Developing a High Nature Value Farming area indicator

FINAL REPORT

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1. Introduction

Perhaps expressed at its simplest the aim of this project is to obtain an objective indication of where HNV farmland is predicted to occur in Europe together with an impression of the likely agricultural characteristics of the farming systems practised in association with such HNV farmland

Why indicators?

The Concept of High Nature Value (HNV) farmland and farming systems have been evolving over the last fifteen years in Europe. In the European Union this has been closely linked to the aim of integrating environmental concerns into Community policies. The idea that nature values, environmental qualities and even cultural heritage are linked to or dependent on farming also underlies and supports the concept of a multifunctional 'European model of farming' which provides benefits other than food. The 'High Nature Value farming' idea thus ties the preservation of the diversity and wildlife value of the countryside to the need to safeguard the continuation of farming in certain areas and the maintenance of specific farming systems associated with the long term management of these areas.

At a more technical level the issue of High Nature Value areas has been brought into the discussion on indicators for the integration of environmental concerns into the Common Agricultural Policy (Com (2000) 20). The European Commission has given an overall rationale for the development of indicators (Com (2001) 144, p. 3):

- to help monitor and assess agri-environmental policies and programmes, and to provide contextual information for rural development in general;
- to identify environmental issues related to European agriculture;
- to help target programmes and address agri-environmental issues;
- to understand the linkages between agricultural practices and the environment.

Objective of this project

Though the existence of a wide range of predominantly low intensity farming systems valuable for the rural environment has been recognised for more than a decade, there is a lack of data on the precise distribution, character and evolution of the farmland and the farming systems in question.

To remedy this the study has had to provide a framework for compiling compatible information on HNV farmland across Europe, laying some of the foundations for longer term improvements in data. Based on this information the primary objective of the study is to develop and test a High Nature Value farming area indicator or indicators at EU level and to analyse the possibilities for extending these to all EEA member countries.

The tasks to be addressed in the project were:

- An initial survey of relevant European datasets

- The conceptual development of a potential HNV farming area indicator
- The elaboration of a map of HNV farmland in the EU
- An analysis of the possibilities of extending any HNV farmland indicator to all EEA member countries and Switzerland
- The validation of results through consultation with regional experts etc.
- An evaluation of the project results and recommendations for future work.

It was understood from the outset that there was no guarantee that an acceptable indicator could be developed for use at a pan European level. However, it was essential to investigate a range of different approaches and to explore the options thoroughly.
Indicators

The report and the underlying study are not on HNV farming as such, but on developing indicators in relation to HNV farming and farmland. Thus, detailed descriptions of the characteristics of HNV farming systems across Europe cannot be found here. Detailed information has been gathered, both at the European level and in individual countries, but only to support the choices made in working up the approaches for developing indicators taken in the project. The reasoning behind this is that the indicator(s) need to be developed using Pan-European data to make them applicable across EU Member States and perhaps beyond. This is a major challenge because of the limitations of the Pan-European datasets available to effectively capture the characteristics of HNV farmland. It is important to keep this in mind as it constrains the scope, methodology and results of this project.

What are High Nature Value farming areas?

HNV farming areas in Europe include a wide range of landscapes and habitats like the Spanish dehesas, Alpine pastures, the wet heaths and moors of Western Ireland and the grazed salt marshes of Northern Germany. These at first glance very diverse areas are in fact all landscapes that have in common the presence of valued habitats and species and the presence of specific types of farming.

One of the first essential tasks of this project was to define HNV farmland in a way that links the presence of natural values directly to the farmland. We used the following working definition,

'High Nature Value farmland comprises those areas in Europe where agriculture is a major (usually the dominant) land use and where that agriculture supports or is associated with either a high species and habitat diversity or the presence of species of European conservation concern or both'.

The project was undertaken by a core team drawn from six different institutions, with members based in a range of European countries. In addition, regional specialists were subcontracted to work on some detailed national profiles and specific questions. Further experts were involved through a verification process described below. Several team meetings were held, including a number with EEA staff. A considerate number of working papers were generated, including national profiles for a range of countries. A collection of these papers is available separately from this report, which is the principal output of the project.

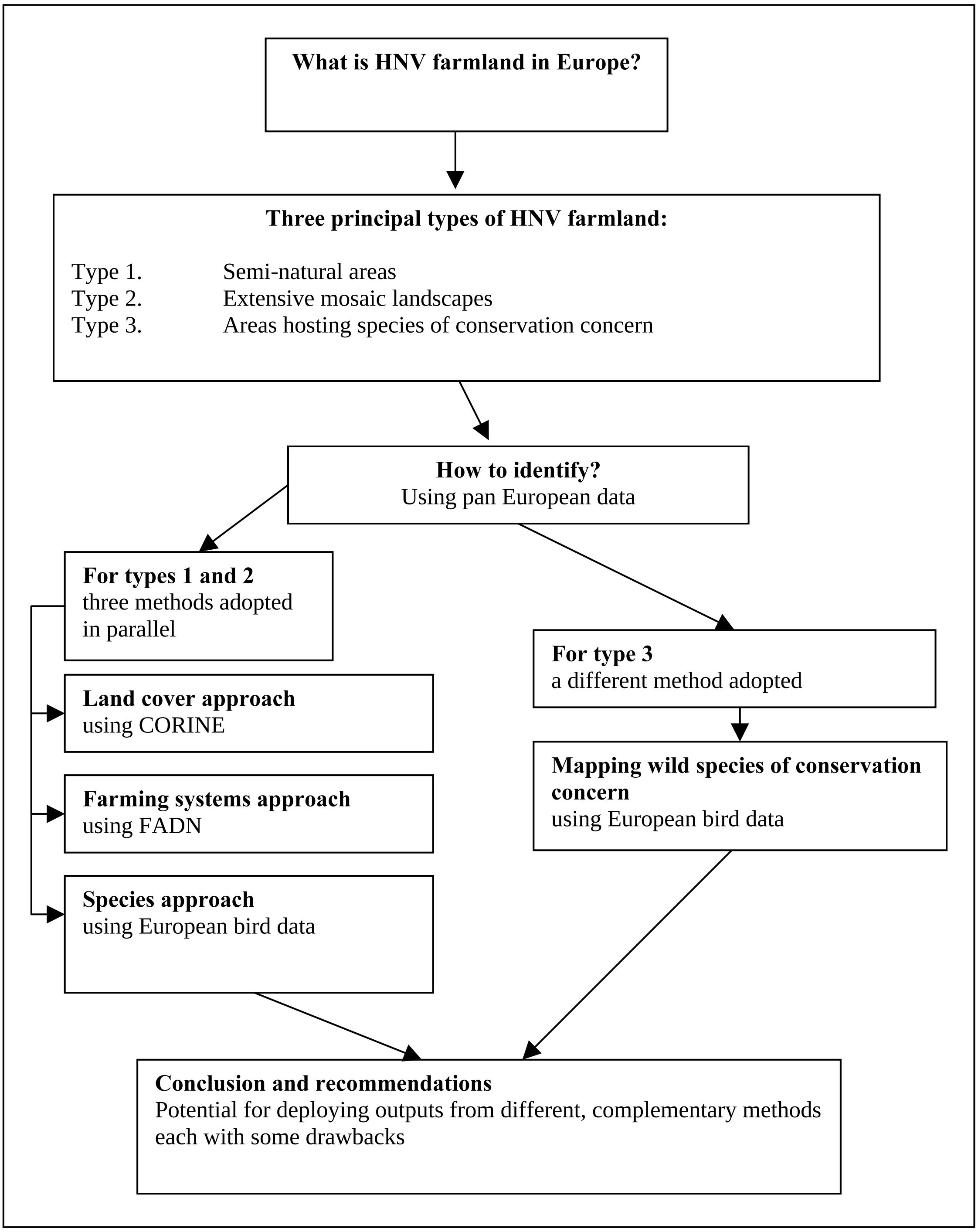
Overall approach

The early stages of the project involved examination of the range of potentially relevant data sources available at a European level and some national sources as well. This exercise was complemented by conceptual work, drawing on the literature and earlier studies of HNV farmland or livestock systems in Europe. Some work at a national level proved essential, particularly in identifying the characteristics of HNV farmland in areas which have been studied more closely in order to narrow the range of variables that might be used to develop an indicator. After an initial analysis it was decided to pursue three different methods to identifying HNV farmland areas utilising data on land cover, the character of farming systems and the distribution of wild species, specifically birds. A fourth approach using bird data to identify a particular type of HNV farmland was also explored. The scope for compiling these approaches was also considered.

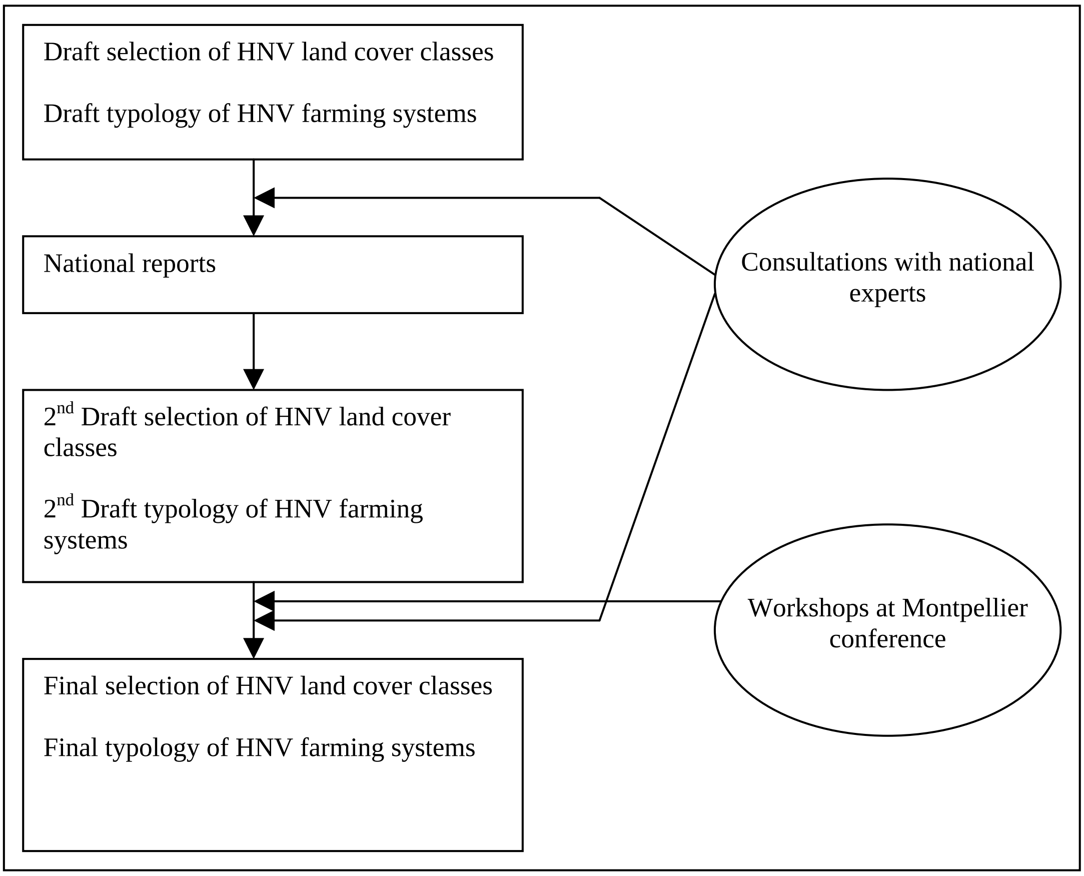
Structure of the workprocess and verification

The project schema in box 1 below gives an overview of the structure of the workprocess in the project and the approach taken from defining HNV farmland to the conclusions and the recommendations. In box 2 on the following page an overview is given of the verification process pursued in the project. As can be seen, national (or regional) experts have been involved at different stages of the project, particularly to ensure that the interpretation of results based on Pan-European datasets does reflect as far as possible the situation on the ground and the range of conditions in Europe. Another important part of the verification process was the organisation of 3 parallel regional workshops held in Montpellier 16th of September 2003. At these workshops the preliminary results were presented to experts and stakeholders. It should be mentioned that the work on using the bird species data approach did not follow this verification process. It was never anticipated that this approach would lead very far and the more fundamental work based on land cover data and farming system typology had been given higher priority at that time.

Box 1: Project schema



Box 2: verification process



Structure of the report

The main report is divided into four sections and supported by relevant annexes. An additional set of Working Documents put together during the course of the project is provided separately. In section 2 of this report we present a range of conceptual considerations, including the definition of HNV farmland and related terms. As described above, it was decided to proceed by pursuing three different methodologies for the identification of indicators, bringing these together in the closing state of the project. In section 3 these three methodological approaches (land cover, farming system and bird species-led) are described. In section 4 we critically assess the predicted distribution and characteristics of HNV farmland utilising the proposed indicators, focussing on three distinctive regions: Southern Europe, Western Europe/Scandinavia and Central/Eastern Europe. Finally, in section 5, we draw some conclusions, consider the potential application and also the limitations of the indicators and make final recommendations.

2. Conceptual framework - definition of HNV farmland

Background

The concept of European farmland being of high value for nature in many ways runs contrary to accepted wisdom about the interaction between farming and the environment. It is certainly true that, over large parts of north-west Europe, agriculture has been and continues to be, a major factor in reducing biodiversity. Reflecting this, the majority of the work on agriculture carried out by environmental NGOs and government agencies focuses on ameliorating the negative effects of agriculture. Most of these relate to the high intensity of external inputs, especially fertilisers and chemicals, the simplification of the landscape, both physically and in terms of land use, and to pollution of soils and ground water.

During the mid 1990s it began to be recognised that in many places particular styles of farming were not only less damaging to the environment but were in fact positively linked to biodiversity. Some might even be essential for maintaining the current nature conservation value (e.g. Baldock, 1990, Beaufoy *et al* 1994, Bignal *et al*. 1994, Bignal & McCracken 1996a, 1996b). Very often these "systems" were long established with modernisation being prevented by physical constraints, location or, in some places, regional culture.

To differentiate them from the more damaging modernised, intensive systems, they were termed "Low Intensity Farming Systems". The latter term has recently tended to be replaced with High Nature Value (HNV) farming systems, although the two are not strictly interchangeable (see Defining High Nature Value and HNV farmland below).

At a general level it is relatively easy to conceptualise these systems from actual examples. In the report on "The Nature of Farming" in 1992 there were case studies of livestock, cereal, permanent crop and mixed systems which were of significance for nature conservation (Beaufoy *et al* 1994).

The biological value of these systems relates to a number of essential factors such as:

- They maintain a wide range of vegetation structures and niches (e.g. different semi-natural habitats, different land use types) on farmland which in turn are essential for species of other biota. At its simplest a varied habitat mosaic generally maintains the highest biodiversity (Angelstamm, 1992).
- Their farming practices (e.g. through grazing and other management factors) create levels of disturbance, which maintain many vegetation communities which are highly valued for their nature value.
- Farming practices are generally more constrained by location, climate and topographic factors leading to greater synchronisation with natural features and processes.
- They often farm at a large scale producing conditions favourable for the viability (sustainability) of plant and animal populations.

But producing a detailed definition of High Nature Value farming systems is much more difficult - but nevertheless essential if a Europe-wide classification with indicators is the objective.

A huge problem is the loose terminology that tends to be used in the literature and policy debate. For example "HNV farming areas" is ambiguous and imply that the farming itself is of High Nature Value, "HNV areas" also commonly used makes no direct reference to agriculture and could imply that both optimal and sub-optimal farming could occur; whilst naming a set of "HNV farming systems" suggests that farming at varying levels of appropriateness leads to the nature value and seems to suggest that all farms within the classes are of High Nature Value, while those outwith are not. We need to explore these issues further.

Defining High Nature Value farmland

Whilst most previous approaches to classifying farmland have tended to focus on aspects of agriculture (specifically either low intensity or high intensity), this project focuses on High Nature Value. The word "value" in HNV refers to conservation value and necessarily introduces a strong element of subjectivity that would not be there if we were dealing with a more quantitative subjects such as biological diversity or species richness. It also introduces the question of the relative position and extent of particular habitats or species - which might be valued differently in different locations.

So, regardless of agricultural activities, our first step was to agree some definitions relating to what is meant by High Nature Value to provide the foundations for subsequent analyses and classification. After considerable debate the three broad categories of farmland set out below and defined in box 3 were agreed on as being potentially of HNV.

Type 1: Farmland with a high proportion of semi-natural vegetation.
Type 2: Farmland with a mosaic of habitats and/or land uses
Type 3: Farmland supporting rare species or a high proportion of European or World populations.

Type 1 and Type 2 are based on factors relating essentially to biodiversity although this is not quantified. Type 3 areas will mostly overlap with Type 1 or Type 2 areas but not always (for example some highly valued rare bird species such as bustards are associated with biologically simplified agricultural areas with low vegetation diversity).

On the one hand we use *land cover* surrogate. We believe that for semi-natural areas we can not necessarily quantify the biodiversity present, but it has inherent value as well as being associated with a range of species. Large areas of semi-natural land cover (visible, by definition, from space) also have the potential to support a wide range of biodiversity at a variety of scales. To complement this we have a land use surrogate.

We do acknowledge that some farms of high biodiversity might not be located by our methods. We are not convinced that this class accounts for a significant proportion of

Europe's HNV farmland. On the other hand we appreciate that it may be locally significant but, if so, would need to be defined by local criteria.

From this we have established a set of broad definitions that together we feel helps distinguish most types of *farmland associated with HNV*. The definitions are set out as a dichotomous key in the table below.

Box 3: Definition of types of potentially HNV farmland

Question 1: Is the farmland dominated by semi-natural vegetation?

If yes = **HNV farmland type 1** (e.g. heath, dehesa or grasslands)

If no, go to question 2

↓

Question 2: Is it dominated either by low intensity agriculture or a mosaic of semi-natural and cultivated land and small-scale features.

If yes = **HNV farmland type 2** (e.g dry arable areas and small-scale farms in southern Europe. Small scale features includes open water (e.g. on rice farms), ditches, relict grassland, field boundaries and woodland.

If no, go to question 3

↓

Question 3: Does the area host rare species or support a large proportion of European or world population of certain species?

If yes = **HNV farmland type 3** (e.g. areas of intensively managed wet grassland favoured by migrating geese)

If no = Not HNV farmland

From this key, it becomes apparent that the team did not define HNV primarily in terms of rare species or Habitats Directive priority habitats. We believe that a biodiversity-oriented definition is in fact closer to the spirit of the EU's biodiversity strategy, while still being able to encompass narrower policy goals focussed on rare or threatened species and habitats.

Defining HNV farmland itself is essential, but not simple. We use the following definition:

High Nature Value farmland comprises those areas in Europe where agriculture is a major (usually the dominant) land use and where that agriculture supports or is associated with either a high species and habitat diversity or the presence of species of European conservation concern or both.

