). Meadows and rough pasture support a very wide range of associated fauna. Five bird species including the golden eagle (*Aquila chrysaetos*), red grouse, peregrine

falcon and raven (*Corvus corax*) attain higher concentrations in the uplands than in any other European country. There are several sites in this zone requiring protection under the birds and habitats Directives. The habitats of many of these species bear some relationship to the distribution of agricultural LFAs in the UK.

CHAPTER 6:

CHANGES AFFECTING LOW INTENSITY FARMING SYSTEMS



The traditional Iberian pig is becoming increasingly rare in the management of Spanish *dehesas*

Credit: G. Beaufloy

Types of information available

Most information on the changes affecting low-intensity farming falls into two main categories. First, broad changes in land use and farm type at a national, regional or provincial level, which are recorded to some degree in official statistics almost everywhere in Europe. Time series data can be used to identify changes such as the relative areas of arable land and pasture (and vice versa) or the development of natural woodland, indicating that farmland may have been abandoned. Agricultural statistics on the numbers and distribution of different types of livestock may illuminate developments such as changes in the type of livestock held on farms, the conversion of permanent pasture to temporary grassland or forage crops, such as maize, and the conversion of dry arable land to irrigation.

Secondly, there are changes in specific farming practices, which taken individually do not constitute a complete alteration of the farming system or land use, for example changes in fertiliser use or animal stocking densities, or a switch from hay to silage making. Information on these sorts of change is much more difficult to obtain at a sufficiently focused geographical level. Some specific areas and

systems have been the subject of research projects carried out by universities and other organisations. However, most of the information which is available is out of date, making recent developments difficult to identify.

The dynamics of farming systems

The evolution from one farming system to another may take the form of a sudden transformation, or may be the result of gradual changes in individual practices. For example, the conversion of a dryland arable system to irrigated agriculture constitutes a fundamental change. On the other hand, a low-intensity, traditional dryland arable system may become more intensive through a gradual increase in fertiliser use, a corresponding reduction in the proportion of land left fallow, the introduction of modern cereal varieties, etc.

It is not always useful to summarise change in terms of intensification or extensification. The national studies reveal a range of different patterns of development. Many of the farming systems identified are a mixture of traditional, low-intensity and modern, intensive practices. There are arable systems which combine the use of fallows and high in-

puts of fertiliser and livestock systems involving both transhumance and the significant use of compound feeds. Furthermore, individual practices may alter from year to year in response to changes in markets, technology and wider socio-economic developments.

The farming systems discussed in the nine national studies have changed considerably over the past 20 years or more and are continuing to evolve. In many cases, the origins of contemporary low-intensity systems can be found in a broadly similar but more traditional system, as in the case of Scottish crofting. However, some low-intensity systems have displaced an entirely different agricultural land use, for example specialised livestock raising has replaced mixed arable-livestock systems in parts of the French Pyrenees.

Broad patterns of change in farming systems and land use

Historic data show that the total area of farmland in European countries tends to fluctuate over time. The relative areas of different agricultural land uses, such as arable or grazing land, also ebb and flow. Sometimes a longer term perspective assists analysis of more recent developments. Although the area of permanent grassland in France has fallen considerably since the 1970s, it is still much higher than it was in 1908 for example.

Important factors influencing change include socio-economic development, the markets for agricultural products, crop profitability, the labour and technology available and the policy framework within which agriculture takes place. Hungary and Poland provide extreme examples of the sensitivity of farming to economic conditions and government policies. The collapse of the COMECON trade bloc, together with the withdrawal of grants and subsidies to agriculture, has had dramatic effects on land use in both countries. In Poland, since 1989, the amount of fallowed land has risen from one to nine per cent of the total arable area (about 1.3 million hectares were fallowed in 1993). There have been drastic reductions in the use of inputs, particularly agrochemicals. For example, on arable land, the average application of nitrate fertiliser fell from 196 kilograms per hectare in 1989 to 62 kilograms in 1992 (Klepacki, 1993). Livestock numbers have fallen sharply too.

The pattern of changing agricultural use (on less intensively managed land) over the past 40 years varies greatly depending on the region, although two broad trends stand out:

- on potentially productive land (and where farm structures allow), there has been a widespread process of conversion to more intensive management since the 1940s, often with an expansion of arable land at the expense of perma-

nent grassland, wetlands and woodland and an intensification of grassland management. In some cases, public investment in irrigation, drainage, etc., has made this possible;

- in more marginal farming areas with physical or socio-economic obstacles to modern agriculture (steep slopes, small terraces, wet areas without drainage, remote mountain regions) arable land and mixed systems have been abandoned on a large scale, often to be replaced by specialised livestock systems, plantation forestry or natural succession;
- in many of those areas which have remained under more extensive forms of management, practices have been adjusted to changing conditions, particularly a lower use of labour, often leading to a simplification of traditional systems, such as a tendency to “ranch” permanent pasture.

For example in Britain, there has been an expansion of arable land at the expense of grassland in recent decades, whilst much permanent grassland has been reseeded and otherwise “improved” for agricultural production. The area of grassland in England and Wales fell from 7.8 million hectares to 4.8 million between 1937 and 1984 (Fuller, 1987). The area of species rich grassland has been reduced even more dramatically. Data from English Nature and the Countryside Council for Wales suggest that the area of unimproved grassland in the lowlands of these two countries is now less than 100,000 hectares.

A similar pattern of expanding arable land and declining permanent grassland can be seen in the more productive areas of France, Spain and Italy, where hundreds of thousands of hectares of grassland have been cleared for cultivation. In Spain, the concentration of livestock on more productive land has added to the loss of extensive grazing areas. From the data given in Table 6, this trend of gradual or more rapid decline in the area of permanent grassland appears to be common to several European countries.

However, regional changes can be more revealing. In France, the biggest decline between 1970 and 1985 was recorded in the regions of the north west, where over 50 per cent of permanent grassland was lost. By contrast, some regions less well suited to intensification, such as the Auvergne, experienced an increase in permanent grassland. Nationally, the only types of forage land to increase during the 1970s and 1980s was maize and rough grazing, which seems to indicate a process of rationalisation in land use, with intensification on more productive land and extensification (or abandonment of cultivation) on poorer land. Sizeable areas have been converted from permanent pasture to forage maize in recent years, a process ac-

celerated by incentives under the CAP.

In many marginal areas, particularly in the mountains, there has been a dramatic decline in the arable area as largely self-sufficient rural societies have collapsed or contracted and abandoned subsistence cultivation. This process has been taking place for many decades in mountain areas of southern France, parts of northern Greece, Italy and Spain. Portugal is one of the few countries where data is readily available concerning land abandonment; in the 1989 farm census, over 245,000 hectares of farmland were classified as recently abandoned, with clear concentrations in interior regions.

One result of the contraction of arable cultivation in less-favoured areas has been the development of large areas of grazing land and natural forest on abandoned farmland. However, this has not been on a sufficient scale to balance the losses resulting from the ploughing up of more productive grassland and the abandonment of grazing in many marginal areas.

These land use changes have been accompanied, and partly driven, by changes in farming systems. Many previously low-intensity, often mixed systems have developed into, or been replaced by, more intensive and more specialised systems. In particular, intensive arable and dairy production has developed in more productive areas. At the same time, certain new low-intensity systems have emerged, particularly specialist livestock raising on previously cultivated or mixed farmland. For example, livestock based on meadows and rough grazing has replaced mixed arable and livestock systems in many parts of the Pyrenees (in Spain and France) and in the Cantabrian mountains. In the central French Pyrenees, some areas which previously were a relatively intensively managed mosaic of meadows, pastures and arable plots are now used for extensive grazing (Balent and Gibon, undated). In Hungary, it seems likely that large areas of arable land will come under low-intensity management in future, partly because of a sharp reduction in government support.

A mixed system with arable cultivation near to the villages and seasonal grazing by a variety of livestock on cultivated pastures and both lowland and higher altitude common land was once widespread. In Navarra and Huesca in the Spanish Pyrenees it has been replaced by more specialised livestock systems based on meadows and some seasonal grazing. In places, new meadows have been created through natural colonisation from woodlands and hedgerows; unless they are intensively managed, these meadows usually are of high floral diversity (Fillat et al, 1993).

The extent of abandonment in marginal regions varies greatly, even between neighbouring valleys of a region such as the Pyrenees. Comprehensive

and sudden change is unusual but can occur; several valleys have been flooded to make new reservoirs, particularly in the Mediterranean. More common is a gradual process of marginalisation leading to progressive abandonment. In the intermediate stages traditional systems may be modified and simplified to permit management by an elderly farmer or on a part time basis. The development of tourism may help to maintain the population level, but cause people to abandon farming. Poor rural infrastructure is an important factor in the decline of mountain livestock systems in some regions, including parts of Spain. In northern Italy, there is a well-organised system run by the *Comunità Montana*, which maintains the infrastructure and builds roads. In France there is also a comprehensive system of support for mountain farmers.

Changes affecting arable systems

The arable systems identified in the study take many different forms. In some isolated areas on small farms, arable cultivation is still very traditional, involving animal traction and minimal use of external inputs. However, most systems operating on a larger scale have undergone some modernisation, particularly in the form of mechanisation but also in the use of artificial fertilisers and pesticides. Apart from isolated exceptions and a growing number of organic farms, low-intensity arable systems are confined mainly to certain regions of southern Europe, most notably in Spain, Portugal and Italy. Much of the following discussion refers to Spain, which has the largest area of extensive arable land in the European Union.

Extensive arable systems produce very low yields per hectare. However, whereas low-yielding livestock systems often make use of large areas of land, low-intensity arable farms are often quite small. Even larger holdings in Spain and Portugal are relatively small compared with their competitors in southern England and the Paris basin. In many more arid regions, a proportion of the holding is usually left fallow each year, thus further reducing the output from the total farm area. Consequently, there is considerable pressure on many of these farms to achieve higher crop yields. Unless they can increase their holding size.