This does not necessarily imply causality between farming practice and the existence of HNV on farmland. High species and/or habitat diversity may exist alongside or despite farming (although for most categories of HNV farmland there would have been a positive link, at least historically).

We have established a set of criteria that together we feel help to distinguish most types of HNV farmland. The criteria include factors relating to land cover on the one hand and land use on the other. Both are only proxies for HNV farmland since they do not measure biodiversity as such. Lack of adequate data on species distribution and habitat condition at an appropriate scale prevents a quantitative biodiversity-based approach. However, we feel confident that the proposed criteria form a reasonable basis for the delineation of areas where HNV farmland can be expected with high probability, given sufficient locational details on the one hand and access to data on the other.

The issue of appropriate agricultural management of HNV farmland, whether historically or at present, is complicated because it cannot be defined directly from the presence of HNV farmland. In most cases it is conveniently tackled through the farming systems approach This approach defines (within the limits of resources and knowledge currently available to us) those systems that are likely to promote the maintenance or enhancement of High Nature Value based mainly on past examples and statistics on contemporary systems. These HNV systems may or may not be visible in terms of land cover. Identifying and naming a set of systems as such does not imply that all farms within the class in fact support HNV or that there are no HNV farming systems outside these classes. However, they can help to understand the management needs of High Nature Value farmland and support the identification of further potential HNV areas.

Since we are not able to distinguish by either the land cover or the farming system approach the precise extent of HNV farmland, and since we believe that some HNV areas are sub-optimally managed with current farming practices, we are unhappy about the ambiguities of the term “HNV farming area”. We therefore propose to re-name this indicator *area of High Nature Value farmland* rather than to use the initially defined *High Nature Value farming area*. By taking out the term 'farming' the implied positive link between current farm management and species and habitat richness is eliminated, yet the critical association between High Nature Value and farmed area (and not other land uses) is still expressed.

This new phrase (area of HNV farmland) also contains some difficulties which we must acknowledge. In particular, we stress that any *areas* of HNV farmland which might be identified by this project are not necessarily homogeneously HNV or homogeneously well-managed. Conversely, farmland outside of these areas is not necessarily non-HNV. We are making generalisations only. Similarly, *areas* identified using one approach may differ from those identified by another – neither is necessarily wrong.

Developing the HNV concepts into a methodology.

The 3 types of HNV farmland pose different problems in terms of their characterisation and location. To address this we have developed 2 complementary approaches (land cover and farm system typology) to describing and locating types 1 and 2 which we feel confident about; and we have explored the potential of a third approach (using bird species), which although less useful does highlight why there is the need for indirect indicators.

For the identification of Type 1 and Type 2 areas the first approach used was land cover which, although saying nothing about state relative to the optimum (even assuming this could be defined), is suited for the identification of *areas, that is the location.* The second is agronomic and economic data derived from farms (e.g. FADN, IACS, farm census) which, by analysing the pressure from farming practices, gives a general indication of the presence and character of farming systems that are likely to manage HNV farmland. The third approach involves using the distribution of birds associated with HNV farmland to predict the potential occurrence of their breeding habitats which in turn is used to infer whether the area is of HNV or not.

For the location of Type 3 HNV areas we regard the only feasible way forward to be the plotting of the actual species distributions. Limitation of species data (e.g. for invertebrates) means that this is not possible on an European scale other than for breeding birds. We have explored the possibility of this approach.

In table 1 the expected output from the different methodological approaches are summarised. Though the table indicates that the different approaches cover different types of HNV farmland, the validity of the results might differ. This is for example the case for the land cover approach and for the farming system approach, where the results for the semi-natural areas (HNV farmland type 1) can be expected to be more valid than the results for the mosaic landscapes (HNV farmland type 2).

Also the land cover approach is principally about locating areas whilst the farm system approach is about describing the types of farm. The species approach has not produced easily interpretable results because there are so many assumptions built into the methodology. In the presentation of the results references to the different types of HNV farmland are not made explicitly.

Table 1: Expected output of the different approaches in relation to the different types of HNV farmland

	HNV farmland type 1	**HNV farmland type 2**	**HNV farmland type 3**
Land cover approach	Presence of land cover classes related to HNV farming. Indicative maps of the location of HNV farmland.	Presence of land cover classes related to HNV farming. Indicative maps of the location of HNV farmland.	Not suited
Farming system approach	Presence and extent of HNV farming systems. Indicators on the extent of HNV farmland. Indicators on the pressure from farming on HMV farmland.	Presence and extent of HNV farming systems. Indicators on the extent of HNV farmland. Indicators on the pressure from farming on HMV farmland.	Not suited
Species approach	Predicted occurrence of the habitats of key farmland species in a 50x50km square Indicative maps.	Same as on the LEFT.	Species distribution maps show relationship to other approaches and help identify other types of farmland

3. Methodology

Introduction to the approaches of the project

As outlined above the project has developed three different approaches to developing indicators of High Nature Value Farming. The *land cover approach* aiming to identify HNV farmland using general land cover data, the *farming system approach* aiming to identify farming systems likely to promote the maintenance or enhancement of nature value and the species approach aiming to identify selected species supported by or associated to HNV farmland.

Each of these approaches has different strengths and weaknesses and it has been an important task of the project to test the different approaches and evaluate the potential use in an indicator framework.

In this section the methodology of the three different approaches are described in details.

3.1 land cover approach

Background and objectives of the land cover approach

In the *Nature of Farming* (Beaufoy *et al.* 1994) typical characteristics of low intensity farming systems were identified and it was recognised that the types of land cover present was a potentially important indicator of whether the farming systems being practised were likely to be low-intensity or not. In particular, it was found that many of these HNV farming systems were being practised on farmland containing a high proportion of semi-natural vegetation and that this typically occurred in close association with areas of natural vegetation (such as woodlands or wetlands) and other landscape features, or within landscapes containing a large diversity of agricultural land covers.

The definition of HNV farmland used in this project reflects these land cover characteristics, with the presence of semi-natural vegetation being considered a dominant feature of Type 1 HNV farmland and the occurrence of a mosaic of different low intensity agricultural land uses and other landscape elements being a key feature of Type 2 HNV farmland. Given the close association of these land cover features with HNV farmland, it was considered that obtaining an indication of where relevant semi-natural vegetation types, mosaic farmland and landscape features occur throughout Europe may therefore suggest where there was also a higher likelihood of HNV farmland occurring in those areas.

The main objectives of the land cover approach was therefore to:

- Assess the range of land cover information available at the European level and select the most appropriate dataset to work with.

- Identify relevant land cover types within that dataset considered to be closely associated with agricultural land.

- Identify those agricultural land cover types considered to be closely related to HNV farmland throughout Europe and plot the location of these cover types on maps.

- Make an assessment of whether or not the maps of the chosen land cover types reflects the likely distribution of HNV farmland on the ground.

Given the concentration of land cover data on semi-natural vegetation types, it was expected that the land cover approach could potentially be useful to locate both Type 1 and Type 2 HNV Farmland. However, by definition all Type 3 HNV Farmland is not necessarily associated with particular land cover characteristics and so it was not expected that the land cover approach would be useful as a means of locating that type of HNV farmland.

Data sources

At the European level CORINE-Land Cover (LC) was considered to be the best source of consistent detailed land cover information. One advantage of using CORINE above other land cover information sources such as PELCOM and the IGBP-DIS Land Cover information, is that it contains a much larger spatial variety of Land Cover Classes (LCCs) and also contains a diversity of LCCs which can be regarded as being potentially closely associated with agricultural land (Table 2). The latter range of LCCs also offers the potential to distinguish specific LCCs that may have stronger links with HNV farmland. An additional advantage of CORINE is that the minimum mappable unit is quite small (corresponding to 25 hectares) and so the potential to provide good location precision is quite high. The last advantage of CORINE is that it is currently in the process of being updated. Hence, if this project established that the existing CORINE data did have a real potential to identify HNV farmland, then the likelihood of updated data becoming available at some point in the near future would also give EEA the possibility of making an additional assessment of the potential for the CORINE land cover approach to be used as a monitoring tool.

Methodology

CORINE contains information on the distribution of a total of 44 Land Cover Classes (LCCs) and nineteen of these were selected on the basis of being potentially closely associated with agricultural land (Table 2).

Table 2: The 19 Corine Land Cover Classes (LCCs) which were regarded as being potentially associated with agricultural land

CORINE code	CORINE LCC
2.1.1	non-irrigated arable land
2.1.2	permanently irrigated land
2.1.3	rice fields
2.2.1	vineyards
2.2.2	fruit trees and berry plantation
2.2.3	olive groves
2.3.1	pastures
2.4.1	annual crops associated with permanent crops
2.4.2	complex cultivation patterns
2.4.3	land principally occupied by agriculture with significant natural vegetation
2.4.4	agro-forestry areas
3.2.1	natural grasslands
3.2.2	moors and heath lands
3.2.3	sclerophyllous vegetation
3.2.4	transitional woodland-scrub
3.3.3	sparsely vegetated areas
4.1.1	inland marshes
4.1.2	peat bogs
4.2.1	salt marshes

Prior to attempting to select which of these LCCs may be more indicative of HNV farmland, it was decided that this selection process would need to be stratified using a combination of national boundaries and Environmental Zones (see Annex A for description of Environmental Zones used in this project). This stratification was considered necessary:

- To take into account the fact that there are known inconsistencies in the way CORINE classes have been interpreted between the different European countries

- To reflect the fact that there are differences in the type of HNV farmland that can occur between different countries and also often within different climatic and altitude zones.

National experts in each country were provided with the list of CORINE LCCs and, where relevant, an indication of the extent and location of each environmental zone within their respective countries. These national experts were then asked to provide for each Environmental Zone separate lists indicating those LCCs which they judged could be used to potentially indicate (a) the Minimum potential location of HNV Farmland with that zone and (b) the Maximum potential location of HNV Farmland within that zone. The *Minimum* selection was to include only the LCCs which are made up *primarily* of HNV land, while the *Maximum* selection was to include all LCCs that include *some* farmed HNV land. It was assumed that the Maximum selection would also contain much non-HNV land, whilst the Minimum inevitably would exclude some known HNV land. The rationale behind the Minimum and Maximum approach was that it was intended that taken together these may provide some measure of the extremes within which HNV Farmland was likely to occur.

For some Member States, this initial selection of Minimum and Maximum HNV LCCs was checked and revised by comparing maps of the selected LCCs with the location of areas where HNV farmland was known to exist and with national spatial data sources, e.g. inventories of non-improved grasslands, and/or national land cover maps which can be considered of better quality for indicating where the HNV farming areas are than CORINE.

Further validation and revision of the selection of LCCs per country and Environmental Zone occurred during workshop sessions held in Montpellier, France in September, when delegates from countries throughout Europe were shown draft maps based on the selected LCCs and their views sought on the selection of LCCs which would be appropriate for the countries within each of the three European regions (Northern Europe & Scandinavia; Southern Europe; Central & Eastern Europe)

A final revision of the LCCs selected per country/Environmental Zone occurred when the national experts were asked to compare their initial selection with those made by experts within other countries located within the same Environmental Zones. If large differences between selections occurred within similar Environmental Zones, corrections were applied on order to achieve greater coherence between countries and zones, or explanations for the differences were required and registered. An example of the results of the definite selection is shown in table 3 and the final selection for all Member States and Environmental Zones are shown in annex B.

Table 3: Example of selection of LCCs in the Alpine South Environmental Zone (for all other selections see Annex B) X = selected, O = not selected.

		MIN	MAX	MIN	MAX	MIN	MAX
Alpine South	Class no.	**Fran-ce**	**Fran-ce**	**Italy**	**Italy**	**Spain**	**Spain**
Non-irrigated arable land	211	0	X	0	X	0	0
Permanently irrigated land	212	0	0	0	0	0	0
Rice fields	213	0	0	0	X	0	0
Vineyards	221	0	0	0	0	0	0
Fruit trees and berry plantation	222	0	X	0	X	0	X
Pastures	231	X	X	X	X	X	X
Annual cops associated with permanent crops	241	0	0	0	0	0	0
Complex cultivation patterns	242	0	X	0	X	0	X
Land principally occupied by agriculture	243	0	X	0	X	0	X
Agro-forestry areas	244	0	X	X	X	X	X
Broad-leaved forest	311	0	0	0	0	0	0
Coniferous forest	312	0	0	0	0	0	0
Mixed forest	313	0	0	0	0	0	0
Natural grasslands	321	X	X	X	X	X	X
Moors and heath lands	322	X	X	X	X	X	X
Sclerophyllous vegetation	323	0	0	0	0	0	0
Transitional woodland-scrub	324	0	X	X	X	X	X
Bare rocks	332	0	0	0	0	0	0
Sparsely vegetated areas	333	0	X	0	X	0	X
Burnt areas	334	0	0	0	0	0	0
Inland marshes	411	0	X	0	X	X	X
Peat bogs	412	0	X	0	X	X	X

Limitations of the land cover approach

Even though CORINE was the best source of land cover data identified, it is clear that using CORINE LCCs as a means of potentially locating High Nature Value Farmland has many limitations:

- Some problems are related to the internal logic of CORINE, which is basically to identify land cover that is relatively uniform. Because the minimal mapping entity was 25 hectares CORINE classes are either determined by the most dominant land use or they have been classified as a mixed class. Especially with the mixed CORINE classes, such as complex cultivation patterns, it is difficult to determine whether HNV farming areas land use are contained in this class, especially because most of the CORINE classes, e.g. “pastures” and “non-irrigated arable land”, do not distinguish between intensive and extensively managed types.

- Some problems relate specifically to the version of CORINE we have worked with. Firstly, this version of CORINE is several years old and has a large temporal heterogeneity (1985-1994) which is mainly the consequence of image data availability and addition financial restrictions. Secondly, the coverages of Finland and the United Kingdom are the result of translation of classes from independent national land cover databases. The coverage of Sweden is based on the national land cover, which was translated into the seven CORINE land cover classes, which in turn were combined with PELCOM, resulting in the 44 CORINE classes. Also, some other localities, such as Greek islands, are not covered by the existing CORINE version.

- It is essential to note that forest LCCs were excluded from the LCC selection process because CORINE does not distinguish between forest management systems or give any indication of whether forest are subject to grazing or other forms of agricultural management. Consequently, if forest LCCs had been included then this would automatically included a very large amount of forest that has no connection with any type of farming at all. It is, however, recognised that the decision to exclude forest LCCs from the selection process also means that there was no possibility of identifying the location of various types of grazed forest that may be considered HNV farmland.

- Finally, it is essential to remember that land cover information cannot (except in extremis) indicate anything about the quality of the Nature Value relative to its potential since it indicates little about management practices. It should therefore be emphasised that the areas shown in the land-cover derived maps should not be interpreted as meaning that farming *management* in the mapped areas is necessarily appropriate in relation to the nature values, since in some cases it is clearly not.

Outcome of the land cover approach

The spatial distribution of the final selection of LCCs was mapped for each country/Environmental Zone and the results combined and presented in the form of:

- One map showing the distribution on the ground at a 10 x 10 km square level of those LCCs considered to potentially indicative of the Minimum location of HNV Farmland and
- one map showing the distribution on the ground at a 10 x 10 km square level of those LCCs considered to potentially indicative of the Maximum location of HNV Farmland.

These maps are presented in the Results section together with a consideration of their likely potential usefulness and a consideration of the similarities and dissimilarities between the outcome from the land cover approach and the outcome from the other two approaches.

The land cover approach is useful for identifying the potential location of HNV farmland or at least where there is a higher or lower probability of HNV farmland occurring. However, it cannot be used to indicate anything about the intensity of the farming systems or management practises occurring in those areas or even whether the LCCs mapped are actually under agricultural management at all. The strength of the land cover approach is its potential to highlight areas where HNV farmland may be occurring and thereby also provides a means of targeting more accurately any future validation and ground-truthing exercises. However any potential measurement of the likely extent of HNV farmland within these areas cannot, for the reasons given above, be obtained from the land cover approach. Rather this should be best attempted using the farming system approach and it is in this way that the two approaches have the potential to complement each other.

3.2 Farming system approach

Background and objectives of the farming system approach

The Nature of Farming study put High Nature Value farming on the agenda and pointed to the existence of a wide range of low intensity farming systems valuable for nature. However, the study also revealed a lack of data on the precise distribution, character and evolution of the farming systems in question.

In this light the overall objective of the farming system approach is to identify those systems that are likely to promote the maintenance or enhancement of nature value. However, the brief for this project also specified that the approach should take into account the need for monitoring. This meant that the availability of data which were both coherent across the EU and regularly updated became an over-riding factor in methodology and in the selection of discriminators. The challenge has therefore been to transform the qualitative knowledge of High Nature Value farming systems on the ground (mostly based on case-studies providing no predictive capability) into meaningful, quantitative and monitorable information based on statistical sources which are universally, regularly and uniformly updated.

It is important to realise the limitations inherent in the farming system approach. The link between farming practices and the nature values is a complex and seldom direct one. In particular, it is rarely causal in terms of the data gathered in EU-wide data sources. For example, stocking density is almost never *directly* related to HNV anywhere - the effect is indirect through other species and the structure and composition of the habitat. This can vary between different environments, so that a stocking density which may appear generally positive in one place may be highly negative in another.

This means that identifying and naming a set of farming systems as HNV farming systems does not imply that all farms within the class in fact support HNV or that there are no HNV farming systems outside these classes.

However, subject to weaknesses in the data, the strength of the farming systems approach is that it relates to the management practices of the farms. This means in principle that the approach can help us to understand the management needs of High Nature Value farmland and support the identification of further potential HNV areas. In monitoring terms this means that the farming system approach can be used to give indications on the pressure from farming in relation to nature values and that it can be used as a tool for designing and assessing relevant policy initiatives.

It may indeed be that the identified HNV systems may not be visible in terms of land cover at the large scale. They may be present on single farms and still be significant on the scale at which some species organise their lives. Thus the farming system approach has the capacity, if carefully tuned and tested, not only to make predictions as to the *state* of HNV, but also to focus down to a much finer scale than the land cover approach *without* losing meaning.

Data sources

As a part of the project the existing data on farming has been reviewed and it was decided to use the data from the Farm Accountancy Data Network (FADN) for the farming system approach. There are several reasons for this. Firstly, FADN contains a broad set of data enabling links to be made to environmental aspects of the sample holdings. In particular, it contains data on farm area, stocking and input levels - all important if intensity of use is at all related to HNV.

Secondly, FADN contains data on the level of individual farms enabling the grouping of farms on the basis of a range of variables. Finally, FADN is updated regularly enhancing the usefulness for monitoring purposes. It was also an important factor, that by choosing to work on FADN data, the work could build upon the work on typologies of grazing livestock systems done in the ELPEN-project.

The use of IACS data was rejected in the initial stages of the work since a) the data is confidential at farm level, b) there is no consistent EU-wide accessibility of this data, c) it does not cover all farm types (being related to claims under specific CAP direct support schemes) and d) the variables available in the data differ between the Member States. However, it potentially provides a much larger data source than FADN and is at very least accessible to national policy makers.

Structure

To organise the information on HNV farming systems derived from the FADN data a typology of HNV farming systems have been designed. The typology is based on the work in the Nature of Farming study, expert knowledge from the different Member States and on the previous work in the ELPEN project, which also included statistical analyses.

The typology is divided in three: (1) A common level covering EU-15, (2) a regional level covering Western Europe and Scandinavia and (3) a regional level covering Southern Europe. The regional-level typologies represent further refinements of the EU-15 typology, enabling further differentiation between systems than is possible at the common level.

There are two reasons why we operate with different types at a common level and at a regional level. Firstly, different discriminating variables and different threshold values have to be applied in the different regions according to differences in farming systems and in the environment. Thus working at a regional scale enables more differentiation than is possible at the common level.

Secondly, working with different levels in some cases make it possible to by-pass the limitations in the FADN data-set in relation to the number of farms that needs to be in the data-set to extract information. Furthermore, establishing a common typology separately allows for direct cross regional comparisons Thus working at a regional (this time as opposed to sub-regional) level allows for a degree of meaningful generalisation which is necessary in order to fulfil the demands of the contract and which would not otherwise be possible.

Despite the fact that we attempted to optimise the degree of regionalisation used in our analysis, we recognise that both between farms within one part of that region and between the various different sub-regions, there are significant variations in the threshold values of the various indicators of HNV farmland. To illustrate this we have attempted a maximum/minimum approach corresponding to the approach taken for land cover. The maximum approach aims to include ”all” HNV farms but in doing so it is acknowledged that some non-HNV farms will be included. The minimum approach aims to include only HNV farms, but accepts that some HNV farms will be excluded. The 'reality' on the ground is therefore somewhere in between the results that can be captured by the two different approaches..

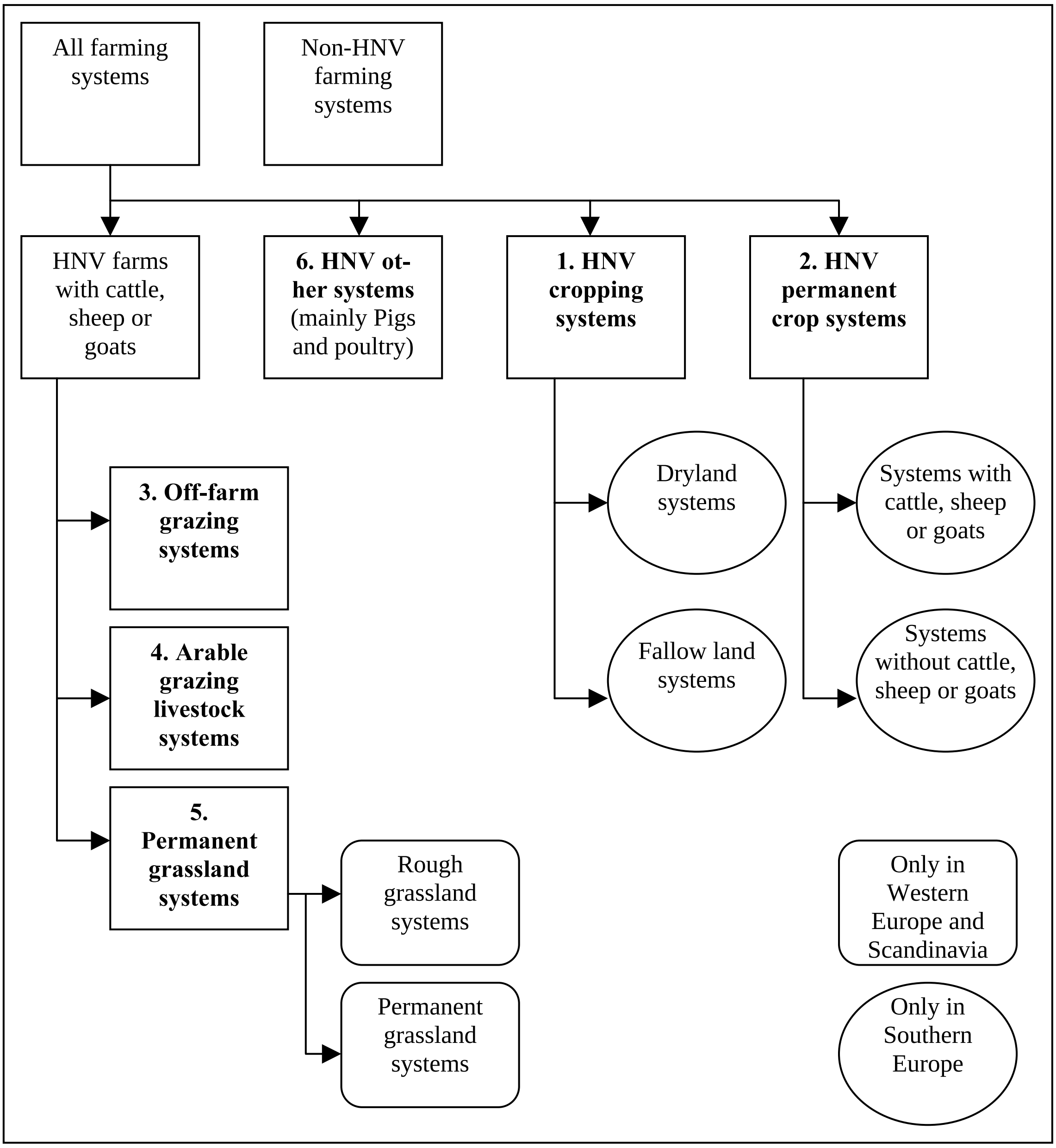
The typology

The typology distinguishes between 6 types of farming systems (see also figure 1):

- HNV cropping systems, low intensity arable systems. Might have livestock, but this is not the dominant income source.
- HNV permanent crop systems, low intensity olives and other permanent crop systems.
- HNV off-farm grazing systems, systems with cattle, sheep or goats grazing outside the farm for example on common land.

- HNV permanent grassland systems, cattle, sheep or goat systems where the main forage resource is grass from permanent or rough grassland.
- HNV arable grazing livestock systems, cattle, sheep or goat systems where the main forage resource is arable crops.
- HNV other systems, mainly low intensity pigs or poultry systems

Figure 1: Overview of the different types of HNV farming systems



Basically, this divisions is based on the findings in the Nature of Farming study added the more detailed division of livestock systems developed in the ELPEN project. This structure also links to the division in EU farming types used in the agricultural statistics, which again is based on an evaluation of the dominant source of income. This means that livestock might be present at cropping or permanent crop systems, but that the non-livestock production is more important economically. In general input use is used to define HNV versus non-HNV. This includes the cost of fertilisers, crop protection and concentrate feedstuff and not the exact amounts of input as these are not available in FADN. The exact threshold values are fixed based on expert knowledge and, for the off-farm grazing systems, the permanent grassland systems and the arable grazing livestock systems, additional statistical analyses. The off-farm grazing systems are identified based on the variable grazing days outside utilised agricultural area in FADN. Ideally this variable identifies systems grazing on common land and systems practising transhumance. However, it should be noted that the quality of the variable across EU-15 is not high, and that a lot of farms of this type therefore will not be correctly represented in the results. It is also worth noting that, although relevant, information on rough grassland is not used at this level because the data quality is poor in some countries.

As it can be seen in the figure 1 of these types of farming systems have been divided further. Permanent grassland systems have in Western Europe and Scandinavia been divided into systems where the dominant land use is rough grassland and the other systems. As mentioned above the quality of the data do not allow an EU-15 wide use of this division. In Southern Europe cropping systems have been divided into fallow land systems and dryland systems and permanent crop systems have been divided into systems with or without cattle, sheep or goats.

Table 4 gives an overview of the discriminators and threshold values used. As it can be seen the same HNV system specific discriminators and threshold values have been applied across EU-15 at the highest level. At this level input cost, share and type of grassland and grazing outside the farm are used to identify the most HNV farming systems.

Moving to the regional level the discriminators and threshold values differ between the Southern Europe region (Greece, Italy, Spain, Portugal and parts of France (Provence/Alpes/Côte d´Azur, Languedoc-Roussillion, Rhone-Alpes, Auvergne, Midi-Pyrénées, Corse and Bourgogne)) and the Western Europe and Scandinavia region (Finland, Sweden, Denmark, Germany, Austria, the Netherlands, Belgium, Luxembourg, United Kingdom, Ireland and parts of France (Ile de France, Champagne-Ardennes, Picardie, Haute-Normandie, Centre, Basse-Normandie, Nord-Pas de Calais, Lorraine, Alsace, Franche-Comté, Pays de la Loire, Bretagne, Poitou-Charentes, Aquitaine and Limousin)).

For the maximum approach the same types as on the EU-15 level are used for Western Europe and Scandinavia except for the permanent grassland systems, where a division has been made between systems where the dominant land use is rough grassland and the other systems. In Southern Europe information on fallow, irrigation and stocking density is added to narrow down the number of identified farming systems. For the minimum approach the same discriminators are used but with tighter threshold values. Also in the Western Europe and Scandinavia region a distinction is made for permanent grassland systems between those that use rough grassland for grazing and the others that do not. An overview of the different HNV farming types and the definitions at the different levels is shown in the table on the following page.

Table 4: Overview of typology

	Common Level	Maximum level		Minimum level	
	EU-15	**Western Europe and Scandinavia**	**Southern Europe**	**Western Europe and Scandinavia**	**Southern Europe**
1. HNV Cropping systems	EU-type 1 and 6 and input cost < 80 Euro per ha	As common level	Fallow systems: >12,5% of UAA in fallow	Input cost < 40 Euro ha	Fallow systems: >20,5% of UAA in fallow and input cost < 40 Euro ha
			Dryland systems: Not fallow systems and < 10% of UAA irrigated		Dryland systems: Not fallow systems and < 10% of UAA irrigated and input cost < 40 Euro ha
2. HNV Permanent crops	EU-type 3 and Input cost < 80 Euro per ha	No data	Systems with GLS: < 10% of UAA irrigated and >= 5 LU GLS	No data	Systems with GLS: Input cost on crop protection < 10 Euro/ha and no irrigation and >= 5 LU GLS
			Systems without GLS: < 10% of UAA irrigated and < 5 LU GLS		Systems without GLS: Input cost on crop protection < 10 Euro/ha and no irrigation and < 5 LU GLS
3. HNV off-farm grazing systems	EU-type 4, 7.1,8.1 and >= 120 grazing days outside UAA	As common level	As common level	>= 150 grazing days outside UAA	>= 150 grazing days outside UAA
4. HNV Permanent grassland systems	EU-type 4, 7.1,8.1 and input cost < 150 Euro per ha and >= 55% of UAA in grass and <40% of grass in temporary grass and not common type 3	Rough grassland systems: Rough grassland >=66% of UAA and stocking density < 0,5	Stocking density < 0,5 LU/ha	Rough grassland systems: Rough grassland >=66% of UAA and stocking density < 0,3	Stocking density < 0,2 LU/ha
		Permanent grassland systems: Rough grassland <66% of UAA and stocking density < 1,5		Permanent grassland systems: Rough grassland <66% of UAA and stocking density < 1,0	
5. HNV arable grazing livestock systems	EU-type 4, 7.1,8.1 and input cost < 150 Euro per ha and not common type 3 or 4	As common level	Input cost < 80 Euro/ha and ((>= 12,5 % of UAA in fallow) or (<10% of UAA irrigated))	Input cost < 40 Euro/ha	Input cost < 40 Euro/ha and ((>= 20 % of UAA in fallow) or (0% of UAA irrigated))
6. HNV other systems	EU-type 5, 7.2,8.2 and input cost < 80 Euro per ha	As common level	(>= 12,5 % of UAA in fallow) or (<10% of UAA irrigated)	Input cost < 40 Euro/ha	Input cost < 40 Euro/ha and ((>= 20 % of UAA in fallow) or (no irrigation))

EU-type = Type of farming used in FADN: (1) Specialist field crops, (3) Specialist permanent Crops , (4) Specialist grazing livestock , (5) Specialist granivore, (6) Mixed cropping (7.1) Mixed livestock, mainly grazing livestock,(7.2)Mixed livestock, mainly granivores, (8.1) Field crops-grazing livestock combined and (8.2) Various crops and livestock combined. (2) Specialist horticulture has not been included in the study

Limitations in the farming system approach

Given that the aim was to produce a typology of EU-wide application, it is inevitable that there will be errors of inclusion of non-HNV systems and non-inclusion of HNV systems in HNV classes and errors of inclusion of HNV systems and non-inclusion of non-HNV systems in non-HNV classes. These are most likely to occur at or around the class discriminators. However, our opinion is that most HNV systems will be included in the suggested HNV types and most non-HNV systems will be in the non-HNV classes. It is imperative that field testing of our hypothesis is carried out, but imperfections are likely to remain given the degree of generalisation involved.

Although the FADN database is very extensive, the use of it puts restrictions on the outcome. The most important limitation is that the sample farms that occur in FADN might not represent all HNV farming systems very well (or not at all). In total the FADN represents 52% of the farms and 86% of the Utilised agricultural Area in EU-15, when compared to the data in the Farm Structural Surveys (see table 5).

Table 5: The number of farms and area of utilised agricultural area (UAA) represented in FADN and the share of the farms/UAA covered compared to FSS (Farm Structural Survey).

	No. of farms represented in FADN	UAA represented in FADN	Share of FSS-farms represented in FADN %	Share of FSS-UAA represented in FADN %
Belgium	42464	1442890	63	104
Denmark	49934	2595416	79	97
Germany	282429	15282780	53	89
Greece	484566	2993321	59	86
Spain	539907	16551642	45	65
France	387210	25301779	57	89
Ireland	128737	4904409	87	113
Italy	998375	11603783	43	78
Luxembourg	1763	107154	59	85
Netherlands	82512	2102937	76	105
Austria	86220	2139713	41	63
Portugal	301846	3664020	72	96
Finland	52137	1832882	57	84
Sweden	38021	3331265	42	107
United Kingdom	128110	16945535	55	105
EU 15	3604231	110799526	52	86

Source: FADN-CCE-DG Agriculture/A-3; Farm Structural Survey; adaptation LEI.

Though this is not the only reason for the lack of representation of FADN, the exclusion of economically small farms explains most of the missing farms and agricultural areas. Comparing the different Member States an average of 36% of the farms and 11% of the Utilised Agricultural Area are not included in the FADN data due to the elimination of the small farms. This varies from Ireland, where only 12% of the farms and 4% of the Utilised Agricultural Area are not included, to Austria, where 58% of the farms and 38% of the utilised agricultural area are not represented. It is important to stress that economically small and ’non-professional’ farms may in fact be physically large and apparently full-time, particularly in marginal areas where the land has low productivity but alternative employment is scarce.

It is possible not only that small farms represent a different % of HNV farmland to commercial farms within a given region (all HNV farms might be small farms, to give an extreme example), but different thresholds might be necessary to differentiate small farm systems (for example, a small farm might be highly intensive and non-HNV despite having very low levels of outside inputs, whereas a larger farm might substitute inputs for labour). These issues require further investigation, but this lies outside the scope of this current study.

In addition to these problems a comparison with the Farm Structural Survey data also reveals that mixed livestock farms and beef cattle farms are not very well represented in FADN, though considerable differences occur between the different Member States. This problem is of course worse in the cases where specific types of farming systems with a high probability of being HNV farming systems are not included in FADN. So the interpretation of the results of this project must always bear in mind this inherent weakness in the FADN data.

Another important limitation to consider is that the variables in FADN have a strong economic bias. It is obvious that some of the selected criteria are not the most useful, e.g. input costs are only a proxy indicator for the pressure from the farming practices, but no information is available in FADN on the amount (and in some cases on relevant types) of inputs used.

Furthermore, all data is gathered and presented at the farm level. It is not possible to discriminate between the intensity in the use of different parts of the farms. Especially in cases where farms run more than one enterprise, for example dairy cattle and sheep, it can be difficult to identify potential HNV farming practices. In relation to the results presented in the following section it is important to stress that the data on agricultural area managed by potential HNV farming systems includes the entire farmed area of these farms rather than the actual HNV farmland.

Lastly, a major weakness of FADN is that its major unit of data collection is the Utilisable Agricultural Area (UAA), *not* the area actually occupied by the agricultural business. Seasonal lets (common in some countries, such as Ireland) or wintering/summering arrangements, as well as the use of common land and the grazing of fallows, are excluded from consideration.

Any discriminants which use per hectare measures will produce incorrect and misleading results for farms with these tenurial arrangements. Worse, these are *more* likely to be HNV in many parts of Europe, since these traditions reflect extreme seasonal variation in forage resources often associated with semi-natural vegetation. We have attempted to get round this problem by separating out a group of farms with high use of land outwith the UAA. However, we recognise that for these the FADN approach provides no further analytical tools and that this is not a satisfactory outcome.

Outcome of the farming system approach

The output of the farming system approach is maps showing the regional importance of HNV farming expressed as the share of the UAA managed by the identified HNV farming systems. Tables have been produced to present the regional distribution of

HNV farming and different types of HNV farming systems. Finally, the typology has been used to present the general characteristics of the different HNV farming systems and, more specifically, the environmental performance of the systems using selected agri-environmental indicators.

FADN is useful for identifying HNV farms but not the farmed HNV areas since the regional level at which FADN data are presented is very coarse. The strength of the farming system approach is that it provides insight in the farming practices linked to HNV farmland. This, combined with the characteristics of the FADN data, means that the farming system approach can be used to monitor short term changes in HNV farming systems and thus in the pressure on HNV farmland. The farming system approach will also provide valuable insight into the policy options for keeping the HNV farming systems in place and for supporting HNV farmland management. The farming system approach also provides (at best) an alternative 'truth' to that given by the land cover approach and comparisons between predicted % cover at the regional scale should prove productive, providing a mechanism for the mutual improvement of the two methods.

3.3 Species approach

Background and objective of species approach

From what is know about HNV farmland, it is clear that it supports a wider variety of species than more intensively managed agricultural habitats such as arable or grass monocultures. The main reason for this is that HNV farmland has a number of essential characteristics:

- It can contain a wide range of types of ecological niches (e.g. different semi-natural habitats, different land use types, different structures of vegetation) and hence provides the conditions which allow a large range of species from different biota to exist there.

- The farming practices associated with HNV farmland create medium levels of disturbance (e.g. through grazing and other management practices such as ploughing) which maintain more open types of vegetation without letting these progress fully to its climax stage.

- The timing of these farming practices is usually constrained by climatic and topographic factors on these farms, which means that the farming practices are more extensive and also more synchronised with natural process and natural fluctuations in these from year to year.

- HNV farmland habitats usually occur at a relatively large enough scale to allow enough individuals to survive in an areas to maintain viable populations of each species. The diversity of habitat types and structures on the farmland also mean that at any one time of the year there is sufficient choice of suitable conditions for different species.