Irrigation makes possible a far greater use of fertiliser and more intensive cropping. Fallows generally become unnecessary. Yields can be increased from two tonnes per hectare to four, six or more tonnes. Since 1973, 1.4 million hectares of agricultural land in Spain have been converted to irrigation. If irrigation is not available then the most straightforward means of increasing yield is to apply artificial fertiliser, particularly nitrogen and phosphate. Fallowing as a means of maintaining fertility becomes less necessary. One indicator of the overall intensification of arable cultivation which has taken place in Spain since the 1970s is the decline

in the proportion of land left fallow each year. The national proportion of arable land left fallow declined from over half in 1973 to less than 40 per cent in 1990. Productivity per hectare has increased too; average wheat yields more than doubled between the late 1960s and the late 1980s; total output changed very little, even though the area of wheat almost halved during the same period.

Dryland arable production in Spain has been intensified significantly in many areas over recent years, particularly with the widespread introduction of modern varieties and inorganic fertilisers. Important changes include earlier harvest dates and the use of herbicides to control weeds and insecticides to control pests such as locusts. At the same time, traditional varied rotations, using legumes as a fertilising break crop, have tended to be abandoned in favour of simple cereal-fallow-cereal rotations, with synthetic fertilisers and pesticides providing the fertility and controlling weeds. These changes in practice have been accompanied by an expansion of crops such as sugar-beet, which require high levels of pesticides and sunflowers.

The continued viability of low-yielding dryland cultivation seems to be seriously in doubt, other than for very large holdings; for example, in a brief study of dryland cultivation in Aragón, the minimum viable size for a holding yielding the average 1,200-1,300 kg/ha/year of barley was put at over 300 hectares (Cavero Cano, 1988). Very few holdings currently reach this size. On many holdings in the more arid parts of Aragón, average yields fall as low as 800 kg and below, requiring even larger land areas to be viable.

Changes affecting permanent crops

The range of low-input permanent crops in Europe is large and includes tree crops, the most common being olives around the Mediterranean basin, and other cultivars such as vines. This form of production has undergone considerable change because of poor economic returns, high labour costs associated with activities such as pruning, replanting and general silviculture, and difficulty in mechanising low-input production techniques. These underlying economic trends have been reinforced by EU and national grants for removing old permanent crops. Between 1986 and 1992, CAP subsidies aided the uprooting of 28,095 hectares of old olive plantations in Portugal, while almost 8,000 hectares were planted with new trees.

In Central Europe, the decline of traditional orchards has been notable. For example, in Hungary on the river Tisza old varieties of plum, apple, pear and apricot are grown in dispersed orchards, with hay crops taken from underlying grass avenues. In the past, most of the fruit was dried or distilled for alcoholic beverages. However, markets for these products have dwindled and remaining orchards are

under threat of abandonment, intensification or felling and replanting with fast growing conifer species. In Bács-Kiskun, vines and fruit trees are often planted together; old apricot, sour cherry and plum varieties are typical. There has been little investment in these vineyards and most are stocked with traditional varieties which are resistant to fungi, but of low productivity. They are not suitable for commercial wine production and a recent trend has been to grub them up and replant with modern rootstocks.

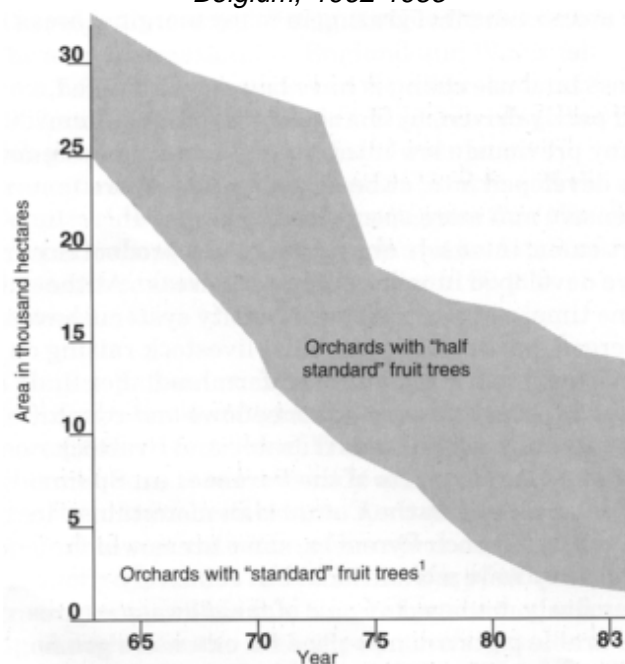
Figure 3 shows the overall decline in the area of orchards in Belgium between 1965 and 1983 and the dramatic switch from more traditional to modern varieties.

Changes affecting livestock systems

Most extensive livestock systems have undergone considerable change over the past forty or fifty years. In many cases, individual practices have been intensified in order to increase production, even though the system may continue to appear essentially extensive. Some of these changes are reviewed below.

In a few cases, there are signs of extensification in recent years; this is often seen as a first step towards abandonment, but may in some cases be a rational response to changing social, economic and policy conditions. A common tendency affecting many systems seems to be one of simplification or rationalisation, under which traditional ways of managing and exploiting semi-natural resources are abandoned in favour of a simpler and less labour-intensive system, perhaps depending more on machinery and purchased inputs.

Figure 3: Change in the area of fruit orchards in Belgium, 1962-1983



Source: Noirfalise, 1989

Livestock Numbers

There have been significant changes in the numbers and distribution of livestock in most countries although not all in the same direction. Over the last decade there have been very substantial increases in the number of sheep in many EU states, particularly in the UK, Spain and, most of all, in Ireland, where sheep numbers almost tripled in eight years (1982-1990) (see Table 7).

Table 7: Changes in sheep numbers in selected Member States (1973-1993)

	1973	1980	1993
France	11.91	12.20	9.95
Ireland	2.84	2.36	6.10
Italy	7.81	9.11	11.29
Spain	16.24	c16.40	24.50
UK	20.19	21.61	29.83
EU	43.07	55.22	99.26

Sources: EUROSTAT various years; Agra Europe 12.11.93, 11.2.94

In these three countries and elsewhere in the EU such as parts of Greece, this increase has been stimulated by EU livestock headage payments, provided under the CAP sheepmeat regime. In more marginal agricultural areas benefiting from the LFA designation, additional subsidies can provide an added incentive to increase stocking levels. For example, in the UK Disadvantaged LFA, sheep numbers rose by 79 per cent between 1985 and 1992 (House of Commons, 1993). In Spain, between 1985-1989, the number of sheep and goats rose by 34 per cent and 77 per cent respectively. Only in France have numbers remained relatively stable. Cattle numbers have been more stable than those for sheep in most countries, with small increases in Spain and Ireland and reductions in France, UK and Italy.

In the Hungarian steppes, on the other hand, sheep numbers are reported to be declining due to a crisis in this production sector and there has been a drastic decline in Poland where the size of the national flock fell by 41 per cent in 1992, mainly as a result of severe drought and feed shortages. In the same year, numbers of breeding cows fell by six per cent and the total was reduced by 19 per cent (Agra Europe, 1993).

The patterns of change vary within countries. In Spain, many upland and mountain regions have experienced an almost continual decline in sheep numbers over several decades. With the exception of a few mountain areas, the growth in sheep numbers since EU accession has been mainly in the plains where they are fed on residues of arable and horticultural crops and other sources of fod-

der, often in irrigated areas. In many Spanish extensive livestock areas, there has been a tendency for farmers to switch from sheep, requiring shepherding, to cattle, which require less labour. Cattle numbers have increased in some areas of traditionally extensive grazing, such as the *dehesas* of western Spain and some mountain pastures in León and the Pyrenees, sometimes to the point of causing local overgrazing.

In France there has been some rationalisation in the distribution of livestock, with farmers in certain regions tending to specialise in particular sectors, such as dairy, beef cattle or dairy sheep for cheese production. Following the introduction of milk quotas in 1984, there was a marked shift away from dairy cattle towards suckler beef cattle, especially in traditional beef-producing areas e.g. Limousin, Bourgogne. Dairying has declined sharply in many mountainous regions.

The use of work animals on farms has been subject to a rapid decline throughout Europe since the 1960s. This has caused a considerable reduction in total livestock numbers in most regions. However, on mixed low input farms in Poland and Hungary, the use of horses and some cattle for traction is still common.

Livestock types

Many systems traditionally involved a variety of livestock types which were fed on a range of different sources of grazing, browsing and other forage. These relatively complex systems were labour intensive but provided a range of different products and made full use of locally available resources. Many have experienced a reduction in variety and now concentrate on one or two types of livestock. For example, Scottish crofting now involves mostly sheep, rather than a mix of cattle and sheep. Similarly, under the traditional *dehesa* system in Spain, each farm kept pigs, sheep, goats and some cattle; the recent tendency is to concentrate on beef or sheep production. Many mountain and upland systems in Spain also have gone this way, with cattle often replacing sheep. Over the last decade in the uplands of the UK, the reverse has happened. Here, beef and dairy production incurs higher variable costs than sheep rearing. As a result, there has been a sharp decline in cattle numbers and increasing specialisation in sheep raising.

Livestock breeds

In most of the more productive agricultural regions of Europe, local livestock breeds have been improved by selected crossing or displaced by a limited number of highly bred types, such as Friesian cattle for dairy production and Charolais or Limousin for beef. However, in certain regions, local breeds have survived, particularly where physical conditions and readily available sources of forage require a hardy type of stock. Generally, the

Table 8: Comparison of numbers of cattle of various breeds in Spain 1955-1986 (many lesser native breeds have not been included)

Breed	1955	1970	1986
Friesian	338,392	667,559	1,374,600
Swiss Brown	103,662	135,944	193,575
Charolais	-	3,669	21,817
Rubia Gallega (typical Galician breed)	311,202	363,701	188,944
Asturiana	62,583	74,752	37,569
Retinta (a breed typical of the dehesas)	39,056	111,897	137,331
Other native breeds	729,884	231,396	9,951

Source: Elaborated from MAPA, 1989.

modern, highly productive breeds have more exacting requirements in terms of feed and management and are not well-suited to harsh physical conditions, such as extremes of cold and heat and grazing at high altitudes or in very wet conditions. Where local breeds have survived, these often are associated with low-intensity systems. However, the majority of farms with extensive grazing have switched to more productive breeds.

In each of the study countries, there are examples of traditional types of animal which have dwindled and now have the status of rare breeds. For example in Hungary, once widespread sheep breeds such as the Racka, are now found only on isolated farms and increasingly, one crossbreed, the Fesus-merino, dominates production. In Italy, in 1993, the national breeding herd of the Montana cow numbered only 61.

In Spain, local and regional breeds of all livestock types are still widely used. However, many are in serious decline and are subject to crossing with more productive breeds to produce animals for slaughter. As a result, pure breeds of all types of livestock are increasingly rare with pure examples of many local breeds reported to be limited to a handful of herds or flocks (e.g. merino sheep, Blanca Cacereña cattle and many others) (J.Serna, personal communication).

During the 1970s and 1980s, there was a widespread trend in Spain (encouraged by the Ministry of Agriculture) to replace traditional cattle with foreign cattle, particularly Swiss Brown and, later, Friesians. Table 8 illustrates the massive increase in recent decades in the numbers of cattle of foreign breeds, especially Friesians, and the decline of various native breeds. However, more recently there have been signs of a tentative move back to traditional local breeds, particularly in mountain regions and other areas with harsh conditions. For example, Friesians have been found to be unsuitable for grazing at higher altitudes in Cantabria. The cattle transhumance system based in the

Gredos mountains uses the well-adapted and hardy Avileña Negra breed. The Retinta, a breed typical of the dehesa region, has increased in number. Some farmers appear disillusioned with systems based on imported breeds which have failed to achieve the economic results that were hoped for and there may be considerable scope for improving the productivity of traditional breeds without losing their hardy characteristics; little work has been done in this area.

A few livestock systems involving pure local or specialist breeds were identified in the national studies. Where these have survived, they tend to be in specific areas under a particular system of land tenure and management, such as National Parks. Notable examples include the raising of Maremmana cattle in Italy and grey cattle (Magyar Szunke) in Hungary.

Grassland management and grazing patterns

Both grassland management and grazing have been intensified on many farms in recent decades. There is a widespread tendency towards making silage rather than hay, both to the increase productivity and to reduce the hazards of drying hay in the field in areas with high rainfall. Many of the changes involved in the intensification process are closely interrelated. Thus, silage production is associated with a higher use of nitrogen fertiliser and earlier and more frequent mowing; increased stocking levels usually are achieved through the agricultural improvement of grassland and/or the use of supplementary feeds.

Many essentially low-intensity systems have intensified production on part of the holding, particularly on more fertile soils or in fields closer to the farm, whilst other land has remained under a more extensive regime. For example, in the north Pennines in England, farms often include some intensively managed silage meadows in valley bottoms. However, pastures further from the farm on the valley sides still tend to be under extensive

management, as are the rough grazing and moors on the hill.

On the other hand, there are signs of an intensification of management practices in some livestock areas. For example, in an area of the Picos de Europa in Cantabria, some farmers seem to be reducing their management of fields furthest from the farm. Whereas previously these might have been mown for hay and possibly irrigated using a traditional flood system, the tendency now is to use such land only for low-intensity grazing (García, 1992). In the Pays d'Auge in Normandy, some farms are reported to have reduced the management of meadows, pastures and hedgerows to the minimum whilst continuing to use them for low-intensity grazing.

In many Mediterranean pastoral areas which previously were grazed on a seasonal basis, there has been a tendency towards more sedentary systems for many years. This development often involves an overall increase in stocking density over the course of a year, achieved either by intensification of fodder production on the holding, or as a result of increasing dependence on purchased feeds. There has been a massive increase in the production and sale of dried fodder (lucerne and grass) since the support regime became applicable in Spain, rising from 50,000 tonnes in 1986 to over one million tonnes forecast in 1993 (Agra Europe, 25.6.93). This development, stimulated by a special CAP subsidy, may be associated with the intensification of livestock systems where grazing and browsing were previously more important.

In several countries, the increased use of feed has gone hand in hand with a decline in transhumance, since it is now possible to maintain livestock in dry lowland areas all year round (see Boxes on the Pyrenees and Greece). It also seems to be leading to an abandonment of traditional management practices, particularly the maintenance of optimal stocking densities and distribution of stock, as pastures are treated more as a holding area for stock rather than as the principal feed source.

Nonetheless, in recent years, a few regions have experienced a limited trend towards less intensive systems based on the exploitation of semi-natural resources, rather than forage cultivation and purchased feeds. In Navarra, it appears that traditional, extensive sheep raising can produce higher margins per labour unit than more intensive and technically advanced systems thanks to very low fixed costs, even though the system has high labour costs per sheep. Farmers using this system are based mostly in the south of the region and graze stubbles and common land in the Ebro valley and common grazings in the mountains in summer. Typically, they have 600-700 sheep and access to about the same number of hectares of grazing. Being transhumant, these extensive producers benefit from low-cost summer grazing and, if the sheep spend 90 days in the upland LFA, they are eligible for LFA headage payments. This system also depends on some hidden support from the administration, which manages the common lands, provides infrastructure, supervises transhumance, etc. (Lax Cacho et al, undated).

Changes in livestock feeding patterns in parts of the Spanish Pyrenees

In many parts of the Pyrenean mountains, the switch from transhumance to more sedentary livestock systems has been accompanied by a decline in the number of animals present in upland valleys. Housing and forage production have been developed to enable cattle to over-winter in the upland valleys. Previously the number of animals in the valleys was determined by the availability of summer alpine pastures, as there was no shortage of winter grazings in the pre-pyrenees and lowlands; now that cattle stay in the upland valleys over the winter, the limiting factor is the availability of winter forage and housing.

For example, for twelve valleys of the central Pyrenees, the potential summer grazing in alpine pastures has been estimated as sufficient for 83,361 LU whilst the potential winter forage produced in the valleys is sufficient for only 7,856 LU. The total number of stock in 1989 amounted to 8,559 LU. These figures indicate the limiting factor of winter forage production as well as the extent of "under-grazing" in the alpine pastures. An analysis of three valleys shows how the use of feed from different sources has developed.

	Traditional system	Current system
High pastures	20-25%	20-25%
Woods and matorral	10-20%	1-3%
Cultivated pasture and forage	20-30%	60-70%
Winter grazing in Ebro valley	30-40%	0%

Source: García Ruiz and Lasanta Martínez, 1992

Average stocking densities seem to have increased in some areas and declined in others. Although data on local stocking densities generally is not available, an indication of change may be provided by the invasion of pastures by scrub and woodland, or the development of over-grazing. This was the method used for a study of the effects of the decline in transhumance on mountain pastures in Greece. Reduced grazing levels had allowed scrub and other unpalatable species to develop, reducing the grazing capacity of these areas by 25 per cent. Nationally, 40 per cent of all mountain pastures (including pasture, wooded pasture and scrub) were undergrazed. This figure includes some previously grazed areas in the mountains which had become highly eroded and could no longer be used.

By contrast in the UK, some upland, predominantly livestock farming regions which land cover data would suggest is under low-intensity management have quite high stocking densities, in reality particularly in the north of England, Wales and southern Scotland. This is indicated by regional statistics and by local evidence of over-grazing. In a recent case on common land in Cumbria, the Ministry of Agriculture proposed that sheep numbers be reduced by 41 per cent in order to avoid damage to vegetation. Over-grazing is not uncommon on higher land in England and Wales, although



Effects of different management in adjoining fields in Lower Normandy, France Credit: G. Beaufoy

there are patches of under-grazing, for example on lowland heath.

In Poland, high altitude pastures in the Bieszczady Mountains are being overgrazed by

Changes in Greek transhumance

In much of the country, the seasonal movement of stock remained commonplace until the early 1960s but in the last thirty years the number of transhumant goats has fallen by half, with many stock owners settling in the lowland plains and becoming sedentary livestock farmers. The reasons for this include the inconvenience of transhumance, the increased use of compound feed and dried forage and greater convenience for sedentary farms in claiming Sheep Annual Premium and other subsidies.

National and EU subsidies (available since 1976 and 1981 respectively) may have contributed to a decline in transhumance on foot. Herders receive 50 per cent of transport expenses for livestock travelling more than 50 kilometres. In 1991 applications for aid were received for all transhumant sheep and 60 per cent of transhumant goats. Many "transhumant" flocks are now moved by road or rail.

Montane pastures in the Pindos mountains are especially important as summer grazings, with 46 per cent of all transhumant flocks, around 450,000 animals, concentrated in this area of outstanding importance for nature conservation. On the higher slopes of Mount Oiti there are still large areas of montane grasslands used by transhumant herds; during the summer months, these flocks account for roughly 70 per cent of all domestic animals on the mountain, mainly sheep of improved rather than traditional breeds.

In winter, transhumant herders move their stock to the Attica plains, which are close to the large Athens market. Management is more intensive, with stock milked daily, and a higher use of concentrates. Much of the milk is sold directly, but some is processed for yoghurt and cheeses such as Feta. Winter pastures are becoming increasingly difficult to rent, with many traditional sites being developed for urban uses and intensive horticulture. This has contributed to the growing use of concentrates during the winter and to the local decline in transhumance. For example, between 1980 and 1991, in the mountain village of Mavrolithariou, seasonal movement of livestock fell by a quarter and there was a 16 per cent decline in the number of herders. There seem to be few successors to the present generation of transhumant farmers in this community; over the eleven year period, the average age of farmers rose from 57 to 63 years.

sheep. The thin poor soils cannot support present stocking levels, which range from 3 to 5 ewes per hectare. It is not clear how much land may be affected. In Hungary, parts of the uplands are reported to have scrubbed over in recent years due to a decline in grazing. Some areas of wooded pasture in Békés and Zemplén counties are endangered by afforestation, whilst in others regeneration of the tree cover is threatened following intensification of grazing.

In Spain, information on stocking densities is available only for a few areas. One example is the Sierra de Castril Natural Park in the province of Granada where a study has shown that the current stocking level of 20,000 sheep and goats grazing on 12,000 hectares needs to be reduced by 30 per cent to achieve a sustainable situation. On average, stocking densities in the dehesas of

Extremadura had risen to around two sheep per hectare by the mid 1980s, approximately double traditional levels (Campos Palacín and Martín Bellido, 1986).

In the Appenines in Italy stocking levels of sheep, which taken in isolation might be regarded as low, may in fact be unsustainable. Total sheep numbers have remained relatively stable, but in a few places have increased significantly. A range of habitats including alpine pasture, wooded pasture, scrub and forest are regularly used by transhumant flocks in the summer. A shared characteristic is the arid, stony nature of the soil and, despite average stocking densities being only 0.3 sheep per hectare this level of use is responsible for widespread overgrazing. This affects about 1.5 million hectares in the mountains.