The Land Cover approach based on Corine (section 3.1 above) largely involves a specific focus on semi-natural vegetation and/or complexes of agricultural habitats identifiable via the Corine classification. As such, the Corine approach would be expected to be potentially useful in identifying HNV Type 1 and Type 2 Farmland and the resulting outputs from Corine would also be expected to include some Type 3 Farmland where the species concerned have a particular association with semi-natural habitats. However, by its very nature not all Type 3 Farmland is associated with semi-natural vegetation and hence it would be expected that areas of Type 3 farmland would not be readily identifiable with the land cover approach.

Making a selection of the species and habitat types that are typical of, and most indicative for HNV farming systems requires expert knowledge on typical farmland biodiversity in different European regions. The relationships between HNV farmland and biodiversity are very broad-ranging and can be considered in terms of many different groups of biota such as vegetation, birds, mammals, insects and reptiles. The selection is further complicated because one particular species may be potentially indicative of HNV farmland in one region but the same species may have no link to farmland in other European regions. The range of expert knowledge needed to make an appropriate selection of indicative species for the whole of Europe is therefore considerable.

The objectives of the species approach were to:

- Investigate whether it was possible to identify areas of HNV Farmland by concentrating on the distribution of species known to occur in association with it.

- Compare the results with the land cover approach and assess whether or not the species approach provided similar results with regard to the potential distribution of Type 1 and Type 2 HNV Farmland.

- Assess whether the species approach was of additional value in helping to identify potential Type 3 HNV Farmland not achievable through the land cover approach.

Data sources

Ideally the types of groups and species to use in such an approach would be vegetation communities or species strongly associated with extensive farmland or particular fauna (such as butterflies or other invertebrates) with intimate links with the vegetation structure on HNV farmland, since the distribution of those species or groups of species would then be expected to reflect closely the location of their required habitats on the ground. For example, knowledge about the ecological requirements of butterflies has been well documented and some information on butterflies distribution has also become available recently (Swaay, C. van, and Warren, M. S. (1999), Red Data Book of European butterflies (Rhopalocera) (Council of Europe Publishing, Strasbourg, Nature and Environment Series No. 99) and Swaay, C van and Warren, Prime Butterfly areas in Europe (2003)). However, distribution information is only available for a selection of countries and regions and at a variety of different scales (e.g. in the Netherlands there are population data available at 1*1 km square level; for Belgium the same applies for 5*5 km square; for the UK and Ireland at 10*10 km square; and for the whole of Europe at a 50*50 km square level. However, the quality of the data and consistency of the data collection exercise (especially at the latter scale) is unclear at the moment and time and the availability of resources meant that this was not possible within the scope of this project.

The potential for using distribution data based on indicative plant species was also considered during the early stages of the project. However, there is no currently available consistent European-wide database on indicative plant species and communities for extensively managed farm land and semi-natural vegetation. For some countries, information is available at a national level of distribution patterns of individual plant species. Another difficulty is that in the present sources the vegetation species distribution information is often provided without its ecological context, making it very time-consuming to select the “characteristic species” and link them to the right HNV farming habitats. At present a European-wide spatially explicit vegetation distribution database is being built in the SYMBIOSES project. For each plant species the aim is to present country-based distribution patterns. SYMBIOSES aims to link national flora data to a hierarchical overview of European vegetation types. In this way vegetation information will, it is intended, be presented for each vegetation unit including descriptions, species composition, structure and dynamics, ecology, geographic distribution. The results of this project have however not yet been finalised and the data from SYMBIOSES was therefore unavailable for use within this HNV project.

At present the most up-to-date species distribution information at European level is for birds via such sources as *The EBCC Atlas of European Breeding Birds* (Hagemeijer & Blair 1997) and the *Atlas of the Birds of the Western Palearctic* (Harrison 1982) Additional data sources covering parts of Europe are ornithological reference works such as *Birds of the Western Palearctic* (Cramp *et al.* 1997-1994), *Handbuch der Vögel Mitteleuropas* (Glutz von Blotzheim *et al.* 1966-1997), *Handbook of the Birds of the World* (del Hoyo *et al.* 1992-2003) and *Europese Vogels. Alle vogels van Europa, Noord-Afrika en het Midden-Oosten* (Mullarny *et al.* 1999). The breadth of information available on birds and the potential greater level of consistency of data collection across Europe mean that birds were taken as the group of choice used for testing the species approach within this project.

Methodology

Two approaches were taken with the available bird distribution data:

- The first one is based on a selection of breeding bird species judged to be indicative of different types of farmland habitat within different regions of Europe.
- The second one is based on a selection of bird species of conservation concern in Europe (SPECs) which were considered to be potentially associated with farmland.

The approaches is described in detailed below.

For both approaches the selection of bird species could then be used to map presence-absence data (based on EBCC's Bird Atlas of Europe) across Europe on a 50*50 km grid.

Approach 1: Selecting breeding bird species judged to be associated with HNV farmland in different regions of Europe

Experts at the European Birds Census Council (EBCC) were asked to select bird species representative of the following 10 types of potential HNV farmland (based on a slight expansion of the habitat classes used by Tucker & Heath 1994) in different regions of Europe:

- Arable and improved grasslands
- Mediterranean Shrub
- Montane grassland
- Moorland
- Pastoral woodland
- Rice cultivation
- Sand dunes and saltmarshes
- Dry grassland (steppic)
- Wet grasslands
- Agricultural complexes

Annex C provides an exact description of the selection procedure. In summary this involved: Making a list of breeding birds recorded within each of nine biogeographical regions of Europe, using literature surveys to assess the habitat requirements of the bird species within each region and subsequently for each region obtaining 10 separate lists of bird species considered to be linked to each of the 10 HNV farmland habitats given above. This assessment of link with each HNV habitat was based both on recorded occurrence in each habitat and on an assessment of whether each habitat was of primary, secondary or tertiary importance to the respective bird species in that biogeographical region. An attempt was made to ensure that the list of bird species associated with each HNV habitat within each biogeographical region only contained bird species considered to be good discriminators of that habitat within that region. Annex D shows the final list of bird species selected by biogeographical region and each of the above 10 HNV farmland habitats

Approach 2: Limiting the focus to bird Species of European Conservation concern

Tucker & Heath (1994) conducted an assessment of the conservation status of all Europe's birds and provided a list of Species of European Conservation Concern (SPECs). Four categories of Species of European Conservation Concern were identified according to their global and European status, and the proportion of their total of their world population occurring in Europe (Table 6). Species are considered to have an Unfavourable Conservation Status if their European Threat Status is Localised, Declining, Rare, Vulnerable, Endangered or Insufficiently known according to criteria summarised in Table 7 (see Tucker & Heath, 1994 for full details). The SPEC designation has become accepted as highlighting bird species of especially high conservation concern.

A total of 102 species were chosen by the project partners for inclusion in the analyses (Annex F). This list included all Category 1-3 species which were considered to be potentially associated with farmland throughout Europe

Table 6: Categories of Species of European Conservation Concern (SPEC), from Tucker (1997)

Category 1	Species of global conservation concern because they are classed as Globally Threatened, Conservation Dependent or Data Deficient in Collar *et al.* (1994).
Category 2	Species whose global populations are concentrated in Europe (i.e. more than 50% of their global population or range in Europe) and which have an Unfavourable Conservation Status in Europe.
Category 3	Species whose global populations are not concentrated in Europe, but which have an Unfavourable Conservation Status in Europe.
Category 4	Species whose global populations are concentrated in Europe (i.e. species with more than 50% of their global population or range in Europe) but which have a Favourable Conservation Status in Europe.

Table 7: Summary of European Threat Status categories. Adapted from Tucker (1997)

	European population size			
Size of Decline	< 250 pairs	< 2,500 pairs	< 10,000 pairs	> 10,000 pairs***
Large*	ENDANGERED	ENDANGERED	ENDANGERED	VULNERABLE
Moderate**	ENDANGERED	ENDANGERED	VULNERABLE	DECLINING
None	ENDANGERED	VULNERABLE	RARE	SECURE

* Declined in size or range by at least 20% in at least 66% of the population, or by at least 50% in at least 25% of the population between 1970 and 1990

** Declined in size or range by at least 20% in 33%-65% of the population, or by at least 50% in 12-24% of the population between 1970 and 1990

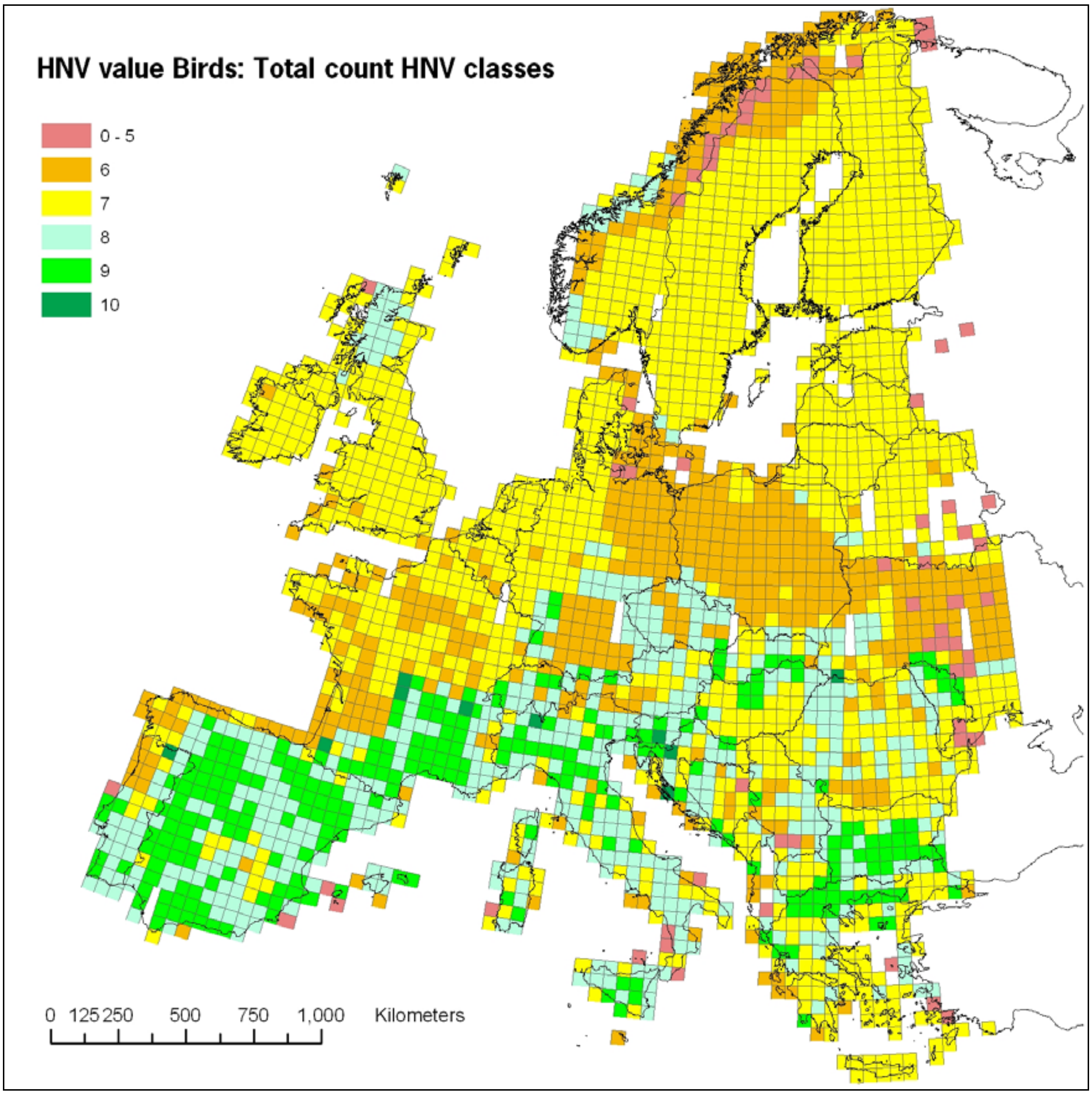
*** In addition, species that have more than 10,000 pairs in Europe are categorised as Localised if more than 90% of the population occurs in 10 sites or fewer

Outcome of the species approach focussing on breeding bird species indicative of different HNV farmland

Map 1 shows the number of the 10 agricultural habitats where one or more of the indicative species are present. In other words, the map shows how many of the 10 HNV farmland habitat types that are predicted to occur within each square (see also Annex E). There are two important points to be taken into account in the interpretation of the map:

- The predicted occurrence of any HNV habitat type within any one square is based simply on the occurrence of one or more of those bird species taken to be associated with that habitat in that part of Europe. As some of the species allocated to each habitat type are quite broad-ranging in habitat requirements, then this has the potential to lead to an over-representation of HNV farmland in some areas of the maps. For example, it is highly likely that many of the very dark green dots on the map in Spain do not actually contain montane grassland but instead do contain bird species (such as red-billed chough and twite) which were taken as indicative of that habitats but which in these instances are also breeding in other habitats.

- The 10 chosen habitat types are not all of equal weighting in terms of likely size of each habitat when occurring on the ground. Hence the apparent under-representation of HNV habitat types in northern Europe is likely to be reflecting the fact that type of HNV farmland which occurs in northern Europe generally occurs in larger blocks and so wherever it occurs there is less chance of other habitats also occurring since there is less 'room' for them to 'fit' in the square. The potential value of some areas on the map (especially northern and mountain areas) are therefore likely to be misrepresented by any consideration of diversity of these 10 habitats occurring.



Map 1: The number of the 10 agricultural habitats where one or more of the indicative species are present.

Given these qualifications, it may be best to try and view the map in terms of the red and orange categories being taken together as predicting a low potential diversity of HNV farmland habitats, the yellow and grey cells taken together as predicting a medium potential diversity of HNV farmland habitats and the two green categories as predicting a high potential diversity of HNV farmland. However, a difficulty arises because there is no separate category for predicted zero occurrence of these 10 farmland habitats and so other than where data is lacking, the impression is given that one or other of these 10 agricultural habitats occur all over Europe. In addition, the inclusion of some very broad habitat categories which can also be extremely variable in terms of the Nature Value associated with them (such as *Arable and Improved*

Grassland and *Agricultural Complexes*) has the effect of swamping the overall appearance of the map.

Leaving aside these qualifications for a moment, the map suggests that the diversity in HNV farmland habitats generally increases towards the south of Europe. This does suggest some similarity with the results from the land cover approach, with higher diversity of HNV farmland occurring in central parts of Spain, southeast and south-central parts of France, Central and northern parts of Greece, large parts of Bulgaria and Rumania, northwestern Scotland and mountain ranges throughout Europe. However, this map only gives a limited picture as it does not take account the type of habitat present nor does it provide any indication of the quality of the farmland in relation to the birds requirements. It is therefore very difficult to provide any real interpretation of this combined map.

Because of this a second map was elaborated (See Map 2). This map is elaborated in the following steps:

1. It is decided which of the 10 agricultural habitats that are present in each of the 7 environmental zones (see annex D).

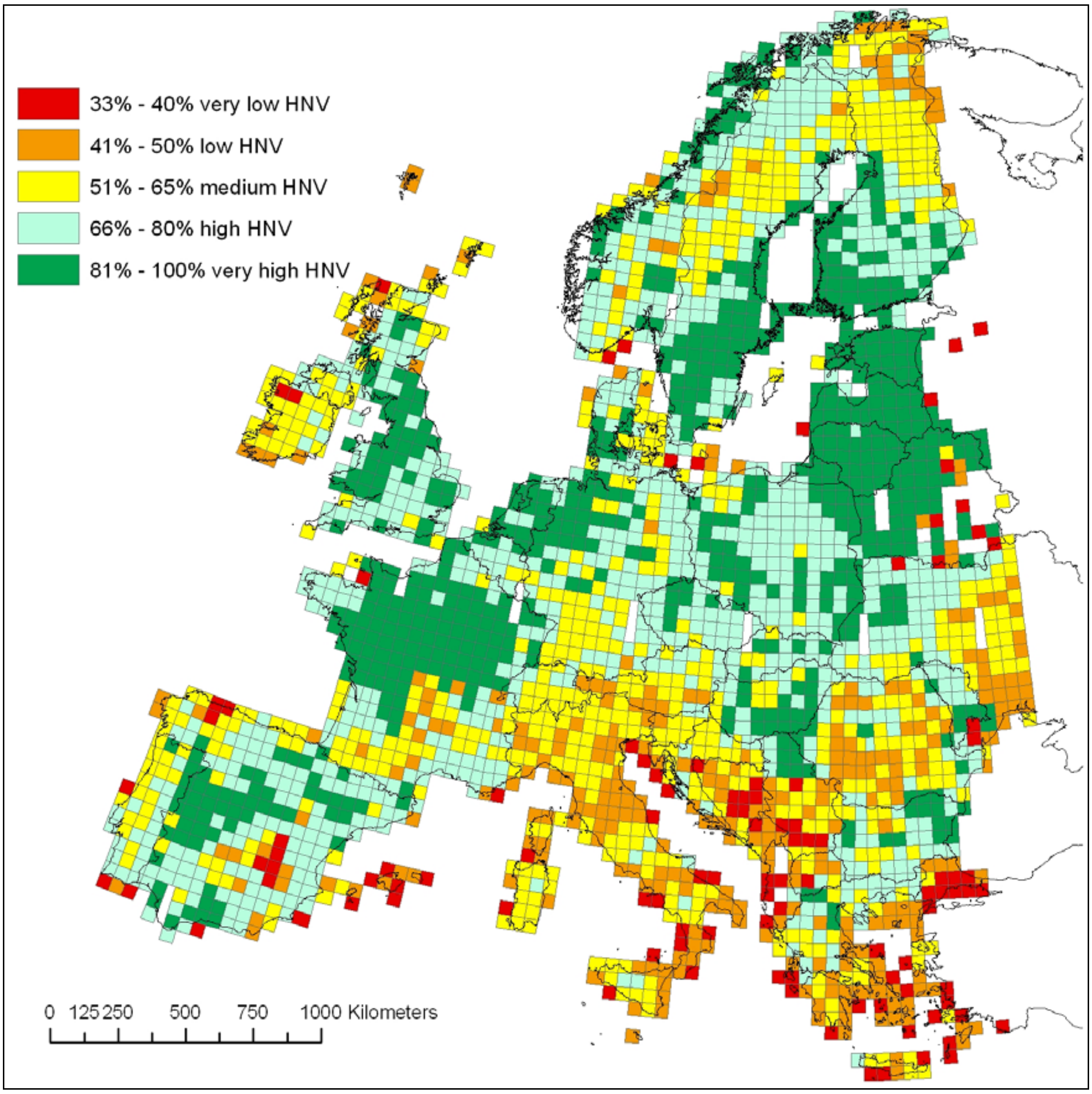
2. The results on presence of indicative species in the 50*50 km grid has been grouped in high, medium and low using the standard deviation. This is done per agricultural habitat and only on the agricultural habitats present according to point 1. This takes into account that not all habitats occur across the EU-15 and that the different types of agricultural habitats can differ in terms of the extent of the number of species supported.