THE NATURE CONSERVATION IMPLICATIONS OF CHANGING SYSTEMS

The nature of change affecting low intensity systems varies from region to region in Europe but it has been on a sufficient scale to have profound social and environmental effects. Unfortunately, there is insufficient information available to analyse these effects in detail. There have been few studies of the long term effects on nature conservation of changes in extensive pastoral systems for example. Nonetheless, it is still useful to consider some of the broader trends and some of the more specific studies which are available. Policy decisions about the future of vulnerable systems often need to be made in the absence of more comprehensive information.

Broad patterns of change

Four very broad categories of change affecting low intensity systems can be identified:

- intensification, including growth of grazing pressure; usually the overall impact on nature conservation will be damaging;
- commercial afforestation; usually this will be damaging to the conservation interest of low intensity farmland as well;
- abandonment, followed by some form of natural succession; the conservation interest of new shrubby and woodland habitats often will be less than that of more extensively managed farmland but much will depend on the local circumstances and also on the species of greatest conservation concern;
- changes in agricultural practice within an essentially low intensity system; again, the conservation implications depend on the nature of change and the local circumstances, with the abandonment of some traditional practices, such as hay making, being potentially significant for several species.

Some of the major changes in agricultural practice of recent decades have resulted in an evident change in land use. Most striking is the overall decline in the area of permanent grassland under low intensity management, usually to be replaced by intensive pasture or arable cultivation, or by scrub and forest in marginal areas. This represents a significant loss of a valuable semi-natural habitat. The expansion of arable cultivation in more productive areas has been accompanied by a loss of farmland habitats such as hedgerows, trees and old or-

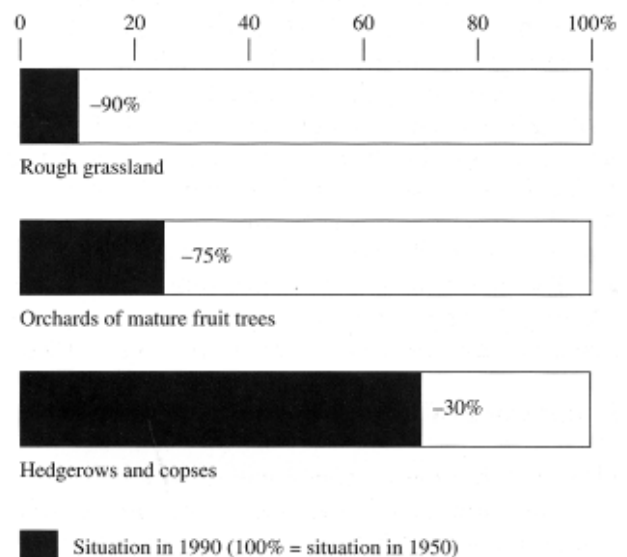
chards, which are also of conservation interest. In some areas losses have been quite dramatic. Figure 4 shows the decline of three important habitats in Switzerland.

The recent reform of the CAP and the associated GATT agreement have reduced some of the incentives for intensification; in many parts of Europe abandonment seems likely to be a more acute threat in the coming decade. However, the absence of long-term research makes it difficult to establish the overall impact on biodiversity of the abandonment or conversion to extensive grazing of large areas of traditional arable, mixed and pastoral farmland.

An important consideration for nature conservation is whether such changes will threaten the survival of viable populations of already endangered species. In most cases, we lack the data to judge how much of a habitat type, such as semi-natural grassland, is needed for the sustainable conservation of priority species; it is precisely these questions which need to be answered in the face of rapid land use changes. In many zones, conservation objectives, such as those set out in the EU habitats and species Directive, cannot be met without deepening our understanding of the relationship between species requirements and agricultural management.

The RSPB/JNCC "pastoral birds" study (Pain et al, 1994) is one of the few attempts to compare

Figure 4: Decline in three semi-natural habitats on farmland in Switzerland since 1950 (WWF Switzerland, 1992.)



developments in the status of particular species with land use change. The distribution of the eight selected species of European conservation concern was mapped using data from 1968-72 and 1988-91. A comparison of the two distribution maps for the six selected species found in Britain shows a significant decline in their presence in a number of areas. Some of the most obvious changes have occurred throughout East Anglia, the south-east and south-west of England. The band of nutrient-poor calcareous and sandy soils running north-east between Hampshire/Wiltshire through to the Norfolk Brecklands was particularly important for a number of species (especially the stone curlew and red-backed shrike) in 1968-72 but, by 1988-91, the selected species had disappeared from large areas in the central sector of this band. Exmoor, Dartmoor and the North Downs in Kent also suffered significant losses in this twenty year period (Pain et al, 1994).

The decline of the selected bird species in these areas has coincided with an expansion of arable cultivation and reduction in the area of extensively managed permanent pasture. It is probably as a result of these developments that these species are now confined mainly to the upland parts of Britain, where there are still large tracts of grassland under relatively low intensity management. Furthermore, the range of these species has retracted and been fragmented in parts of the uplands, again probably due to a decline in the presence of low intensity pastoral land.

The decline of more common species associated with lowland farmland also has been shown to be severe in recent reports from large scale ornithological surveys in Britain. Data from breeding bird atlases compiled by the British Trust for Ornithology shows that the range of 24 of the 28 farmland species contracted between 1970 and 1990. In no other type of habitat was the proportion of species with a contracting range so high. The population of seven breeding species, including the tree sparrow and corn bunting, fell by more than half over this period (Fuller et al, 1994).

Changes in arable systems

In Europe's temperate zones, concentrated mostly in northern Member States, very few purely arable systems are still under low intensity management. Intensification has been associated with the increased use of pesticides to control weeds, smaller field boundaries, earlier harvest dates and a decline in the use of fallow and traditional crop rotation. The fertility of soils tends to be much higher than natural levels, which has deleterious effects on the diversity of flora. Previously commonplace arable "weeds" are now amongst the rarest plants in parts of northern Europe.

However, in central and southern Europe, there

are large areas of low intensity arable land, some of exceptional conservation value. These include traditional shallow cultivation of low-fertility steppeland on the Hungarian Great Plain, chiefly for fodder crops; mixed cultivation on hill land in the Apennines; and large areas of drylands in Iberia. Recently, some areas of dryland cultivation in Spain have been studied in detail from a conservation viewpoint. These include parts of the arable plains of Castilla y Leyn where there are important populations of birds associated with steppeland and extensively managed arable land. Some of these have been proposed and designated as Environmentally Sensitive Areas under Regulation 2328/91 and, more recently, under Regulation 2078/92.

In the areas studied, intensification has reduced the proportion of fallow and of permanent pasture as well as the diversity of cropping patterns. The individual areas of permanent grassland involved may be quite small, but the overall loss of this semi-natural element in the landscape is likely to be very damaging for nature conservation. For example, in a predominantly arable area of Castilla y Le?n (Tierra de Campos), the Sociedad Espa?ola de Ornitología (SEO) cites a 20 per cent decline in the area of pasture between 1982 and 1989 as a significant loss of habitat diversity for steppeland birds (Naveso and Groves-Raines, 1992). Levels of inorganic fertiliser application are often high (e.g. 400 kg of NPK per cultivated hectare per year) and the use of pesticides has increased.

The stocking of sheep on cereal stubbles is reported to be excessive in some areas, affecting birds and other species which also feed on the stubble. In the mainly arable area of Villafáfila in Castilla y Le?n, sheep numbers are reported to have increased by 66 per cent over the past twenty years (Naveso, 1992).

Field boundaries have been affected by changing practices in both dryland and more temperate arable systems. In Spain, arable land usually is of the "open-field" pattern, without hedges, but field boundaries consisting of grasses, low shrubs and other natural vegetation nevertheless provide an important element of semi-natural habitat. Grazing by sheep and burning prevents these strips from developing into hedgerows. Many of these field boundaries were lost during the mechanisation of agriculture in the 1960s and as a result of land consolidation projects. Increasingly the nature conservation value of the remaining boundaries tends to be reduced by the use of pesticides. In addition, burning reduces the populations of insects which are a potentially valuable food source for birds.

However, for the time being, a combination of features such as fallows, low intensity lucerne crops, pasture and other less intensively managed land, continue to maintain populations of important species (e.g. great bustard, black-bellied sandgrouse,

and lesser kestrel) over large areas of dryland cultivation in Spain. Meanwhile, surrounding areas with less diverse bird populations are generally more intensively cultivated, often with irrigation, but nevertheless are used (e.g. for feeding) by populations based in the remaining "islands" of less intensive management. The increased intensification of the "wider countryside" therefore is a further threat to the viability of these relatively isolated bird populations.

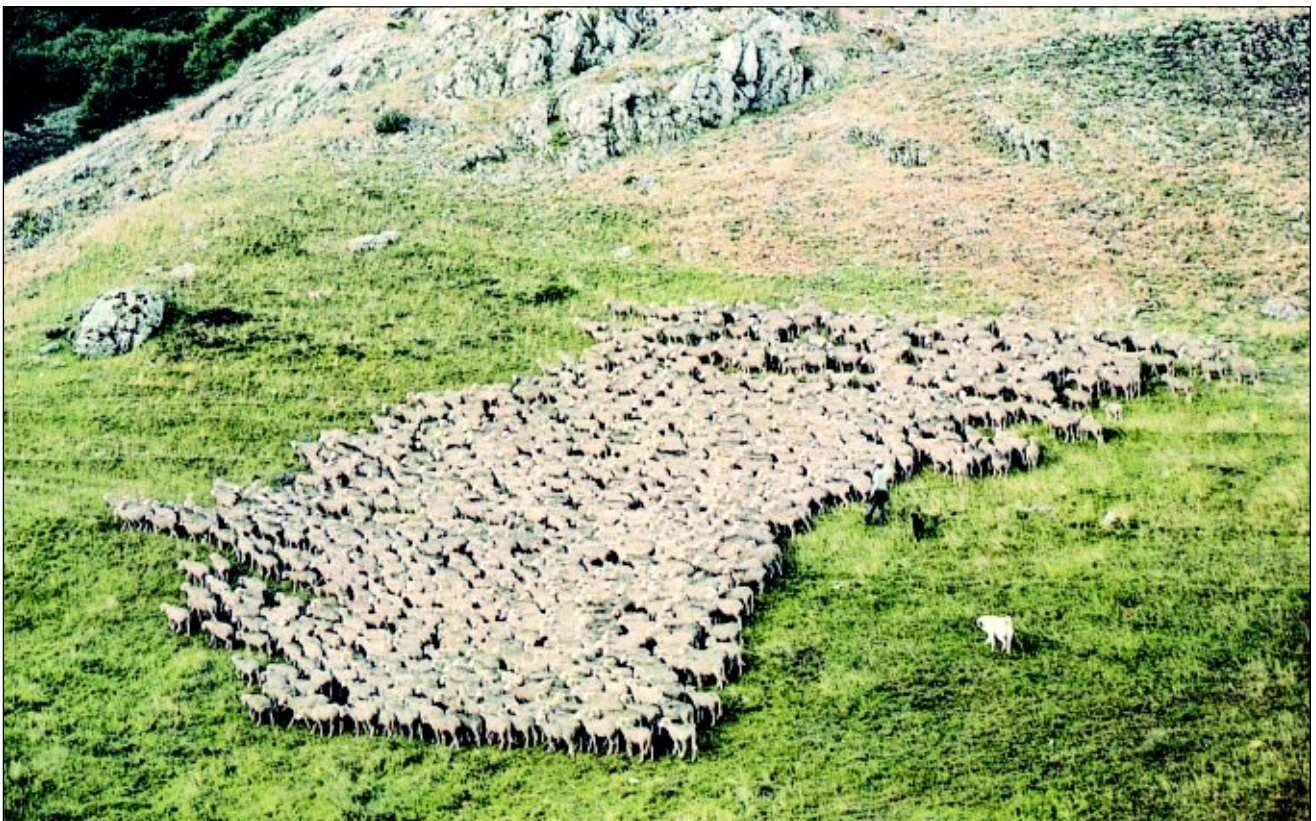
Proposals drawn up by SEO illustrate the potential which exists for improving the nature conservation value of dryland cultivation (for example, Naveso and Groves-Raines, 1992; Naveso, 1992). Modifications to cropping patterns, to the timing of planting and harvesting, to the use of pesticides and to the management of stubble, which could be left over winter and not burnt, could increase wildlife values considerably. There are probably many areas where, this agricultural system has not yet suffered the full process of intensification, although it is no longer truly extensive. Currently, somewhere between four and nine million hectares of arable cultivation are estimated to be more or less extensive and therefore potentially of nature conservation interest (M.A. Naveso, personal communication).

The future economic viability of low intensity arable cultivation is far from secure, however, particularly in areas with very arid conditions and infertile soils. With extremely low yields per hectare, only

very large holdings can compete on economic terms with more productive arable regions. The possibility of considerable areas of extensive arable land being abandoned or changing to other land uses therefore must be considered. The implications for nature conservation will vary according to the site and the kind of management which replaces arable farming. The overall impact may be either positive or negative.

Some abandoned arable land may revert rapidly to scrub and woodland, thus losing much of its current habitat value for steppeland birds. However, in certain areas of Spain where a lot of cultivated land has been abandoned during the course of the twentieth century, natural succession has been extremely slow, producing heathlands with an open, steppic landscape. This is particularly the case in areas known as "páramos", which are characterised by extremes of climate and infertile soils. In certain cases abandoned land has reverted to a pastoral use, thus maintaining a characteristic steppe landscape.

One alternative which has been proposed for dryland arable farms would be to combine cereal production with an extensive sheep system, growing leguminous forage crops such as peas and vetch instead of bare fallow and dedicating part of the land to permanent grazing. On better soils, leguminous crops for human consumption could be produced, for example chickpeas and lentils which are not in surplus in the EU. To some extent, these



The maintenance of many upland pastures is dependent upon controlled grazing by shepherded flocks

Credit: A. Gomez-Sal

changes would be a reversion to a pattern of production traditionally practised in many parts of Spain before barley and wheat became the dominant arable crops. This system could produce positive nature conservation results, enabling an increase in the proportion of permanent pasture and in the diversity of habitats and food sources for wildlife. The outcome would depend on the particular practices involved, such as the amount of pesticides and fertilisers used and the stocking density of livestock. Other options may include plantations of almonds, pistachios, cherries, olives, etc., and forestry, all of which have taken place in various dryland areas, often on a large scale, and involve a major alteration of the cultivated habitat.

Permanent crops

Intensification has eroded the conservation value of many permanent crop systems. The diversity and abundance of insects and other wildlife associated with older and larger trees in olive plantations and orchards is far higher than that found in plantations of modern cultivars. High levels of pesticide use also have a damaging effect on biodiversity in vineyards, olive plantations and orchards. Intensive ploughing of olive plantations in order to remove competitive vegetation removes an important semi-natural element in the form of spontaneous grassland. In Hungary and Switzerland, some orchard pastures are reported to be suffering from poor management.

Many smaller, older olive groves are neglected or abandoned in Spain. The discontinuation of harvesting should not be detrimental to the value of olive trees for birds; on the contrary, it seems that in drought years when many groves are not harvested, birds take particular advantage of the availability of olives, given the scarcity of wild fruits (Rodriguez de los Santo et al, 1986). However, abandonment will result in natural succession and ultimately the development of scrub and woodland in place of the grassland layer. Also, abandoned groves are more vulnerable to clearance for other land uses.

The tree cover of Portuguese montados and Spanish dehesas can be considered as a form of permanent crop. In both countries, cork and Holm oaks are suffering from damage due to new techniques, such as deep ploughing near to trees. The presence of livestock all the year round at relatively high stocking densities is preventing the regeneration of trees on many farms. The tree cover is an essential part of the ecological structure of montados and dehesas.

Changes in livestock systems

As discussed in Chapter 3, the intensification of grassland management is generally detrimental to biodiversity. Several modern practices can result in reduced conservation interest. Where stocking levels increase above the carrying capacity of



The presence of wolves in mountainous areas of northern Spain, Italy and Portugal creates additional problems for livestock farmers; flocks must be kept in corrals at night

Credit: F. Petretti

unimproved semi-natural vegetation, many species are likely to suffer. The use of supplementary feeds often permits farmers to carry more stock during the winter, which may lead to local overgrazing. Good management of semi-natural pastures becomes less important for production and tends to be neglected.

Whereas a shift from hay-making to silage is known to be damaging to the conservation value of grassland, the outcome of a change from hay-mak-



Carrion provides an important source of food for predators and scavengers including wolves, vultures, raptors and sometimes bears

Credit: A. Gomez-Sal

ing to low intensity grazing as systems are "run down" may cause less concern, depending on the site. Both regimes tend to result in high levels of biodiversity, although the communities of flora and fauna will be different. In general terms, a diverse pattern of low intensity management may be most desirable for nature conservation.

Few data were encountered in the study countries on the precise effect of changing management practices on habitats and species. Some attempts to assess the situation in the UK uplands have been made (e.g. CEAS and Wye College, 1993). Increased stocking rates and a decline in the traditional management of grazing land, for example, heather burning, have led to a reduction in the extent of valuable heathland habitat at the expense of species-poor acidic grassland. Agricultural improvement of grasslands has also been widespread in the UK. By the late 1970s, only four per cent of all pasture could be classified as semi-natural and 70 per cent of other grassland over 20 years old contained 25 per cent or more rye grass within the sward (Hopkins, 1993). One estimate suggests that 71 per cent of English ericaceous moorland was overgrazed by the mid 1980s, while only 29 per cent of English and Welsh moor was stocked at levels considered compatible with maintaining vegetation in good condition (Felton and Marsden, 1990).

Changes in the type and breed of livestock can alter the management of semi-natural habitats significantly. Due to their hardiness and ability to exploit rough forage (such as atlantic heather moor, Mediterranean scrub, etc.) traditional livestock breeds often are well adapted for the management of semi-natural vegetation. In many situations, traditional breeds are integral to low intensity livestock systems and their substitution by modern breeds almost invariably will lead to the development of a more intensive system. Modern improved breeds generally either cannot graze less nutritious vegetation effectively, or require supplementary feed to ensure adequate rates of growth and to avoid excessive weight loss. Supplementary feeding can lead to localised overgrazing around foddering sites, as occurs in some areas of atlantic heather moor grazed by sheep. Nonetheless, from a nature conservation perspective, the individual breed may be less significant than the type of animal and the system of grazing management, depending on local conditions.

The simplification of livestock systems and their concentration on one type of animal implies a reduction in the diversity of grazing and browsing patterns and hence in the diversity of vegetation structure. For example, sheep bite grass off close to the ground producing a short cropped sward. By contrast, cattle have less mobile lips and bite and tear at vegetation, chiefly taller herbs and grass species, giving a rougher, more unkempt appearance to pasture. Goats do not graze so much as browse,

and will consume all manner of woody shrub and scrub species including gorse, heather, bramble etc. Sheep will graze at higher altitudes and on steeper slopes than cattle.

In Mediterranean countries, where transhumance is in decline the tendency towards keeping sedentary, lowland livestock production at higher stocking densities will have had considerable effects on habitats and species in both the lowlands and uplands, but very little monitoring of these effects has been carried out. Some areas have come under closer scrutiny recently. For example, the grass steppes of La Serena in Extremadura, which traditionally provided an important wintering area for transhumant sheep flocks, but where the majority of livestock are now sedentary and fenced, is suffering from considerable overstocking. Incentives to reduce grazing pressure are being proposed and may be eligible for CAP funding under EU Regulation 2078/92. In the dehesas of the west of Spain, the maintenance of livestock all the year round seems to be an important factor in preventing the regeneration of the characteristic tree cover.

The decline in transhumance throughout southern Europe has resulted in an overall reduction in grazing pressure in the traditional summer pastures in mountain regions, although the long term consequences for nature conservation have received little attention from scientists. In most parts of the Italian Apennines and Spanish Pyrenees, under-grazing and consequent development of scrub appears to threaten conservation interest more than overgrazing, particularly on the vast areas of common land below the alpine pastures. However, there is no simple pattern. Simultaneously, some mountain and alpine pastures are reported to be scrubbing over, while others appear to be overgrazed at current stocking levels, particularly those with relatively easy access.