3. A total score for all agricultural habitats is calculated from point 2 assigning the value 3 to high, 2 to medium and 3 to low and adding the values per agricultural habitat.

4. A potential high score is defined per grid cell by multiplying the number of agricultural habitats present in the environmental zone in question by 3.

5. The relative score is calculated by relating the result of point 3 to the potential high score in point 4.

This procedure takes into account that not all habitats occur across the EU-15 and that the different types of agricultural habitats can differ in terms of the extent of the number of species supported.



Map 2: Map showing the presence of indicative species relative to a potential maximum score. The potential maximum score takes into account that not all agricultural habitats are present in all environmental zones. See text for further explanation.

The results in Map 2 show that Northern parts of Europe generally come out better than most southern and eastern parts. The explanation for this can be obtained when the individual farmland habitat maps in Annex E are involved.

Take for example the high scores for the Baltic States which can be especially related to a high occurrence of farmland birds in the HNV farmland habitat categories Arable land, Agricultural complexes, Dry grassland and Dunes and saltmarshes. This high score generally indicates towards HNV farmland types 2 and 3 and less of Type 1.
Another example is the high average score in many parts of Hungary. Overall this can be related to a relatively high score on birds in Agricultural complexes in combination with a relatively above average score on birds for most other agricultural farmland habitat.

Part of Western Europe and Scandinavia score well in Map 2 because of a relatively high score on farmland birds in agricultural habitats most strongly related to Type 3 HNV farmland such as arable land and wet grasslands. Scotland on the other hand comes out rather low, even though the score on Moorland, which makes up an important part of the semi-natural vegetation of HNV farming areas in this region, is very high.

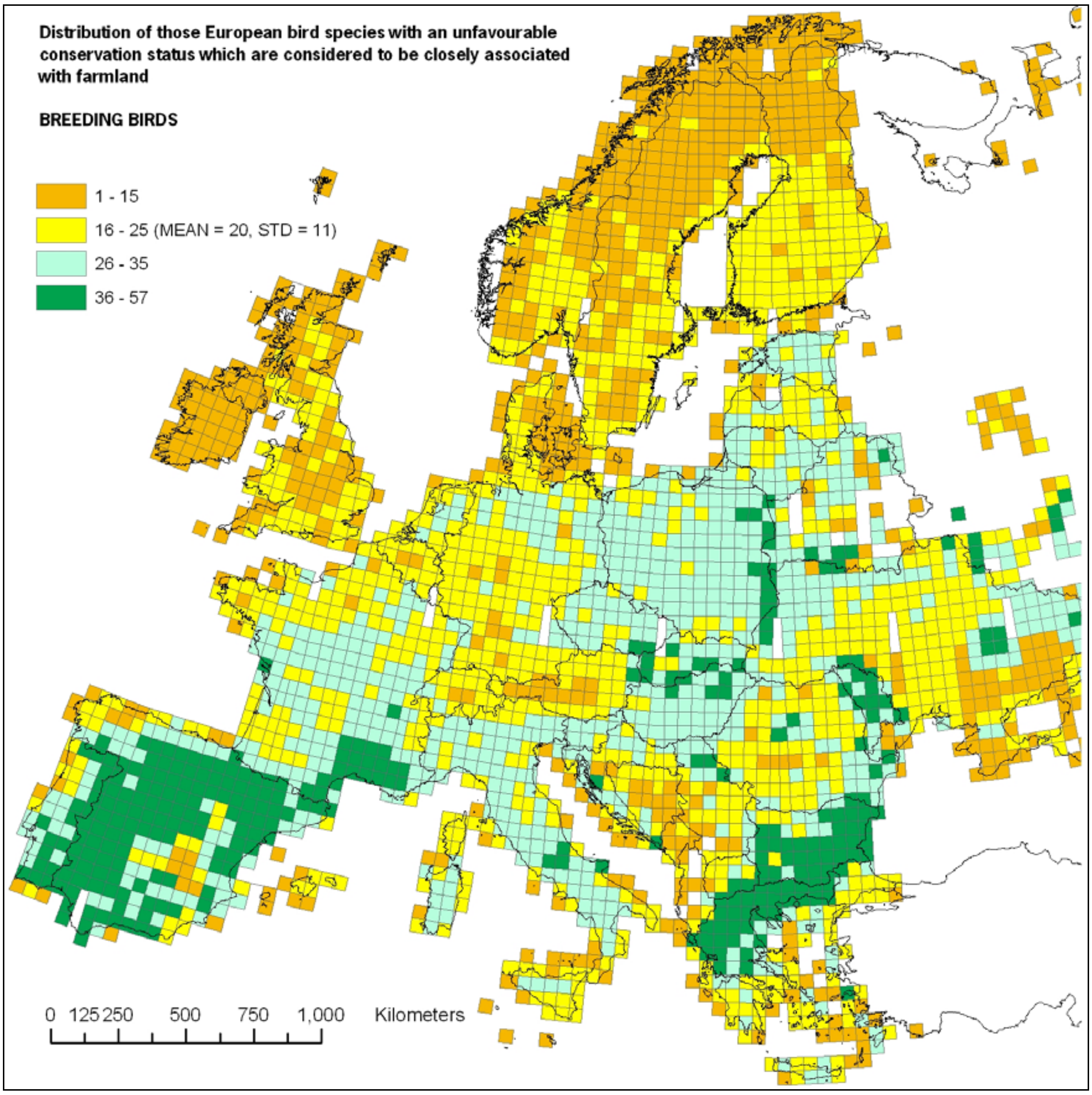
The high average scores in central and western parts of France can probably be explained by high average scores on agricultural complexes and dry grassland and Pastoral woodland. The high score on this last farmland habitat in comparison to Portugal, where one would expect this score to be high because of occurrence of Montado agricultural landscapes, does not match with what is really happening on the ground. Clearly an improvement must be made in the selection of farmland bird species indicative for this habitat.

The results for some areas in Eastern Europe are poorer than expected. This might partly be explained by the quality of the data, but further work is needed to verify this.

In conclusion, the potential value of any species occurrence approach will depend very strongly on the type of species chosen and the scale at which information on those species is available. For this project it was only possible to obtain distribution data for breeding birds at a 50*50 km level for Europe. The selection of the indicative species was done by EBCC, but had to be done within a limited time span. Consequently, the data in the draft list of key bird species has limitations. In particular, the selection for certain HNV farmland habitat categories are very broad and include bird species which are not necessarily very good discriminators of any one habitat. In addition, the HNV farmland habitat categories which were selected are also rather broad. For example, the category dry grassland does not distinguish between the different types of steppe (e.g. grass or arable) and the different bird communities associated with them. The selection of both bird species and habitat categories should therefore be seen very much as a first selection, which can be further improved by involving more regional expert knowledge in a later stage and by using better and more detailed data.

Outcome of the species approach focussing on bird SPECSs

The distribution of the 102 SPECS in Annex F was plotted on 50*50 km grid level for the whole of Europe using breeding bird data available at that scale. The resulting map (Map 3) was presented as the total number of each of these species occurring in each 50*50 km square. It was anticipated that SPEC hotspots would be identified which would allow a comparison with the maps produced via the land cover approach (with regard to Type 1 and Type 2 HNV Farmland) and in particular serve to identify potential Type 3 HNV Farmland which was less associated with semi-natural vegetation.



Map 3: The number present of the 102 species of European conservation concern associated with farmland

Given that the bird species selected were all considered to have some association with agricultural land across Europe, then at the very basic level the resulting map can be regarded as potentially providing a broad indication of where agricultural land occurs in Europe. Even though agriculture is the dominant land use across Europe, it is, however, surprising that the map indicates that one or more of these species (and hence by implication some form of agricultural land) have been recorded in every single 50 x 50 km square for which data is available across Europe. Even though some of the species selected can be quite widespread in the regions where they occur, it was not expected that so many would be so widespread over Europe as to mean that a hit on at least one species would be recorded in every square. This result is additionally surprising given (a) that the majority of the selected species have quite specific requirements for breeding habitat and so would have been expected to be more localised in their distribution and (b) that despite the large grid under consideration, it would have been anticipated that there would have been much more cells which were unfavourable to all of these species (e.g. through containing complete forest cover).

Leaving these initial qualifications aside, the map could be read as implying that there are areas of Europe which are potentially 'hotter' or 'colder' for HNV farmland in terms of the occurrence of high or low numbers of the selected species. However, there is no consistent pattern across Europe, especially when the known distribution of HNV farmland in some areas is taken into account. For example, overall the map gives the impression that the potentially 'hotter' areas are located in the south and east of Europe while the potentially 'colder' areas are located in the north. The latter may in part be a reflection of the fact that the overall species list was dominated by species more indicative of southern or lowland agricultural habitats.

In either event, it would appear that the apparent 'cold' nature of the north (especially Ireland, Scotland and Scandinavia) is simply a side-effect of the species selection and that consequently it is not valid to try and draw any conclusions one way or the other about these areas. After removing the north and north-west from further consideration, it may then be tempting to regard any increasing number of records of selected bird species per grid cell over the remainder of Europe as reflecting the increased possibility of the occurrence of HNV farmland within the cells with higher number of species. However, again there is no consistent pattern in the map and many inconsistencies with known Type 1, 2 and 3 HNV Farmland distributions (e.g. the fact that most of Italy and much of France are shown as containing high numbers of the these species would suggest that no direct link with HNV farmland can be drawn).

At best, the cells with the highest (26 and above) counts on the map can potentially be regarded as indicating where HNV farmland may occur either in the form of a large extent of individual HNV farmland habitats or where the 50*50 km cells contain quite a mosaic of such habitats. It is only with this approach to interpreting the map that anything potentially 'sensible' appears to emerge from the spatial distribution on the map. However, this would be a rather sweeping conclusion to draw from the map and should not be drawn before cross-checking this with the distribution of sub-sets of species specifically indicative of specific habitats.

Similarly, it might be tempting to suggest that some indication of the location of Type 3 farmland can be obtained from the location of the cells containing 26+ SPECS which fall outwith the areas identified by the land cover approach. However, as indicated above, the map shows many inconsistencies with known distribution of Type 3 farmland and hence it would be wrong to assume that that those cells where nothing is known of their content are reflecting Type 3 occurrence on the ground.

All that can therefore be said about the approach with any certainty is that the map either reflects a simple reality on the ground (in that agriculture and associated bird species is all pervasive throughout Europe) or more likely suggests that the use of only one list of SPECS covering the whole of Europe is far too broad an approach to take. Time did not allow for any iterative process in considering the pros and cons of including or excluding different bird species within the list. If this approach was to be investigated further it may be more appropriate to utilise sub-sets of the SPEC list with regard to species specifically potentially more closely associated with Type 3 HNV farmland within different areas of Europe However, it may also be that 50*50 km is in any event far too broad scale at which to try and locate concentrations of Type 3 farmland.

Limitations of the species approach

The EBCC European breeding bird atlas only provides information on presence/absence rather than abundance or even breeding success. Both the latter factors will be important determinants of what the mapped information is reflecting on the ground. Mapping attempts based on groups of species should therefore always be interpreted with care.

In addition, mapping of biodiversity value can only be done where there is relatively good population distribution data available for different species groups. This of course does not diminish the value of the exercise done in this study. It is true that the biological reality is that a wide range of biotic and abiotic factors affect species distributions. As such it is sometimes possible to find good correlations between species and types of farmland and it would be potentially possible to then use these species as "indicators" but for birds it should be mentioned that there are many other over-riding influencing factors (e.g. degree of hunting, proximity of the sea, territorial behaviour).

If this approach is to be taken further in the future with birds then it would be better to consider the spatial occurrence of different bird and other species assemblages and not only include all farmland-associated (bird) species in the list of species considered but also obtain information on these species at the smallest spatial scale possible (e.g. in Britain bird data is available (at a high cost) at 10 km square level and in the Netherlands at 1 and 5 km square). Similarly, it may be feasible to obtain an indication of potential HNV areas by combining the distributions of different groups of biota, e.g. French regional atlas data on the distribution of birds and butterflies. The value of all these approaches do, however, depend on there being consistent survey/reporting effort across the countries under consideration. For example, in the UK, The Netherlands, Belgium there are many recording schemes, which contain data on the species distribution of different biological groups at a 10-km and 5-km square level respectively. However, it should always be remembered that in general recording/reporting effort will never be equal across all areas of any one country let alone Europe as a whole.

4. Results

4.1 Southern Europe

Broad characteristics of HNV farming in the southern countries

HNV 1: Semi-natural grazing land covers extensive areas of the southern countries. A considerable proportion of this is grassland, ranging from dry grassland on lowland plains to hay meadows and alpine pasture in mountain regions. In addition, a particular characteristic of the Mediterranean regions is the presence of various forms of scrubland and woodland that are used for extensive grazing and browsing by sheep, goats, cattle and pigs and that cover large areas in some regions, especially in the uplands. Where these different forms of semi-natural vegetation exist in a mosaic, the land cover is of particular natural value.

Although stock may be sedentary and fenced on semi-natural vegetation, they are more commonly shepherded, especially in the case of sheep, goats and pigs. Cattle are more often free-ranging, whether on high mountain pastures or dry grasslands in the lowlands. Stocking densities on HNV1 land tend to be extremely low (often well below 0.2 LU/ha). Some types of vegetation are grazed or browsed only occasionally (by shepherded flocks) and/or seasonally (under various forms of local or long-distance transhumance). Extensive grazings are often publicly owned land or some form of common land, with many different systems of allocation, depending on the country and region.

HNV 2: these systems are widespread and diverse in southern countries. Some of the main types are:

- Low-intensity arable systems, that often include a proportion of fallow land on long rotations. These systems may consist of small parcels with semi-natural or tree-lined field margins (e.g. Tras-os-Montes in Portugal), or large-scale, pseudo-steppic landscapes (e.g. on Spanish table lands).
- Mosaics of arable and permanent crops: typically olives and vines, with almonds, figs and other tree crops more localised.
- Grassland landscapes that exist in a mosaic with scrub, forest and sometimes with arable and permanent crops (e.g. chestnuts, fruit trees). These are typically in more northern and/or upland regions.

Distinguishing HNV 2 systems from non-HNV is extremely complicated. Many mixed farming systems are of landscape and cultural value, but some are intensive in their use of inputs and land. Information on the natural values of mixed systems is sparse. Often they are valued for a generally high level of biodiversity, rather than for the specific species and habitats of conservation concern that tend to be associated with HNV 1 and HNV 3 systems.

HNV 3: Probably the most characteristic of these systems in the Mediterranean is extensive arable cultivation that supports valued bird communities. A typical example is provided by the Great Bustard populations in Spain and Portugal. Although they generally are associated with low-intensity fallow systems in pseudo-steppic landscapes (HNV 2), some populations co-exist with more intensified forms of arable cropping, especially where alfalfa is present and used as a feeding area. Also in category HNV 3 may be rice fields in all the Mediterranean countries, that can support valuable bird populations even when quite intensive in terms of input use.

Results of the land cover approach

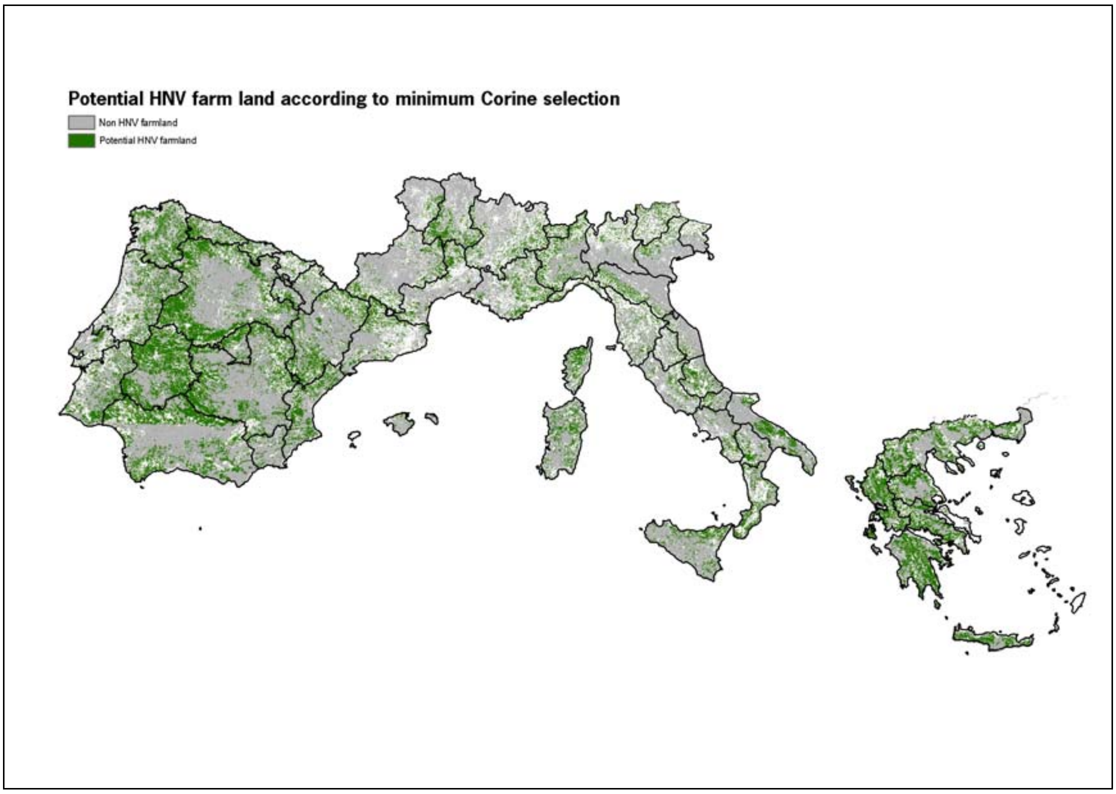
The areas shown in the *Minimum approach* (map 4) are made up almost exclusively of semi-natural vegetation (pastures, natural grasslands, moors, scrub, agro-forestry, marshes, etc.). These areas tend to coincide with upland and mountain regions in each of the countries, plus some other regions, such as the *dehesa/montado* systems in the west of the Iberian Peninsula. The map thus provides a useful illustration of the distribution of semi-natural vegetation types that generally are HNV and, in some categories (e.g. pastures, grasslands, agro-forestry), are under livestock farming by definition.

However, some other categories (e.g. moors, scrub, marshes) may be used for grazing, but may equally well have no farming use at present. The only grazing may be from wild herbivores. CORINE does not distinguish these vegetation types according to use. Thus, whereas the Minimum approach illustrates quite well the minimum HNV area, a considerable proportion of this area may not be farmland.