Abandonment or the conversion of pasture to commercial forestry are perhaps the greatest changes affecting pastoral systems; both will have major implications for nature conservation. Although long term studies of abandonment in Europe are scarce, research work on abandoned mountain grazing systems in northern Italy provides some insights. Abandonment has led to a loss of certain types of grassland and associated birds and mammals (e.g. choughs, Greek rock partridge, *Alectoris graeca*, mole rat, *Spalax leucodon* and Ursini's viper). However, at the same time, resulting natural succession and reduced pressure from stock and shepherds may have benefited some large mammals (e.g. bear, wolf and wild boar - *Sus scrofa*) and certain raptors. The presence in such areas of natural woodland may allow species-rich natural succession whilst wild herbivores (chamois, deer) may permit sizeable grassland areas to be maintained, if conditions are favourable, although in a different form. The precise pattern of local succes-

sion will vary between sites, depending on local circumstances.

In the Appenines, a system of mixed mountain farming (grazing, cultivation, terraces, etc). has been abandoned gradually since the end of the Second World War, resulting in the spread of scrub and woodlands. At first, landscape diversity and heterogeneity increased as woods developed in different stages of succession. This diversity then declined as more uniformly mature woodlands became established. Populations of wild boar, wolf and roe deer have expanded considerably but the number of hares (*Lepus capensis*) has declined. Woodland development has benefited the dormouse (*Muscardinus avellanarius*) and edible dormouse (*Glis glis*). However, as mature forest takes over, bird diversity is expected to decline, especially for the migrant species which historically have made abundant use of the rich mosaic of orchards, crops and terraces (Farina, 1991). This broad pattern of abandonment in upland areas once subject to mixed farming appears typical of many regions, particularly in the Mediterranean, but there are numerous local variations.

Conclusions

The future of large tracts of land currently under low intensity agriculture is highly uncertain; its management is a critical issue for nature conservation. While it is important not to oversimplify the relationship between biodiversity and the intensity of agricultural systems, there are grounds for extreme concern about the rapid rate of change towards intensification, simplification or abandonment. Zones which appear to be particularly vulnerable to such changes include mountainous areas traditionally managed by low intensity livestock systems, Mediterranean dryland arable systems and areas with diverse agricultural landscapes under low in-

tensity management, often involving traditional mixed cropping with some livestock.

The relationship between agriculture and nature conservation can be complex, delicate and sensitive to local conditions. Sometimes apparently minor changes in management can be unexpectedly significant for particular species. Changes in mowing dates and stocking densities may have long term, as well as immediate, effects. It is not only the nature of the vegetation communities found within low intensity systems that dictates their conservation value. The particular combination of farming practices used also can be crucial in determining the biological richness of different sites.

Abandonment and afforestation are major concerns. However, it would be wrong to assume that all low intensity systems identified in this study necessarily should be maintained in their current form in order to achieve nature conservation objectives. Clearly there is potential for improving the conservation value of many low intensity farming systems. Some positive changes may be taking place already, such as the creation of new patches of permanent grassland.

The conservation of many of the habitats involved cannot be achieved simply through "site-based" protection. The areas involved are too great and the capacity of conservation authorities to control their management is heavily constrained, at least in the short term. In any case, the limitations of concentrating conservation efforts on relatively small sites in Europe are already becoming apparent, especially for dispersed species. It is important to identify and implement options whereby land remains under relatively benign forms of agricultural management with conservation requirements becoming a more explicit objective, rather than the incidental result of certain farming practices.

CONCLUSIONS AND RECOMMENDATIONS

The diversity and value of low intensity farming systems

The study has revealed a great range of low intensity farming in the nine countries considered. The Mediterranean regions have the greatest diversity of low intensity systems, including permanent crops such as olives, orchards and cork oaks, arable systems in semi-arid areas, traditional small-scale mixed farming and a range of livestock systems based on permanent pastures, meadows and traditional practices such as transhumance. Spain, in particular, has a wide range of systems covering a very large area, including at least ten million hectares of low intensity grazing land and an arable fallow area of some four million hectares.

Outside the Mediterranean zone, by far the largest areas of low intensity farming comprise livestock systems based on permanent grazing, or a combination of grazing and meadows. These systems are found mostly in upland and mountain regions and, to a more limited extent, on wet grassland and marsh.

Overall, sheep grazing is probably the single most important low intensity farming activity; it takes place on very large areas of upland and mountain in both temperate and Mediterranean regions, as well as playing a significant role in Mediterranean dryland arable systems. However, other forms of livestock are also important in low intensity pastoral systems, especially beef cattle, goats and horses.

Low intensity systems operate under a great range of different conditions. Climate, soils, altitude and other physical conditions vary widely but the diversity extends to social, cultural and economic circumstances as well. Farms range from one or two hectare holdings in parts of Portugal, Spain and Greece to sheep farms of several hundred hectares in the British uplands. Despite the Common Agricultural Policy, there remain sometimes surprisingly significant differences in policy measures between regions.

It is difficult to estimate the total area of land under different forms of low intensity farming. This is partly because of the lack of reliable and consistent data, but also because it is often not possible to draw a clear line between systems which are intensive and those which are not. Many farms practising essentially "extensive" forms of agriculture have introduced modern, intensive practices in recent years. However, it is clear that the area of land under predominantly low intensity farming in the nine study countries is very large. For grazing

systems alone, the total area may exceed 30 million hectares.

Low intensity farming systems are of special importance for the European rural environment. Not only are they less polluting and less dependent on external, energy-intensive inputs; they are of particular value because of the wildlife habitats and communities associated with them. In addition, many forms of low intensity farming are of considerable landscape and cultural interest. It is striking that a large number of nature parks and other protected landscape areas in Europe are partly or wholly managed by low intensity forms of farming. Finally, the concentration of such systems in less-developed, often remote and predominantly agricultural regions means that there are important social considerations connected with their future development.

Unfortunately, there has been a lack of data on the precise distribution, character and evolution of low intensity farming in Europe. Given the current commitment within the CAP to encourage the extensification of production and to promote more environmentally-friendly forms of production, there is an urgent requirement to develop a clearer understanding of existing low intensity systems, the means by which they are adapting to changing economic, social and technological conditions, and the consequences of this process of change. This necessitates detailed research at a regional level. More fundamentally, it requires steps to prevent these systems from disappearing before they have been adequately evaluated.

The importance of low intensity farming for nature conservation

The main concern of the present study is the importance of low intensity farming for the conservation of wildlife and biodiversity in Europe. It is clear that low intensity farming is responsible for the management of a large area of semi-natural habitat of high nature conservation value. The significance of semi-natural habitats for nature conservation in Europe is partly a reflection of the small remaining area of undisturbed natural habitat. Equally importantly, low intensity systems have several characteristics which make them inherently of greater conservation value than intensive farming. These include the low use of nutrient and agrochemical inputs, the relative abundance of semi-natural vegetation, the relative stability of management practices and the structurally diverse vegetation pattern found on many extensively managed farms.

The conservation value of low intensity systems rests largely on their capacity to maintain semi-natural habitats by means of appropriate practices, such as the harvesting of crops and grass later in the season than under more intensive systems, or the shepherding of livestock on seasonal pastures. The relative importance of different practices varies greatly between species and between regions. Further research is essential so as to understand these differences and in order to maintain or introduce those practices of greatest importance for the conservation of species which currently depend on semi-natural farmland habitats. It is not sufficient simply to maintain a low intensity agricultural land use in order to meet conservation objectives. In many cases, existing practices could be modified to enhance nature conservation interest, for example, by altering stocking densities or abandoning stubble burning in dryland arable systems.

Detailed studies of particular management regimes and the needs of individual species are being undertaken already on some sites, particularly where new agri-environment measures are being developed and farmers are being offered management agreements. However, the process needs to be accelerated as so many systems are undergoing rapid change. Furthermore, the research effort needs to be focused primarily in those areas of greatest nature conservation interest, particularly in southern Europe where resources for such work are less readily available than in north west Europe.

However, it must be stressed that the contribution to nature conservation of low intensity farming is not limited to the maintenance of certain key habitats or the conservation of a few "flagship" species. These farming systems also are fundamental to the management of extensive areas of "wider countryside" which is essential to the long-term maintenance of viable European wildlife populations and communities.

While it is not possible or appropriate to try to maintain all low intensity systems, it is highly desirable to identify those which are of particular importance and to ascertain the scale and significance of those ecological changes which will be difficult to reverse. A European inventory of farming systems and practices associated with high conservation value is required urgently.

Directions of change and future prospects for low intensity farming

Some of the systems identified in the study have been affected very little by modern agricultural practices and technologies. For example, in certain areas there are small-scale mixed systems, such as the tanyas in Hungary, which operate on a largely traditional and subsistence basis, involving minimal use of external inputs. The future of such systems is uncertain, both because of the limited economic

returns which they generate and because they are threatened by wider socio-economic change in rural areas. Many such systems have been abandoned during recent decades, for example, in the Apennines of northern Italy and in the central Pyrenees in France.

However, most of the low intensity farming systems existing today are considerably modified from their traditional form. For example, extensive livestock farms in the UK uplands often include areas of reseeded grassland under quite intensive management. In regions of Spain characterised by predominantly low intensity farming, such as dryland arable cultivation or livestock raising in the *dehesas*, some farmers have increased their use of fertilisers or stocking of livestock to a point which may be considered intensive, often with detrimental effects on wildlife.

In Europe as a whole, the area of farmland under stable low intensity management almost certainly is declining. In many regions, intensification has continued in recent years; most commonly in the form of increased grazing pressure. Intensification has been most pronounced and most comprehensive in a more limited group of areas where traditional land uses are being converted to more modern forms of production. For example, new irrigation projects continue to affect areas of dryland cultivation and permanent pasture in Spain and Portugal. Old olive groves are being grubbed up with CAP subsidies in Portugal. Intensive forestry threatens to replace traditional farming in parts of Hungary.

Many of the traditional practices integral to low intensity farming, such as managing meadows for hay, maintaining farm trees and hedgerows, harvesting olives by hand and shepherding livestock, have been abandoned, resulting in considerably simplified systems and a continued trend towards specialisation. Major increases in the cost of rural labour since the 1960s have been a key factor in this process. Often this change will result in a more economically viable system, as production is rationalised and labour costs are reduced. However, often this process is an indication that the system is being run down prior to complete abandonment. In many cases, the farmers concerned are elderly and have no clear successor. The future of their farms remains uncertain; some may be amalgamated to create larger units, others may be abandoned or converted to other uses, such as commercial forestry.

In summary, low intensity farming has been affected by a process of rationalisation in agricultural land use, which still appears to be taking place. In areas and regions with productive potential due to climate, soils or factors such as larger farm structures or targeting of investment aid, many farming systems continue to be intensified. In more mar-

ginal areas, there is a tendency towards the simplification of management and abandonment, often associated with rural depopulation. The outcome is an increasing homogeneity in land use at all geographical levels.

The policy response

In Hungary, Poland and other Central and Eastern European countries, agriculture is undergoing a period of turmoil, with production falling and many traditional markets collapsing. Subsidies and other public supports for agriculture have been reduced and in Hungary most farmland is subject to privatisation. All these changes will affect low intensity systems and it seems likely that some land under low intensity management will be abandoned whilst other areas will be afforested. Some land is being acquired by western European interests and converted to new forms of intensive production.

Within the EU countries, the overall level of support for agriculture is more stable. However, significant changes are taking place in the nature of this support as well as in the underlying objectives of the policies which provide it. So far, these changes have been concerned primarily with containing or reducing the production of several commodities within the CAP. The main mechanisms introduced are limits on the availability of payments for livestock and the set-aside of arable land. Incentives for “extensification” have been introduced on a small scale, with combined environmental and production control aims. However, limited action has been taken to provide support for existing low intensity systems.

Some of the key policy issues affecting low intensity farming are discussed briefly below, with particular emphasis on the CAP. With the likely enlargement of the European Union the CAP is set to have an increasing influence on the future development of farming throughout Europe.

CAP market support

The main subsidies for agricultural production under the CAP are provided in the form of price support and a new system of direct income payments introduced under the 1992 reforms. These subsidies are designed in such a way that they concentrate support on the more productive farms, rather than on those which contribute most to environmental or social goals. Cereal and beef prices are being reduced and farmers now receive more support in the form of direct payments per hectare and direct subsidies per head of livestock; but the livestock subsidies are calculated in proportion to the number of livestock held on a farm, whilst arable payments are based on historic yields. Fallow arable land is not eligible for support payments. In consequence, subsidies are greatest on farms with the largest number of livestock and in regions with the most fertile and more intensively farmed arable land. The support system effectively disadvantages



Drinking trough for Maremmana cattle, Italy. Many traditional livestock systems depend on the maintenance of infrastructure such as watering points and shelter for livestock and shepherds.

Credit: F. Petretti

those producers who have not taken steps to increase their animal stocking densities or to reduce or eliminate the use of fallow in the arable rotation.

One exception is the new premium for “extensive” beef cattle producers, which is available to those with a stocking density of less than 1.4 livestock units per hectare. This will assist a significant number of beef producers but must be balanced against the benefits of the lower cereal prices under the Macsharry reforms to those farmers with more intensive methods of production. There is no corresponding “horizontal” support mechanism for extensive sheep producers or arable farmers.

The new CAP rules obliging larger farmers to set aside some of their land in order to qualify for direct payments will have the effect of introducing a new form of fallow on many farms. However, the economic effects of these rules may be more severe for low intensity dryland arable systems, where a considerable proportion of the land is left fallow each year, than for cereal growers in northern Europe, most of whom make little use of fallow, or for dryland arable farmers in Mediterranean regions who have eliminated the use of fallow by means of high fertiliser inputs. One means of providing aid to low input arable farms, including organic producers, would be to exempt them from the requirement to set-aside land in order to qualify for the new area

payments. In principle, other alterations to the arable set-aside regime could allow greater environmental benefits without increasing expenditure. For example, in low intensity dryland systems, it might be desirable to encourage farmers to introduce livestock, which could help to restore soil structure on fallowed land, or to create permanent pasture with potentially significant nature conservation benefits.

The main CAP market support regimes could be adapted in other ways to integrate environmental objectives. There are many possibilities, some of which have been discussed in recent reports (e.g. Baldock et al, 1993, van der Weijden and Timmerman, 1994). Several options need to be further explored. For example:

- the possibility of paying livestock producers a form of aid per hectare rather than per animal should be examined in depth;
- another urgent priority is to review the current support for forage maize production to avoid giving farmers an incentive to plough up permanent pasture, as has occurred in France, for example;
- the CAP sheep and beef regimes present an obstacle to the redistribution of livestock away from intensively managed areas to marginal zones suffering from under-grazing and abandonment. Equally, they are a disincentive to farmers wishing to re-establish mixed farming. Ways of reducing the rigidity of the current quota system to facilitate a transfer of livestock on environmental grounds could be helpful.

In the shorter term, there are some options which national and regional governments could advance themselves without depending on reforms to the CAP, on which it may be difficult to obtain political agreement. For example, in early 1994, CAP regulations were altered so that national governments could impose environmental obligations on farmers receiving headage payment for beef cattle and sheep. Eligibility for headage payments can now be withdrawn if a farmer fails to comply with the relevant environmental rules. Few governments have committed themselves to implementing this policy; the UK is an exception.

Environmental conditions could contribute to the control of both over-grazing and under-grazing. Over-grazing has been identified as a severe problem in several regions including the west of Ireland, parts of Wales and northern England and various Mediterranean regions including some Greek islands. Other areas are under-grazed, particularly in mountain regions where livestock numbers are falling and shepherding is being replaced by "ranching". If workable, fair and effective measures to link payment levels to sustainable grazing patterns can be developed, it would be a notable step forward.

The main body of the CAP works to the disadvantage of low intensity farming systems; the mechanisms should be redesigned to reward those farmers and farming systems which provide environmental and social benefits, rather than favouring the biggest and often the most intensive producers. At present there are only two principal policy measures which direct CAP funds into less-favoured and environmentally sensitive areas. These measures have the potential to benefit low intensity agriculture and are discussed in more detail below.

Support for Less Favoured Areas

In the EU countries, low intensity farming systems mostly are to be found within the officially designated "Less Favoured Areas" (LFA) within which additional aid is available to farms. This aid is intended to assist the continuation of agriculture, partly for environmental and social reasons.

In northern Member States livestock raising is the dominant type of farming in less favoured areas and LFA payments are made per head of livestock. In southern Europe, on the other hand, there are sizeable areas of low intensity arable crops, permanent crops and mixed farming systems in the LFAs, and aid often is provided through a combination of area payments and headage payments. The level of LFA subsidies varies considerably between different regions within the Community and it is difficult to generalise about its impact.

In certain Member States, the LFA support system has been associated with considerable increases in livestock numbers. Sheep flocks have expanded significantly in the UK, Ireland, Spain, and parts of Italy and Greece. This has occurred because of the increased incentives for production in these areas, in the form of subsidies under the CAP sheep regime, such as Sheep Annual Premium and the additional, although smaller, LFA payments. Consequently, both forms of support have contributed to over-grazing and environmental damage in some regions, such as mid Wales and parts of Spain and Greece. On the other hand, in many of the less favoured regions of France sheep numbers have remained stable or have declined since the 1970s.

Under the current system, most of the criteria for designating LFAs, which include high altitude, short growing seasons, steep slopes, infertile soils, and a dwindling rural population, are intended to reflect the degree of disadvantage for agricultural production. They are quite distinct from those criteria which might be drawn up to denote a farm's environmental or social value. Not surprisingly, farms within the LFA vary greatly in their conservation interest; there are no additional payments under the LFA scheme for farmers who have retained flower-rich meadows, for example. Indeed, because the great majority of subsidy is paid per animal, payments per hectare and per

holding may be higher on those farms where overgrazing is occurring than on those where appropriate stocking levels have been maintained. In this sense, the LFA Directive is an unsophisticated, and sometimes counterproductive, instrument for supporting low input farming systems and fails to discriminate between farms which are providing a positive environmental service and those which are damaging.

Furthermore, in order to try to improve the productivity of farms in the LFAs, special inducements have been available for activities which have reduced environmental value, such as ploughing and reseeded old pastures. This may be a logical means of reducing the handicaps faced by producers, assuming that the "improvements" are worthwhile, but it is not an appropriate method of rewarding farmers who are providing society with an environmental benefit.

Nonetheless, it is clear that LFA payments contribute significantly to the survival of low intensity farming in many areas. Although the headage and area payments often represent a small proportion of farmers' total income, they may still be crucial to the survival of a large number of holdings. On many farms LFA payments constitute more than half of a farm's net income (Baldock et al, 1993). Nor have the subsidies necessarily led to intensification or obvious environmental damage; some regions have experienced little intensification as demonstrated in a study comparing the implementation of this policy in Wales and central France (Smith, 1985). A more carefully targeted system of support, "fine tuning" payments to local conditions, is required if the EU wishes to retain sizeable areas of low intensity agriculture of conservation value. One important reform would be the substitution of the present system of headage payments by the alternative system of payment per hectare; appropriate environmental conditions could be attached to hectare payments. In places where this was not feasible or desirable, for example where there are large areas of commonly owned land, modified systems of headage payments could be considered instead.

Some Member States divide the LFA into two or more zones reflecting different geographical and agronomic conditions; payments generally are higher in more disadvantaged zones. Such a zoning system could be developed further to take more account of the environmental characteristics of farmed land within the LFA. Areas of low intensity agricultural land with particular nature conservation and landscape value could be eligible for higher payment levels than those where agriculture had been improved but conservation interest had declined. The possibility of establishing such zones should be explored, taking account of other factors, such as the social importance of agriculture.

Similarly, special investment aids for LFAs could place more emphasis on the promotion of environmentally sensitive, low intensity farming systems. For

example, traditional practices such as the grazing of seasonal high mountain pastures could be assisted through improvements in facilities for shepherds.