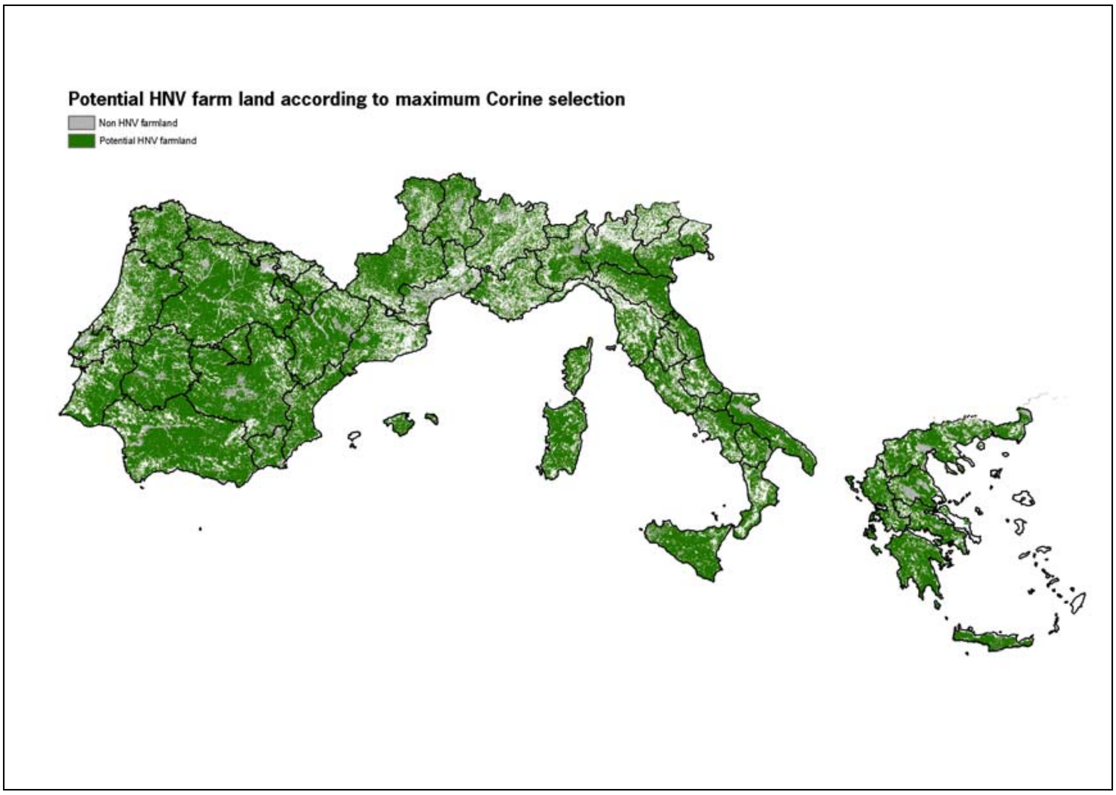
Perhaps the clearest example of this problem is the forest categories. Native broadleaved forest in particular is often used for grazing in some Mediterranean regions (mainly by goats, cattle and pigs), but there are also extensive areas that are not used in this way, although historically they probably were. Because of this problem, and because CORINE does not distinguish native from exotic broadleaves reason, forests were excluded from the land cover exercise. However, as a result, certain HNV grazed forests are excluded from the Minimum map.

Another significant caveat is that the Minimum map includes all types of permanent grassland (under the Pastures category), regardless of the farming system. In some areas, this grassland may be under quite intensive management, with heavy fertilisation and grazing pressure. Lower precipitation in the Mediterranean regions means that these types of pasture are less widespread than in Lusitanian and Atlantic regions (intensification in the Mediterranean generally requires irrigation, which presumably would take them into the Permanent Irrigation category). Even so, they may be present in certain areas, such as Catalunya (Mediterranean North). In wetter regions, such as northern Spain, there are more intensified pastures, especially in the lowlands.

The only categories included in the Minimum approach that are *not* semi-natural vegetation are in the Mediterranean regions: olive groves in Portugal and Italy, and Complex Cultivation Patterns and Land Principally Occupied by Agriculture in the Mountain regions of most countries. Natural and socio-economic limitations in the Mediterranean Mountain region have tended to prevent the intensification of small-scale mixed systems. The category Land Principally Occupied by Agriculture is difficult to interpret, but seems more likely to be HNV in mountain regions than in lowlands.



Map 4: Potential HNV farmland according to the minimum CORINE selection for Southern Europe



Map 5: Potential HNV farmland according to the minimum CORINE selection for Southern Europe

Finally, it should be emphasised that the Minimum map excludes some very significant areas of HNV farmland. Notable examples are low-intensity arable systems harbouring highly valued bird communities and permanent crops, such as olives in parts of Greece and Spain, that are of high biodiversity. The fact that arable and permanent crop systems vary enormously in intensity and in natural values means that they cannot be included in the Minimum approach, except in certain cases as mentioned above.

The *Maximum* map for the Mediterranean regions include almost all farmland that it is not under permanent irrigation (Map 5). As a result, very large areas of land are included, especially outside the main river valleys and coastal areas. Forests are also excluded for the reasons explained above.

For some regions, for example in the interior of Portugal or the LFA in Greece, the picture provided by the Maximum map may be considered acceptable as an approximate, if slightly exaggerated, distribution of HNV farmland. Here, the widespread presence of traditional, low-intensity farming (livestock systems, arable, olives, etc.) means that the rural landscape is generally HNV, except where irrigation and intensive forest plantations dominate.

However, for some other Mediterranean regions the Maximum picture includes an excessive amount of farmland that is not HNV, even in the absence of irrigation. Examples include the intensively managed olive groves that dominate parts of southern Spain, modern fruit plantations, dairy and beef fattening farms in Greek non-LFAs, and the more intensive arable systems that are found on better soils in all countries.

Table 10: Share of minimum and maximum HNV farmland land cover classes in all agricultural land cover classes

	Total UAA	Maximum	Minimum
EU 15	143655448	73.0	26.6
Southern Europe	88854223	91.5	37.0
Southern France	13966940	86.2	25.4
Greece	9120318	90.7	53.0
Italy	20212728	94.8	29.5
Portugal	5970951	94.3	37.9
Spain	39583286	91.5	41

Source: Corine Land Cover
UAA = Utilised agricultural area

Table 11: Share of minimum and maximum HNV farm land in 3 altitude classes

	Maximum			Minimum		
	0-300	300-600	600+	0-300	300-600	600+
EU 15	47.9	24.2	27.8	34.9	26.0	39.1
Southern Europe	33.2	25.5	41.3	18.4	25.8	55.8
Southern France	37.7	27.3	35.0	11.7	15.9	72.4
Greece	38.5	25.9	35.6	21.4	29.4	49.1
Italy	53.3	23.8	22.9	26.9	27.0	46.1
Portugal	57.9	23.2	18.8	50.5	25.7	23.8
Spain	33.2	25.5	41.3	11.3	26.5	62.1

Source: Corine Land Cover

Conclusions on the land cover approach

The Minimum map captures quite well the distribution of HNV 1 systems, but with the problem that unfarmed HNV land is also included, as well as some intensified systems (e.g. Pastures, Olive groves) in certain areas. The very significant HNV 2 systems are mostly excluded, except where Complex Cultivation Patterns have been included (principally in the quite restricted Mediterranean Mountain region). HNV 3 systems are excluded almost entirely.

The Maximum map includes practically all non-irrigated farmland. While this is a reasonable reflection of HNV land in certain regions with predominantly traditional farming, for most regions the Maximum map includes large areas of non-HNV cropping systems.

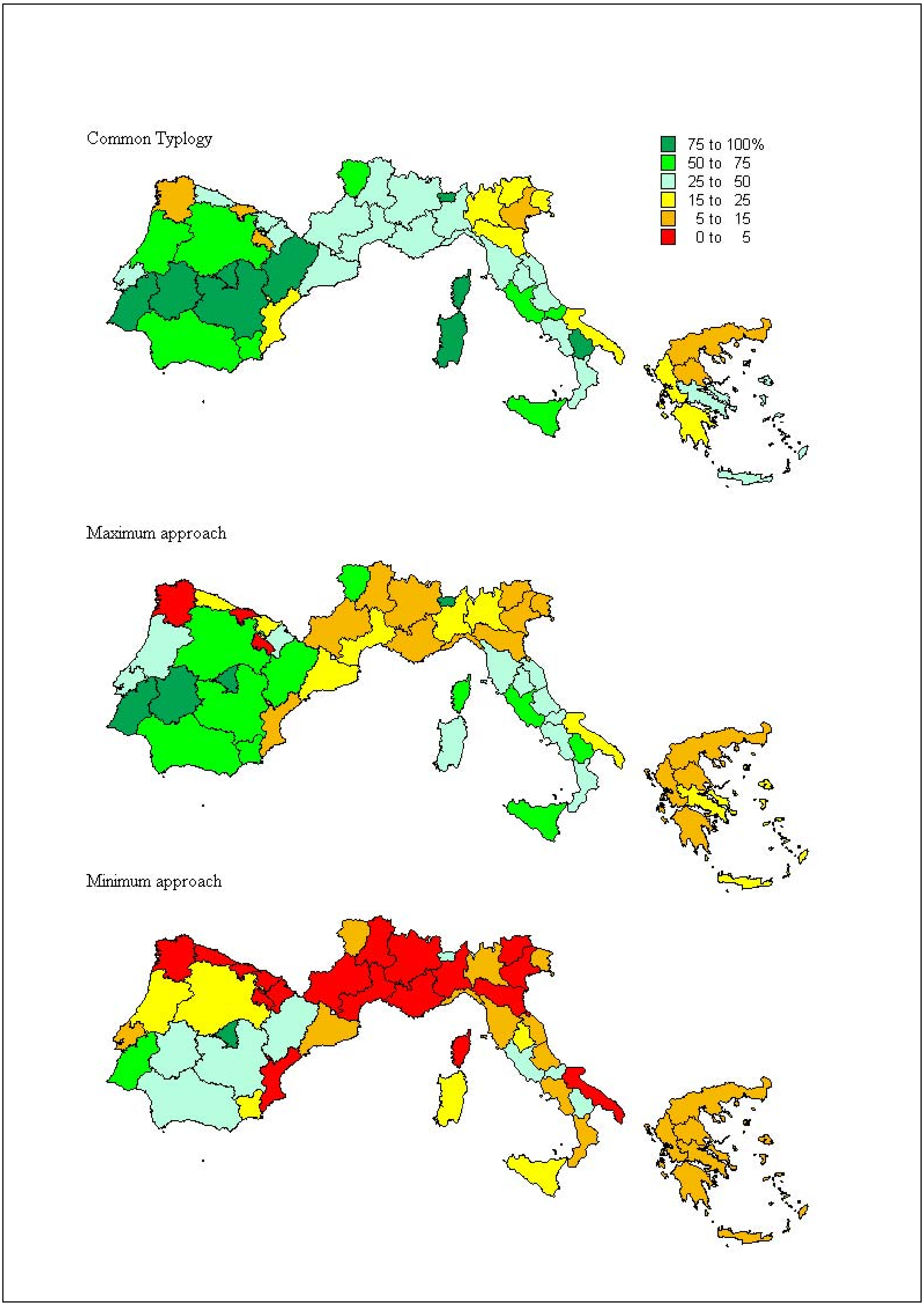
Both maps are hampered by certain problems with CORINE. For example, quite large parts of Greece (such as the Aegean islands) are not covered by the current database.

Results of the farming systems approach

Given the limitations of the FADN-based approach, the maps should only be regarded as giving a general impression of which regions are the most significant in terms of HNV farmland (see map 6). In some cases, the picture provided by the maps appears to coincide with expert judgement and with the CORINE maps. However, there are also cases of regions where the results certainly would be questioned by those with expert knowledge.

Some regions show up consistently under the three typologies as having >25% of UAA under HNV systems, including: Alentejo in Portugal, the Spanish regions of Extremadura, Andalucía, Castilla la Mancha, Madrid and Aragón, and Lazio, Molise and Basilicata in Italy. Regions such as Sicily, Sardinia, Castilla y León and the northern half of Portugal are also prominent, although with lower percentages under the Minimum typology.

Most other regions, notably in Greece, north-east and south-east Italy, northern and eastern Spain and France, are shown as having a considerably lower proportion of UAA under HNV systems. In some cases, such as the Po Valley in Italy or La Rioja in Spain, this result is as might be expected, considering the dominant types of agricultural land use. However, other cases are more surprising. Thus, even under the Maximum typology, most of the mainland regions in Greece are shown as having only 5-15% UAA under HNV systems. Galicia and Asturias in Spain appear to have only 0-5%, despite having quite large areas of land under extensive, mountain livestock systems. Under the Minimum typology, numerous regions are shown as having 0-5% UAA under HNV systems, including Cantabria and Navarra in Spain, and most of Mediterranean France. Clearly in some of these cases, the Minimum typology is excluding considerable areas of HNV farming, especially grazing systems.



Map 6: Share of Utilised Agricultural Area managed by HNV farming systems
Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.

Table 12: Share of Utilised Agricultural Area managed by HNV farming systems

		UAA managed by HNV farms %		
	Total UAA ha	Common typology	Maximum	Minimum
EU15	118000235	34,6	27,9	13,5
Southern	46792384	51,3	38,7	17,9
Southern France	3110182	34,0	9,0	1,4
Greece	8430851	16,7	13,8	8,8
Italy	12477379	41,1	32,6	12,1
Portugal	3762069	75,4	56,7	35,3
Spain	19011904	66,4	56,3	27,0

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.
UAA = Utilised agricultural area

Table 13: Share of the farms identified as HNV farming systems

		Farms identified as HNV farming systems %		
	Total farms No.	Common typology	Maximum	Minimum
EU 15	3815172	25,1	18,9	8,1
Mediterranean	2653794	27,2	19,7	8,4
Southern France	147009	25,4	6,3	1,0
Greece	511622	15,0	12,5	9,1
Italy	1058531	25,9	22,8	7,9
Portugal	317771	48,2	22,1	9,5
Spain	618862	29,3	22,1	9,9

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.

The profile of HNV farming systems selected by the typology is summarised in Table 14 to 16. Of the total number of farms analysed, 8.4% qualify as HNV following the Minimum typology. Of these, 38% of farms are HNV arable systems, and a further 24% are permanent crop systems. Only 23% of the HNV farms are grazing livestock systems.

In terms of land area, HNV systems are more prominent, with 17.9% of the total UAA. As with farm numbers, arable systems represent the largest proportion (47%) of the UAA under HNV systems. Grazing systems represent 29% of the UAA under HNV systems. The average UAA of HNV farms varies from <12ha for permanent crop systems to >240ha for permanent grassland systems.

Table 14: General profile of HNV farming systems in Southern Europe (data from minimum approach)

	Farms	UAA	Share of all HNV farms	Share of UAA on HNV farms	Average UAA	Share farmers over 55 years	Average economic size
	no.	ha	%	%	ha	%	ESU
All systems (HNV and Non-HNV)	2653794	46792384	-	-	17,6	36,2	14,6
All HNV farms	222581	8367740	100,0	100,0	37,6	33,8	11,1
Low-input cropping systems	84496	3887214	38,0	46,5	46,0	38,4	13,7
- of these fallow systems	*17650*	*966588*	7,9	11,6	*54,8*	*60,2*	*11,0*
- of these dryland systems	*66846*	*2920626*	30,0	34,9	*43,7*	*32,6*	*14,5*
Low-input permanent crop systems	53528	634393	24,0	7,6	11,9	33,6	7,3
- of these with cattle sheep or goats	*2585*	*80351*	1,2	1,0	*31,1*	*10,4*	*12,5*
- of these without cattle sheep or goats	*50944*	*554042*	22,9	6,6	*10,9*	*34,8*	*7,1*
Off-farm grazing livestock systems	43873	709267	19,7	8,5	16,2	24,6	10,6
Low-input permanent grassland systems	7126	1729593	3,2	20,7	242,7	16,4	12,0
Low-input arable grazing livestock systems	18399	999835	8,3	11,9	54,3	45,8	11,7
Low-input other systems	15158	407438	6,8	4,9	26,9	29,3	9,6

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI. UAA = Utilised agricultural area, ESU = European size unit

Table 15: Environmental profile I of HNV farming systems in Southern Europe (data from minimum approach)

	Share of UAA in permanent grassland	Share of UAA in rough grassland	Share of UAA in fallow	Share of UAA irrigated
	%	%	%	%
All systems (HNV and Non-HNV)	14,1	8,2	4,5	11,3
All HNV farms	12,8	18,6	12,3	1,5
Low-input cropping systems	3,6	5,1	11,4	1,3
- of these fallow systems	1,2	0,3	40,1	5,1
- of these dryland systems	4,4	6,7	1,9	0,0
Low-input permanent crop systems	3,1	6,1	9,4	0,0
- of these with cattle sheep or goats	2,1	40,3	6,8	0,0
- of these without cattle sheep or goats	3,3	1,1	9,7	0,0
Off-farm grazing livestock systems	47,6	2,9	1,0	6,1
Low-input permanent grassland systems	24,5	71,5	0,0	0,3
Low-input arable grazing livestock systems	8,2	3,7	38,7	2,0
Low-input other systems	17,4	7,0	33,4	1,3

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.
UAA = Utilised agricultural area

Table 16: Environmental profile II of HNV farming systems in Southern Europe (data from minimum approach)

	Stocking density	Grazing pressure	Nitrogen surplus	Fertiliser cost	Crop protection cost	Grazing days outside UAA
	LU/ha	GLS/ha	Kg/ha	Euro/ha	Euro/ha	no.
All systems (HNV and Non-HNV)	0,5	1,5	30,8	70,6	57,4	26,8
All HNV farms	0,3	0,7	14,1	15,6	2,8	190,6
Low-input cropping systems	0,1	0,7	9,2	19,6	3,1	5,3
- of these fallow systems	0,0	1,4	4,5	19,3	3,3	0,2
- of these dryland systems	0,1	0,6	10,7	19,7	3,1	6,0
Low-input permanent crop systems	0,1	0,5	-4,8	24,2	3,7	55,5
- of these with cattle sheep or goats	0,3	0,6	-29,6	14,6	2,7	57,8
- of these without cattle sheep or goats	0,0	0,4	2,6	25,6	3,9	50,6
Off-farm grazing livestock systems	1,4	2,7	79,9	32,7	9,8	363,0
Low-input permanent grassland systems	0,1	0,1	10,0	2,5	0,2	0,4
Low-input arable grazing livestock systems	0,4	2,3	2,1	8,7	0,7	0,4
Low-input other systems	0,6	1,4	1,7	6,2	2,1	29,6

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.
UAA = Utilised agricultural area, LU. Stocking density is calculated on all types of livestock on entire UUA. Grazing pressure is calculated for cattle, sheep and goats in grassland only. Grazing days outside UAA is calculated as the average days per LU spend grazing of the farm – for example on common land.