In practice, reform of the LFA payments system is unlikely to be very effective unless account is taken of the other sources of income available to farmers and the overall structure of economic incentives which will influence their decisions. In livestock areas, for example, farmers are likely to derive a far larger proportion of their income from headage payments available under the CAP market support regimes for sheep, goats, and beef cattle than from LFA payments. If headage payments continue to be paid irrespective of the environmental consequences, the benefits of any "greening" of the LFA system may be rather limited.

Agri-environment programmes

Environmental support schemes for agriculture are relatively new and are now expanding rapidly in the EU. They have a variety of objectives, ranging from the maintenance of pastoral farming to more sophisticated schemes designed to recreate neglected habitats, reduce input use and animal stocking densities or introduce other less intensive methods of arable farming. In return for agreeing to comply with a set of environmental management rules, farmers receive regular payments. Agreements are voluntary and typically last for five or ten years.

In central and eastern Europe, there have been proposals to establish schemes of this kind, for example in Hungary, but the availability of resources has been a severe constraint. Within the EU, the first generation of schemes was concentrated in Germany, the UK, Denmark and the Netherlands, financed mainly by national and regional governments. Since the EU's agri-environment programme (Regulation 2078/92) began to come into operation in 1993, all Member States have been able to draw on a significant source of CAP funds to support environmentally sensitive farming systems. In the least prosperous parts of the Community, where low intensity farming is concentrated, 75 per cent of the costs of agreed support schemes will be reimbursed from FEOGA, the main CAP budget. Consequently, a very large number of schemes has been put forward from the Mediterranean region and from Ireland, where previously this approach was little used.

The CAP agri-environment programme represents an important step forward and will provide support for low intensity farming in some of the most sensitive regions of Europe for the first time. The Regulation lays down a fairly comprehensive menu of measures and allows the Member States considerable flexibility in setting up national and "zonal" programmes. Where schemes are carefully designed and effectively implemented, it should be possible to enhance conservation interest and to improve the economic position of farmers practising low intensity agriculture.



ak woodlands in the Valle de Lozoya, Madrid, are grazed by cattle at very low stocking densities Credit: G. Beaufoy

However, the most important schemes financed under Regulation 2078/92 will apply to only limited areas. The Regulation has several objectives, including the encouragement of extensification in currently intensive systems; it will not be applied solely in low input farming zones. Although the budget is much greater than the past, estimated to be around ECU 800 million for 1995, there is some doubt about whether it is sufficient to finance the large number of proposals being put forward by the Member States. In any case, it is a very small sum relative to the overall CAP budget, which is expected to be around ECU 36 billion for 1994. Furthermore, the voluntary environmental schemes which will be established under the Regulation are potentially in conflict with other CAP policies. In Spain and Portugal, for example, incentives for afforestation of farmland under EU Regulation 2080/92 are planned to be much more generous than those proposed for environmental schemes in many areas (BirdLife International, 1994).

Much will depend upon how the schemes are drawn up and implemented. To be effective, they will need to be designed on the basis of adequate research work. They should be carefully targeted and effectively promoted to farmers; results should be closely monitored, so that schemes can be adjusted and their weaknesses ironed out. This is a new kind of policy and some experimentation will be necessary. In many regions it will be a priority to build up new

sources of environmental advice for farmers, as well as appropriate institutional structures to operate schemes which may be quite different in kind to traditional agricultural subsidies. Schemes introduced rapidly, such as the French prime à l'herbe, which offers a subsidy per hectare to all farms with a stocking density of less than one livestock unit per hectare of forage, may lack the degree of refinement required to ensure lasting environmental benefits.

Appropriate rural development

In large parts of Europe there has been a tendency to regard agriculture as the engine which drives rural development. Most of the policies which have been designed to promote the development of agriculture have sought increased productivity per unit of land or labour, through measures such as pasture improvement, the introduction of modern livestock breeds and irrigation. Often, this has resulted in the transformation of traditional low intensity forms of agriculture.

Some areas are still threatened by agricultural development or, alternatively, by afforestation, usually with public subsidies. Larger projects include the irrigation of dryland cereal and pasture areas, especially in Spain, Portugal and Greece, subsidised afforestation schemes in the west of Ireland, and environmentally insensitive land consolidation schemes. In Galicia, for example, approximately 300,000 hectares of small-scale agriculture has been subject to consolidation with EU support since 1989, resulting in the wholesale removal of many landscape features and small habitats (Costa Morata, 1994).

However, under present market conditions, policies which lead to increased agricultural production are usually not appropriate. Development strategies need to be more imaginative, particularly in regions which are inherently marginal in terms of productivity, but which may have other advantages, such as products of particular quality.

Devising aid schemes which provide support for low intensity systems without requiring them to accept environmentally damaging practices already is a challenge for rural development authorities. It does not require the abandonment of investment aid, which may include support for buildings and other equipment and for local processing facilities. Aid for the development of marketing of agricultural goods associated with environmentally farming systems may be more appropriate and rewarding than "conventional" measures for increasing farm productivity. The current EU Regulation for promoting the registration and protection of regional labels for agricultural products could be adapted to give more emphasis to the farming methods involved. Special nature conservation labels could be developed (Baldock et al, 1993).

At a regional level, initiatives might include new incentives to reinstate mixed farming systems in key

areas. This could involve greater support for the re-introduction of sheep and other stock in parts of the lowlands where stubbles are no longer grazed and permanent grassland has disappeared. In some regions, the reintroduction of small-scale arable forage production in predominantly grazed areas might also be advantageous for nature conservation. Many farmers in marginal areas are looking for a new vocation and would welcome the development of schemes under which they are offered payment for their land management services.

Finally, agriculture should not be regarded as the only or even the main basis for rural development. Investments are needed in social, educational, recreational and health facilities in rural areas. Economic alternatives to farming need to be developed, including part-time work. Farmers practising low intensity agriculture are often under-employed and therefore see intensification as a means of seeking full employment and, of course, a higher income. The availability of off-farm employment can allow low intensity farming to continue on a part-time basis rather than as the sole source of income and activity.

Final Comments and Recommendations

For many years the agricultural land area of what is now the European Union has been divided into two broad zones - the agriculturally Less Favoured Areas and those which are more productive. In an era in which environmental objectives have become increasingly important, this division is no longer sufficient on its own. There is a need to pinpoint those farming systems which are of greatest social and environmental benefit. In this study, we have made a very preliminary step in this direction by attempting to identify those systems which are truly less intensive.

Many of these systems are in the process of fundamental change or abandonment before they have been evaluated or measures to protect them have been even considered. Because of the rapid and large scale rate of change and the increasing value attached to environmentally sensitive, low yielding forms of agriculture, a reappraisal of these farming systems is overdue. This should be one part of a wider strategy for planning the future of low intensity agriculture in Europe. Measures to protect valuable systems should not aim to freeze them in time as museums of agrarian culture. Rather, the objective should be to preserve the most important features and management practices of these systems without stifling their development. It will not be possible or appropriate to continue with low intensity methods of farming unless it is possible to create a way of life which is socially and economically attractive, as well as beneficial for nature conservation.

Research

As emphasised frequently in this report, there is a need for more research on the character and func-

tioning of low intensity farming systems, on their economic viability and the changes which are taking place within them, on the value of different practices for nature conservation and on the ecological consequences of abandonment and other critical changes in management. Beyond this, we need further work on ways of enhancing the environmental value of existing systems and further study of different means of managing marginal and abandoned land.

Agricultural policy

Many systems will not survive without continuing financial support. Where this is provided solely in the shape of conventional agricultural subsidies, there is a danger that nature conservation interests will be damaged severely. Instead, support should aim to promote locally appropriate rural development reflecting environmental and social priorities alongside agricultural concerns. Where farmers wish to continue employing often arduous low intensity practices, the support they receive should reflect the benefits for nature conservation and the wider environment.

This study has touched only lightly on policy issues and it is therefore not appropriate to make detailed recommendations for action. However, there is an immediate need to review the impact of existing agricultural policy mechanisms on low intensity systems at both national and EU levels and to identify those which are most disadvantageous. In the short term, it is a priority to prevent damage and destruction of low intensity systems, for example through inappropriate subsidies for intensification, production control or afforestation. Many of the existing CAP policy mechanisms, including the Less Favoured Areas Directive, should be revised in order to provide more focused support for less intensive and environmentally valuable systems. In the longer term, a more fundamental reform of the CAP is unavoidable if the existing bias in support towards higher yielding, more productive farms is to be removed.

Rural development

No strategy to secure the future of valued low intensity systems should rely on agricultural policy alone. Support measures should seek a more balanced approach to rural development, taking into account the broad spectrum of social, cultural and educational needs of the farming community, as well as the production and marketing of food. Many rural development initiatives now recognise this approach and the importance of sensitivity to local conditions and the new EU agri-environment programme provides significant budgetary support for a growing range of local schemes. Nonetheless, there is a danger that the "extensification" of production and control of pollution can be seen as the only priority for a more environmentally sensitive agriculture. The neglect of less intensive systems would deal a severe blow to nature conservation in Europe; their rehabilitation should be a central goal of rural development.

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WWF - World Wide Fund For Nature is one of the world's largest independent conservation organizations with a network of National Organizations and Associates around the world and over 5.2 million regular supporters. WWF aims to conserve nature and ecological processes by preserving genetic, species and ecosystem diversity; by ensuring that the use of renewable natural resources is sustainable both now and in the longer term; and by promoting actions to reduce pollution and the wasteful exploitation and consumption of resources and energy. WWF continues to be known as World Wildlife Fund in Canada and the United States of America.

JNCC - the Joint Nature Conservation Committee is a forum through which the three country nature conservation agencies, the Countryside Council for Wales, English Nature and Scottish Natural Heritage, deliver their special statutory responsibilities for Great Britain as a whole and internationally. These special responsibilities, known as the special functions, contribute to sustaining and enriching biological diversity, enhancing geological features and sustaining natural systems.

IEEP - the Institute for European Environmental Policy is an independent body for the analysis of environmental policies in Europe. It seeks to increase awareness of the European dimension of environmental protection and to advance European policy-making in this field. The Institute is a network with offices in France, Germany, the Netherlands and the UK, bound together by common objectives and a central charitable Foundation in the Netherlands.

Artists for Nature Foundation is an international non-profit organization dedicated to the preservation of natural environments which are vital as habitats of endangered plants and animals. ANF works closely with the World Wide Fund For Nature as well as other conservation bodies.

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