Overall, the typologies seem to have captured a higher proportion of cropping systems than of grassland systems. This is reflected to some extent in the maps, where regions with extensive areas of low-input arable land show up as having a high proportion of HNV farmland (notably in the drier regions of Spain and Portugal, or Basilicata in Italy). On the other hand, regions where HNV farming is mostly characterised by extensive livestock grazing, but which have little extensive arable cropping, are less prominent in the maps (Asturias in Spain, the Alpine regions in Italy).

Clearly there are weaknesses in the database that are causing some of these unsatisfactory results. In Greece, for example, the FADN data excludes farms of less than 2 ESU. These farms represent 40% of all Greek farms, or 20% of the total Greek UAA. Another difficulty is that publicly owned areas (mainly used for grazing) are not included in the UAA of the respective farms. These areas make up almost 80% of the rough grasslands in Greece. The database thus indicates high stocking densities, calculated for the small areas of privately owned land.

It is possible that a modified database, with greater homogeneity between countries and with a correction of the factors referred to above, could lead to results more in tune with those from the land cover approach, and coinciding with expert knowledge of the Mediterranean regions.

Results of the species approach

The maps based on bird data produce some surprising results, when viewed from the perspective of the Mediterranean regions. For example, the map for arable and improved grassland species shows greater richness across most of northern France than in the arable steppes of Iberia. The same is true for species associated with agricultural complexes. The map for pastoral woodland shows low richness in the regions of dehesas and montados in south-west Iberia, but much higher values in most of Germany. These results suggest that the chosen suites of species do not reflect well the birds associated with Mediterranean land uses.

As a tool for enriching the land cover and farm typology approaches, the data used for the species approach seems to be inappropriate, as the suites of species are not sufficiently tailored to particular systems and regions, such as arable land that harbours important steppeland bird communities.

Overall conclusions on the results for the southern countries

The species approach appears to have significant weaknesses in its present form and will not be commented on further.

The land cover and farm typology approaches give variable results. Some regions show up strongly through both methods, notably western Spain, and in particular Extremadura. This is probably a significant result and is supported by the fact that Important Bird Areas in Extremadura cover over 70% of the land area, considerably higher than for other regions of the EU15. The combined approaches seem to confirm that this region is exceptional for its large proportion of farmland under HNV systems.

Some other regions show up strongly on the CORINE Minimum map, but much less strongly on the FADN map. Southern Greece and Galicia are perhaps the clearest examples. This may be explained by problems with FADN data in these regions, especially in relation to extensive common grazings.

Table 17 and 18 comparing the results of the land cover and the farming systems approach indicates that the land cover approach in general estimates the agricultural area and the HNV farmland to be larger than the calculated by FADN. This is not necessarily wrong as the two approaches have different purposes and logics that can explain this. However, it indicates that the land cover approach is the best suited for mapping HNV farmland, but that the extent cannot be analysed this way. It also points to some problematic regions where the comparisons show skewed results. This is for example the case in Southern France.

Table 17: Comparison of agricultural area according to the farming system approach and the land cover approach.

	FADN UAA ha	Agricultural land cover classes in CORINE ha	FADN in percentage of CORINE %
EU15	118000235	143655448	82
Southern	46792384	88854223	53
Southern France	3110182	13966940	22
Greece	8430851	9120318	92
Italy	12477379	20212728	62
Portugal	3762069	5970951	63
Spain	19011904	39583286	48

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI and CORINE land cover.

Table 18: Comparison of the area included in the different approaches. Farming system approach, common typology is set as 100

	FADN common typology Ha = 100	FADN max %	FADN min %	CORINE max %	CORINE min %
EU15	40828081	81	39	257	94
Southern	24004492	75	35	339	137
Southern France	1057461	26	4	1139	335
Greece	1407952	83	53	588	343
Italy	5128202	79	29	374	116
Portugal	2836600	75	47	198	80
Spain	12623904	85	41	287	129

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI and CORINE land cover.

4.2 Western Europe and Scandinavia

Broad characteristics of HNV farming in the northern Europe and Scandinavia

Type 1 and type 2 HNV farming systems surviving in northern Europe and Scandinavia are associated mainly with grazing livestock systems rearing sheep and/or cattle on farmland dominated by semi-natural vegetation. Areas containing a high proportion of HNV farmland generally contain a patchwork of habitats such as natural pastures (including alpine grassland, heath, moorland, saltmarsh, marshland, bog, wood-pasture) and woodland and scrub (some of which is grazed) as well as agriculturally managed land of pasture and crops.

Most farms are geographically discrete and their management practices create important and complex links between the semi-natural habitats and the annual farming cycle. Although the long-distance transhumance systems common in southern Europe are not a major feature in northern Europe the use of pastures held and managed in common or other off-farm grazing is often an important feature of livestock systems, particularly in the more remote and isolated parts of the region.

Type 1 HNV Farmland: By definition these farms contain pastures composed of a high proportion of semi-natural vegetation which is used for grazing, but they also in many cases involve on-farm finishing of the animals. Hay and silage cropping from meadows is also a practice common across this region. If crops are grown, this is generally only a small proportion of the total UAA but a large proportion of these crops is used for feeding livestock on the farm. Some examples include:

- Grazing of cattle in the marshlands of north-western France, where the grazing and associated mowing practices serve to maintain a range of open grassland habitats within the marshes.

- Low intensity raising of sheep in the Uplands of UK.

Type 2 HNV Farmland: Such systems can involve a combination of both arable and semi-natural vegetation in the landscape. However, they are also found in association with relatively large areas of permanent crops (such as old orchards) or low-lying wetter areas formerly given over to hay meadows. More natural habitats (such as woodlands, wetlands) are also generally interspersed through such areas. Examples include:

- Small scale farming in mixed agricultural/forestry landscapes in Scandinavia

Type 3 HNV Farmland: Across this region, Type 3 HNV Farmland is generally more closely associated with the geographical location and ecological requirements of the rare species involved rather than the characteristics of the farms per se. In some cases this may be associated with remnant habitats, but in others it reflects edaphic conditions rather than the farm management - the large concentrations of wintering Arctic geese found on the wet farmland are examples. Other examples are:

- Areas in Denmark and the Netherlands where the proximity to the coast and relative fertility of the pastures means that these often intensively managed pastures hold internationally important populations of breeding waders and especially wintering wildfowl.

- Areas such as the Breckland and east Anglia in south-east England where birdlife such as stone curlew and wintering geese are attracted to the intensively managed arable land.

Results on land cover approach

The results of the selection of Corine Land Cover Classes (LCCs) are shown in the form of two maps and tables, indicating the results from the Minimum and Maximum approaches.

Overall the results suggest that in northwestern Europe HNV farmland is less widespread than in southern and eastern Europe. This can be seen from Table 19 which indicates the predicted area of those CORINE LCCs taken as being indicative of HNV farmland expressed as a proportion of the total area of those LCCs regarded as being potentially associated with agriculture in each region/country. Separate figures are given for the proportions for both the minimum and maximum approaches. It can be seen that there is a clear difference between Scandinavia and the rest of Europe, and also between the different countries within western Europe. From these figures, Ireland, Austria and the UK would be assumed to have more HNV farmland than Germany, The Netherlands, Belgium, Denmark and Northern France. This is similar to the result from the farming systems approach.

Table 19: Share of the total area of CORINE LCCs potentially associated with agriculture according to minimum and maximum selections

	Total area (ha) of those LCCs associated with agriculture	Proportion of agricultural LCCs total which is predicted to be under LCCs associated with HNV farmland:	
		Maximum	Minimum
EU 15	143655448	73.0	26.6
Western Europe & Scandinavia	111070378	58.3	18.3
Austria	4053038	99.2	29.0
Belgium	1833489	62.7	1.6
Denmark	3366542	46	4.5
Finland	8815056	65.1	49.1
Northern France	23525602	63.3	2.0
Germany	22017339	35.2	1.7
Ireland	6223053	94.7	24.7
Luxembourg	146079	76.7	0.4
Netherlands	2682897	78.6	3.1
Sweden	18436315	64.4	33.7
United Kingdom	19970968	51.7	30.0

Source: Corine Land Cover

From Table 20 it becomes clear that in Northern Europe and Scandinavia a much larger proportion of CORINE LCCs associated with HNV farming are situated in lowland areas than in Southern Europe. This is not so much of a surprise as it was already indicated in the former sections of this report that typical of HNV farming systems is that they are often constraint by climatic and topographic factors which more often occur in mountainous areas than in lowland areas, where farming activities have already taken the opportunities to optimise agricultural activities to the most optimal situation the local physical environment allows.

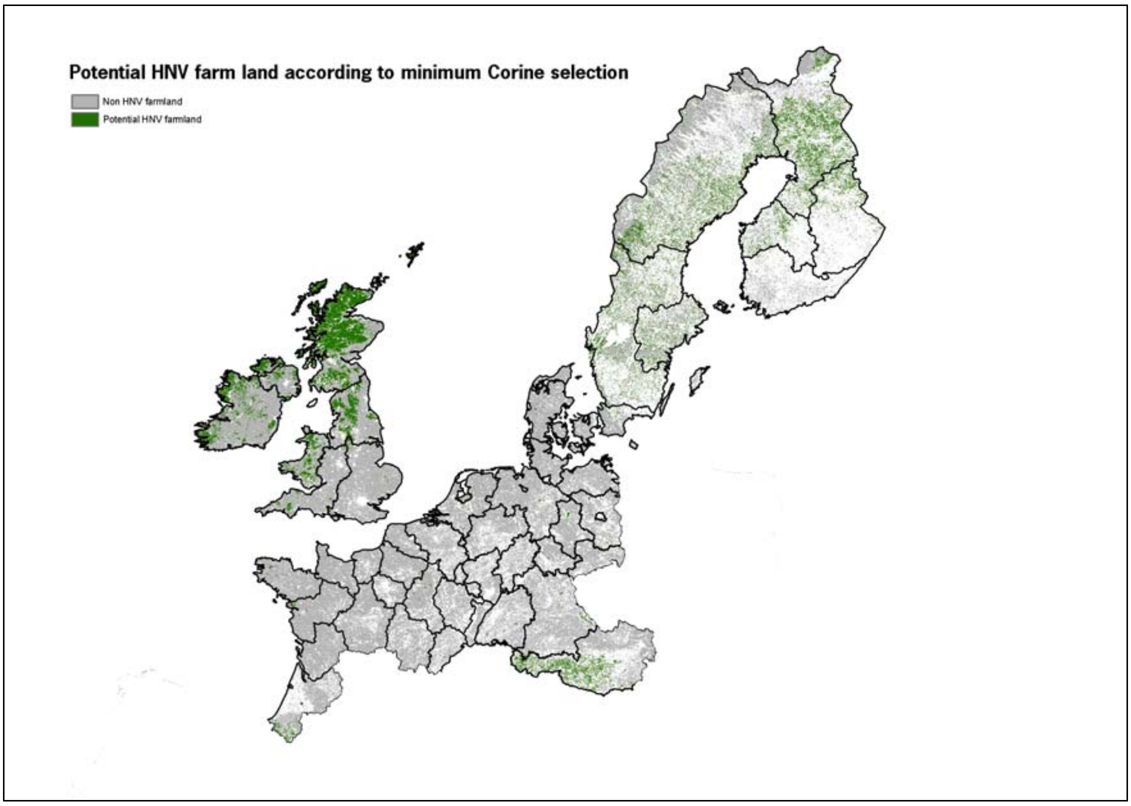
Table 20: Share of CORINE farm land classes potentially of HNV according to minimum and maximum selections in 3 altitude classes

	Maximum			Minimum		
	0-300	300-600	600+	0-300	300-600	600+
EU 15	47.9	24.2	27.8	34.9	26.0	39.1
Western Europe & Scandinavia	66.5	22.6	10.9	61.7	26.3	12.0
Austria	20.0	33.9	46.1	1.2	5.5	93.3
Belgium	77.5	21.7	0.8	67.7	20.5	11.8
Denmark	100.0	0	0	100.0	0	0
Finland	80.2	19.6	0.2	94.8	5.2	0.0
Northern France	85.1	12.2	2.7	53.5	23.9	22.6
Germany	50.1	35.7	14.2	45.1	21.4	33.5
Ireland	94.2	5.6	0.2	82.1	17.1	0.8
Luxembourg	31.1	68.9	0.0	8.4	91.6	0.0
Netherlands	100.0	0.0	0.0	100.0	0.0	0.0
Sweden	38.0	35.5	26.5	58.7	32.0	9.3
United Kingdom	69.2	25.8	5.0	48.1	43.3	8.6

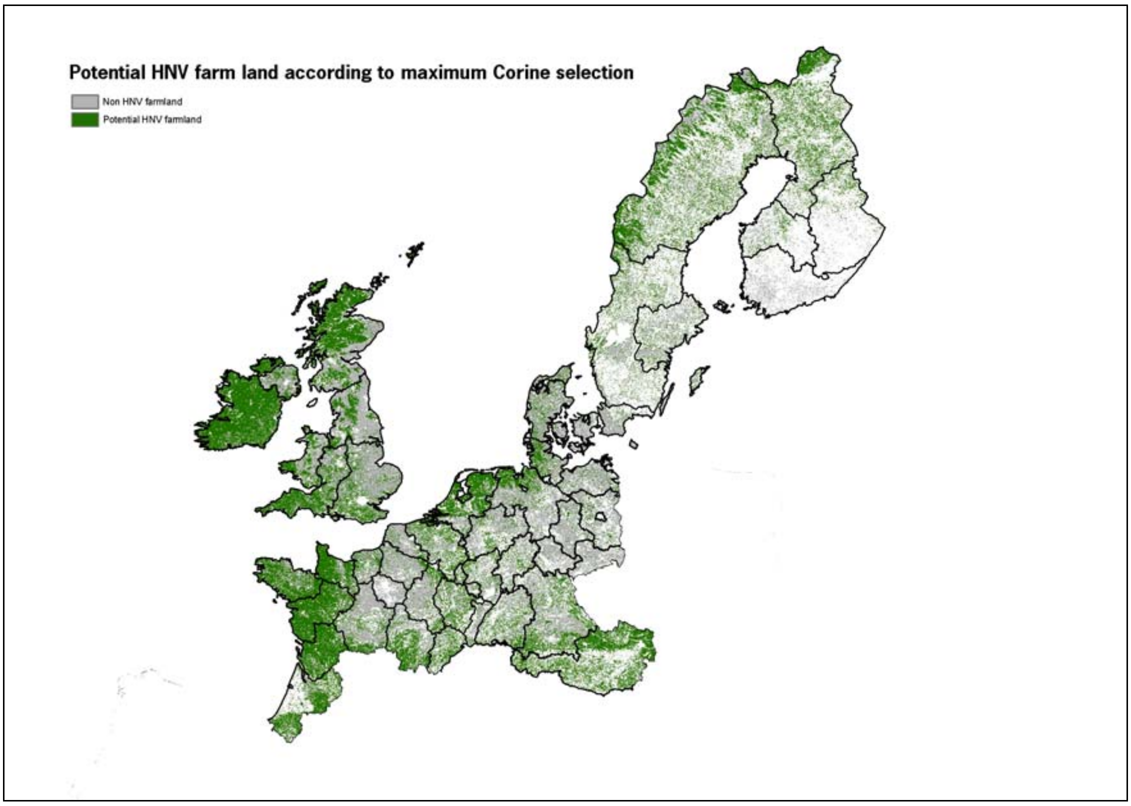
Source: Corine Land Cover

As in southern and eastern European situations, the results show that in Northern Europe and Scandinavian CORINE LCCs included in the *Minimum* approach (see map 7) are made up almost exclusively of semi-natural vegetation (pastures, natural grasslands, moors and heath, woodland-scrub vegetation and marshes, peat bogs and coastal dunes and marshes). The countries where there is the smallest proportion of agricultural CORINE LCCs associated with HNV farmland are also the ones where land is practically flat. Most of the CORINE LCCs associated with HNV farmland are found in the countries with considerable proportions of land above 300 meters. The map thus provides a useful illustration of the distribution of semi-natural vegetation types that are taken as being generally indicative of HNV.

The CORINE LCCs that are mostly associated with HNV farmland are the Natural grassland, Moorland, Inland marshes and Peat bogs classes which can more often be associated with extensive grazing practices than with some arable land use. However, several of these CORINE LCCs may still be used for grazing, but are often managed by Nature Conservation organisations. So strictly they may not be used for farming anymore although grazing is still practised. This situation is most often the case in western European countries such as The Netherlands, Belgium, Germany and Denmark. In most parts of Scotland, Ireland, Northern England grazing as part of agricultural practices is still very commonly practised on moors and heathlands. Thus, the Minimum approach shows reasonably well where HNV farmland is potentially



Map 7: Potential HNV farmland according to the minimum CORINE selection in Western Europe and Scandinavia



Map 8: Potential HNV farmland according to the maximum CORINE selection in Western Europe and Scandinavia

concentrated, but it should be remembered that CORINE does not provide any indication of how intensively an area may be farmed or even whether it is farmed at all.

By definition, the *Maximum* map for Northern Europe and Scandinavian region includes CORINE LCCs that are only very partly considered to be indicative of HNV farmland (see map 8). Consequently, the map from the maximum approach is swamped by the occurrence of a greater extent of the potentially more intensively managed LCCs. This approach therefore markedly over-represents the location of land likely to be under HNV farmland.

Overall conclusions on the land cover approach

The Minimum map captures quite well the likely location of Type 1 and Type 2 HNV Farmland but with the problem that many of the CORINE LCCs used to produce this map will not always be farmed. The Maximum map includes a very considerable amount of farmland that is not HNV.

Results on farming system approach

In Western Europe and Scandinavia 35%, 28% and 14% of the agricultural area is managed by HNV farms according to the different approaches (Table 21). In general United Kingdom, Ireland, Sweden and to some degree also Austria are the Member States with the highest score. In the other end the Netherlands, Denmark and Belgium can be found. For the region the difference between the common typology and the maximum approach are not so different, reflecting that high stocking grazing livestock farms are not included in large numbers in the common typology. In opposition to this the reduction in the area from the maximum to the minimum approach is high, as only half of the agricultural area from the maximum approach is included in the minimum approach. This is mainly due to a relatively large reduction in the area for systems with arable crops. For the dominant system, the permanent grassland system, about one third of the farmed area is not included in the minimum approach area. Compared to the general picture national differences can be found. It is worth noting that the reduction in the area managed by HNV farms from the common typology to the minimum approach is relatively smaller for three of the Member states with the largest share of their agricultural area being managed by HNV farms: United Kingdom, Ireland and Sweden.

Table 21: Share of Utilised Agricultural Area managed by HNV farming systems

	Total UAA ha	UAA managed by HNV farms % Common typology	Maximum	Minimum
EU15	118000235	34,6	27,9	13,5
Western Europe and Scandinavia	71207850	23,6	20,8	10,7
Austria	2161498	31,3	26,9	9,4
Belgium	1447840	6,7	3,3	0,6
Denmark	2785253	5,6	5,4	1,3
Finland	2064233	15,1	15,0	5,4
Northern France	18208392	10,6	10,0	2,8
Germany	16207393	13,9	12,7	4,6
Ireland	4912614	48,1	40,6	23,4
Luxembourg (LU)	127179	15,9	10,6	2,1
Netherlands	2152182	2,3	0,0	0,0
Sweden	3454276	38,1	38,1	19,7
United Kingdom	17686990	43,3	36,7	23,4

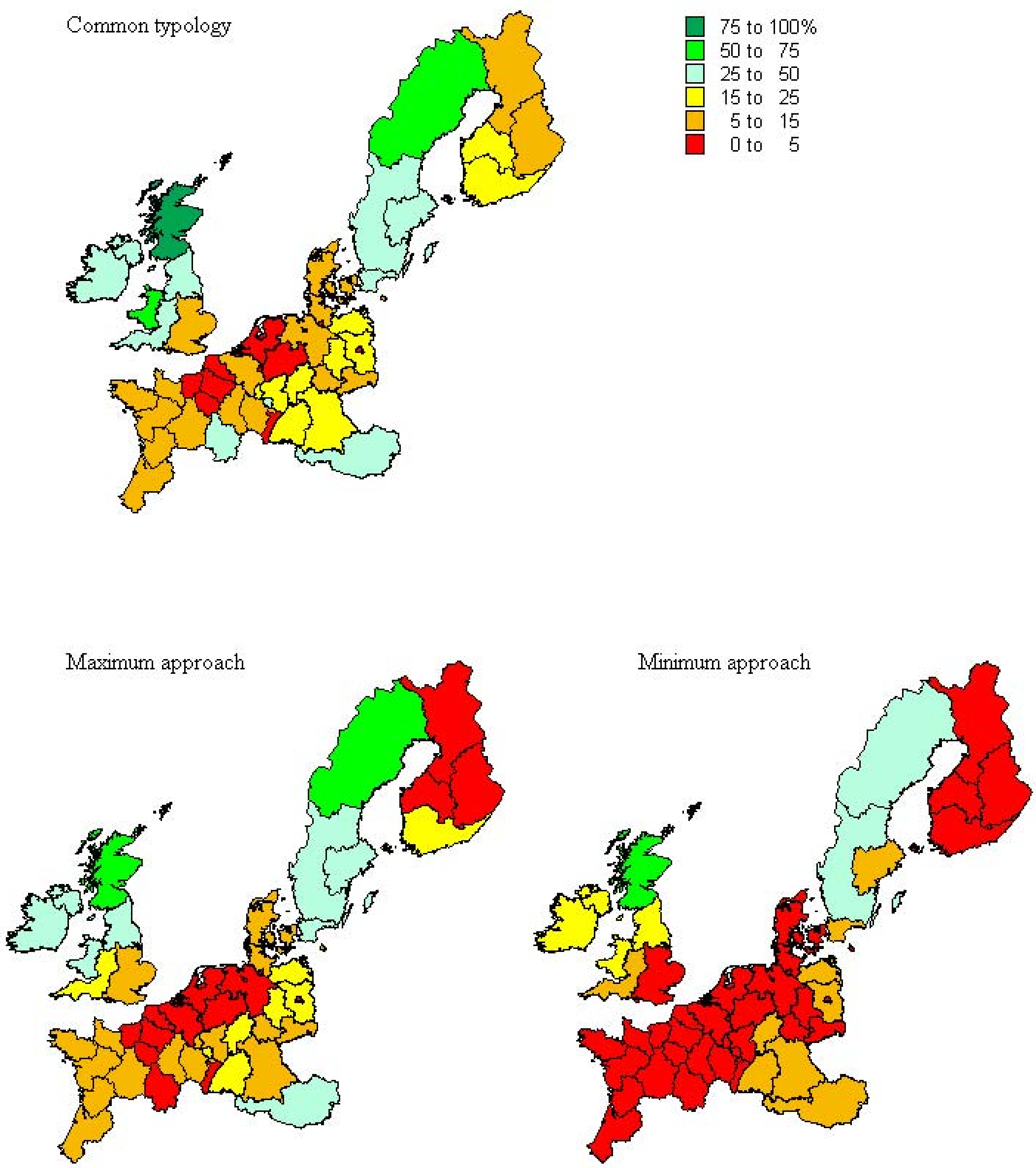
Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.

Table 22: Share of the farms identified as HNV farming systems

	Total farms No.	Farms identified as HNV farming systems % Common typology	Maximum	Minimum
EU 15	3815172	25,1	18,9	8,1
Western Europe / Scandinavia	1161377	20,2	17,2	7,4
Austria	86220	34,0	27,5	8,7
Belgium	41842	4,7	2,4	0,5
Denmark	49970	8,5	7,9	2,0
Finland	55570	14,3	14,0	5,9
Northern France	261456	11,6	10,8	3,5
Germany	279632	13,9	11,6	5,3
Ireland	129350	52,6	44,3	24,9
Luxembourg (LU)	1943	18,1	13,4	1,7
Netherlands	81150	2,5	0,0	0,0
Sweden	40070	33,6	33,6	15,4
United Kingdom	134174	28,3	22,2	8,8

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.

In map 9 the Member State information is detailed on HARM1 regions. As it can be seen the maps pinpoint Scotland as the most important region concerning HNV farming. For some regions the maps indicates relatively stable interregional differences. This is for example the case for United Kingdom and Ireland. In other cases differences can be found in the patterns between the different maps. This is for example the case for France, where only two of the maps indicate that the southwestern regions are more important for HNV than the northeastern regions. The maps also indicate that southern Germany and Austria and some of the northeastern regions of Germany have a relatively high importance for HNV farming. In Scandinavia data problems blur the picture in Finland. The relative picture of the Finish regions is best represented on the common typology map, because of lack of data from FADN. In Sweden the Southern part of the country and the region around Stockholm to the east should be distinguished from the other southern Sweden region, which is not the case on two of the maps partly due to the mapping classes.



Map 9: Share of Utilised Agricultural Area managed by HNV farming systems
Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.

Table 23 confirms the importance of grazing livestock in relation to HNV farming in Western Europe and Scandinavia, though a 15% of the HNV farms and 9% of the HNV managed UUA falls into the category of cropping systems. 83% of the agricultural area managed by HNV farms are managed by Permanent grassland systems, of this half of the area is managed by farms where rough grassland is the major land use. However, it is worth noting that the rough grassland farms only account for 4% of the HNV farms, whereas other permanent grassland farms account for two thirds. Off-farm grazing systems are not very important in numbers in Western Europe and Scandinavia, though their importance for HNV can be high. They account for 3% of the agricultural area managed by HNV farms, but the area used for grazing outside the farms is not recorded in the statistics and might have a significant extent. Also low-input other systems only make up a very small proportion of the HNV farms and the agricultural area managed by HNV farms with 1,4 and 0,3% respectively).

Table 23: General profile of HNV farming systems in Western Europe and Scandinavia (Data from minimum approach)

	Farms No.	UAA ha	Share of HNV farms %	Share of UAA on HNV farms %	Average UAA ha	Share farmers over 55 years %	Average economic size ESU
All systems (HNV and Non-HNV)	1161377	71207850	-	-	61,3	26,2	58,8
All HNV farms	86522	7594649	100	100	87,8	35,9	18,2
Low-input cropping systems	12987	668151	15,0	8,8	51,4	17,9	23,5
Off-farm grazing livestock systems	3020	245749	3,5	3,2	81,4	39,6	32,9
Low-input permanent grassland systems	61160	6275104	70,7	82,6	102,6	43,4	15,2
- of these rough grassland systems	*3334*	*3161971*	3,9	41,6	*948,4*	*49,4*	*27,8*
- of these permanent grassland systems	*57826*	*3113133*	66,8	41,0	*53,8*	*43,1*	*14,4*
Low-input arable grazing livestock systems	8151	380432	9,4	5,0	46,7	10,2	23,6
Low-input other systems	1205	25212	1,4	0,3	20,9	13,4	45,1

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.
UAA = Utilised agricultural area, ESU = European size unit

From tables 23 and 24 a general description of HNV farming systems and the different types of HNV farming systems in Western Europe and Scandinavia can be given. In average *HNV farms* are larger in area than the average farm in the region. This is however not the case for the economic size of the farms, where the average farm is more than 3 times larger than the average HNV farm. It is also worth noting the HNV farmers are older than the average farmer is. 36% of the HNV farmers are older than 55, whereas this is only the case for 26% of all farmers. Also for the environmental profile the HNV farms, as expected, differ from the other farms. HNV farms have more grassland, especially rough grassland accounting for almost half of the agricultural area on HNV farms, but for less than 10% on an all farms. The use of inputs are markedly lower on HNV farms: The use of fertilisers, measured in Euro, are only 15% of the average for all farms and crop protection less than 4% of the average. Combined with a total stocking density half the size of average farms, the low fertiliser use means that the nitrogen surplus is only 30 kilo per ha compared with 76 kilo as average for all farms. Finally, the potential pressure on the grassland from grazing is with 0,5 cattle, sheep or goats more than 3 times lower than on the average farm.

Table 24: Environmental profile of HNV farming systems in Western Europe and Scandinavia (Data from minimum approach)

	Share of UAA in permanent grassland %	Share of UAA in rough grassland %	Stocking density LU/ha	Grazing pressure GLS/ha	Nitrogen surplus kg/ha	Fertiliser cost Euro/ha	Crop protection cost Euro/ha	Grazing days outside UAA No.
All systems (HNV and Non-HNV)	27,3	8,7	1,1	1,6	76,2	85,4	69,4	5,7
All HNV farms	36,2	47,3	0,5	0,5	30,2	13,2	2,5	27,4
Low-input cropping systems	18,0	0,8	0,2	0,4	37,6	10,3	4,5	0,0
Off-farm grazing livestock systems	52,8	34,3	1,5	1,6	76,4	37,7	9,5	196,2
Low-input permanent grassland systems	38,0	55,7	0,4	0,4	24,6	13,1	2,0	5,9
- of these rough grassland systems	*3,0*	*96,1*	*0,1*	*0,1*	*3,6*	*2,4*	*0,2*	*17,8*
- of these permanent grassland systems	*73,5*	*14,7*	*0,7*	*0,7*	*46,0*	*23,9*	*3,9*	*3,5*
Low-input arable grazing livestock systems	26,8	0,2	0,7	1,3	53,7	6,1	2,4	0,0
Low-input other systems	67,4	14,5	13,8	1,2	447,9	10,0	4,1	0,8

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI.
UAA = Utilised agricultural area, LU = Livestock units, GLS = LU of cattle, sheep or goats. See also notes to table 15.

Also information on the specific HNV farming systems can be derived from the tables. As an example the most interesting feature of the *rough grassland farms* is of course that 96% of the agricultural area on these farms are rough grassland. As mentioned before it is a relatively small number of farms that are of this type, but the average farm size is with almost 1.000 ha 15 times as high as for the average farm. This huge agricultural area on the other hand result in an economic size that us only half the size of an average farm. It is also worth noting that almost half of the rough grassland farmers are older than 55, indicating that succession can become an issue in relation to these systems. Apart from having the huge rough grassland areas the environmental in general is positive. In average 2.400 Euro is spend on fertilisers and 200 Euro is spend on crop protection. Combined with a stocking density of 0,1 it means that the nitrate surplus is only 3 kilo per ha.

Conclusions on the farming system approach

The results from the farming system approach in Western Europe and Scandinavia provides a good insight in HNV farming in the region. The systems that have been identified are surely *more HNV* than the systems that are considered to be non-HNV. But, as the results from the three different approaches indicate it is hard to draw an exact line between HNV and Non-HNV. Also the overall pattern regarding the spatial distribution of HNV farming is believed to be reflected in the tables and maps. However, at the harm1 level data problems occur because the number of sample farms in FADN is to small, when a detailed typology like the HNV typology is applied. The results also show that valuable information on the characteristics of the different farming systems can be calculated. Distinct profiles of the different HNV systems can be analysed for monitoring or policy purposes.

Results on species approach

The maps based on both the approaches using bird data produce some surprising results for northern Europe and Scandinavia. For example, although large parts of northern Scotland are shown, as would be expected, as having over 60% of the species deemed to be associated with this habitat type, this figure drops to less than 30% in the Republic of Ireland even though moorland is characteristic feature of much farmland, especially in the west of the country. In addition, most of Britain is shown as having over 50% of the bird species being indicative of dry grassland (steppic) habitat, thereby incorrectly suggesting that much of Britain is on a par with the heartland of this type of habitat in central Spain. Finally, with the exception of bird species associated with pastoral woodlands and those associated with arable and improved grasslands, then most of Scandinavia is shown as being misleadingly low in bird species associated with the other habitat types. Overall, the results suggest that the chosen suites of species do not consistently reflect the bird species associated with HNV farmland in northern Europe. The current maps produced from the bird species approaches appear to be at worst inappropriate and at best unreliable in terms of adding any additional value to the results from the land cover and farming systems approaches.

Overall conclusion on Western Europe and Scandinavia

The different approaches show different strengths and weaknesses in relation to the results on Western Europe and Scandinavia. Though some regions still needs further work and verification the maps bases on land cover approach gives a fair representation of the location of HNV farmland. However, the maps stemming from this approach cannot be used to analyse the extent of HNV farmland. This is indicated in table 25 and 26 comparing the agricultural land cover classes selected from CORINE and the UUA in the FADN and the results of the different approaches. Not surprisingly, the tables show that the agricultural area as estimated from CORINE is too large compared with FADN. Also for the results on identified HNV farmland the figures from CORINE overestimated the area. The main reason is that CORINE operates with heterogeneous areas and therefore includes non-HNV farmland and non-agricultural areas. However, this does not limit the use of the approach for making indicative maps of the location of HNV farmland. The farming system approach is therefore the best approach for analysing the extent of the HNV farmland. Furthermore, the farming systems approach can be used to analyse the characteristics of HNV farming at a regional level. The species approach needs to be elaborated further before an assessment of the use can be made.

Table 25: Comparison of agricultural area according to the farming system approach and the land cover approach.

	FADN UUA ha	Agricultural land cover classes CORINE ha	FADN in percentage of CORINE %
EU15	118000235	143655448	82
Western Europe and Scandinavia	71207850	111070378	64
Austria	2161498	4053038	53
Belgium	1447840	1833489	79
Denmark	2785253	3366542	83
Finland	2064233	8815056	23
Northern France	18208392	23525602	77
Germany	16207393	22017339	74
Ireland	4912614	6223053	79
Luxembourg	127179	146079	87
Netherlands	2152182	2682897	80
Sweden	3454276	18436315	19
United Kingdom	17686990	19970968	89

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI and CORINE land cover.

Table 26: Comparison of the area included in the different approaches. Farming system approach, common typology is set as 100

	FADN common typology ha=100	FADN maximum approach %	FADN minimum approach %	CORINE maximum approach %	CORINE minimum approach %
EU15	40828081	81	39	257	94
Western Europe and Scandinavia	16805053	88	45	385	121
Austria	676549	86	30	594	174
Belgium	97005	49	9	1185	30
Denmark	155974	96	23	993	97
Finland	311699	99	36	1841	1389
Northern France	1930090	94	26	772	24
Germany	2252828	91	33	344	17
Ireland	2362967	84	49	249	65
Luxembourg	20221	67	13	554	3
Netherlands	49500	0	0	4260	168
Sweden	1316079	100	52	902	472
United Kingdom	7658467	85	54	135	78

Source: FADN-CCE-DG Agriculture/A-3; adaptation LEI and CORINE land cover.

4.3 Central and Eastern Europe

Although there is no definitive survey, there is widespread agreement that there are extensive areas of high nature value farmland in Central and Eastern Europe (CEE, see Baldock et al 1994, 2000 & 2002, Redman 2001). Several other EEA countries, including Norway and Switzerland also have a significant endowment of such farmland. In CEE large areas have retained a significant habitat value, despite a period of intensive agricultural production methods and the large land improvement schemes which took place during the communist era. In most countries, sizeable areas persisted on the margin of intensification or remained under relatively traditional management, whether in the more mountainous regions or in small scale production systems on lower land. Since 1990 farmland habitats have benefited in several regions as a result of the collapse of the agricultural economy. The use of pesticides and fertilisers has fallen significantly, major intensive livestock units have been closed, and sizeable areas have been left fallow. However, abandonment and the withdrawal of historic management have become a threat to the nature value of some farmland areas, both on grassland and some traditional arable areas.

Many species and habitats of conservation concern are found on farmland in CEECs and the wildlife dependent on agricultural habitats generally exceeds the biodiversity value of farmland in most EU countries in similar bioregions. Many farmland bird species in rapid decline within the EU have very important populations in the region (e.g. the White stork *Ciconia ciconia*, Corncrake *Crex crex* and Whinchat *Saxicola rubetra*). In addition, many grassland and less intensive arable areas have high botanical values and there are rare or threatened mammals dependent on farmed habitats.

HNV farming in the region

Extensive livestock production is widespread throughout the region. HNV livestock systems typically consist of very small herds, or individual animals, owned by semi-subsistence farmers, which are tethered or herded. Herding mostly takes place on common or fallow land or arable stubbles and is often governed by informal arrangements. The seasonal movement of livestock (transhumance) also remains a key part of some livestock systems, especially in mountainous regions such as the Romanian and Bulgarian Carpathians and Polish Tatras. Larger scale livestock production varies greatly in its character but a proportion is associated with HNV farmland. Some farms that remain from the collectivised period maintain large herds of cows, sheep and horses which are grazed at low stocking densities on low-input grasslands. However, livestock numbers have fallen sharply in the region since the early 1990's and sizeable areas appear undergrazed.

The extensive, and often semi-natural, grassland associated with extensive livestock grazing varies across the region due to climatic and abiotic conditions and variations in management styles. Semi-natural and extensively grazed grasslands range from the dry steppe or 'puszta' in Hungary, to the wet grasslands on the Baltic coast. Both provide a key habitat for migrating birds such as cranes, raptors, geese and waders, as well as specialist flora.

Low input arable systems are also common in the region. They are typically mosaic habitats consisting of small areas of varied crops with few, if any, fertiliser or pesticide inputs. These areas are typically also rich in natural features, often containing hedges, small woodland areas, small wetlands etc.

Permanent crops, in particular low input fruit orchards are often also HNV farmland. Such orchards typically contain mature trees in a mosaic with arable cultivation. In the ’tanyas’ system in Hungary vineyards are found in a mosaic of crops.

The major changes that have swept agriculture in the region since the early 1990a have created new landscapes with a rapidity and on a scale unfamiliar in the EU. Further changes lie ahead with accession to the EU taking place from May 2004. There is concern that significant intensification could occur in some regions, together with an increase in input use, while under-management and abandonment takes place elsewhere.

For this reason it would be particularly desirable to be able to identify HNV farming areas in CEE in the near future in order to assist in policy making. For example, rural development plans and specific measures, including agri-environment schemes, are being drawn up at the time of writing in 2003 and may be further revised before 2003. An ability to target these on areas vulnerable to further adverse change in the coming years would be particularly timely.

Identifying HNV areas

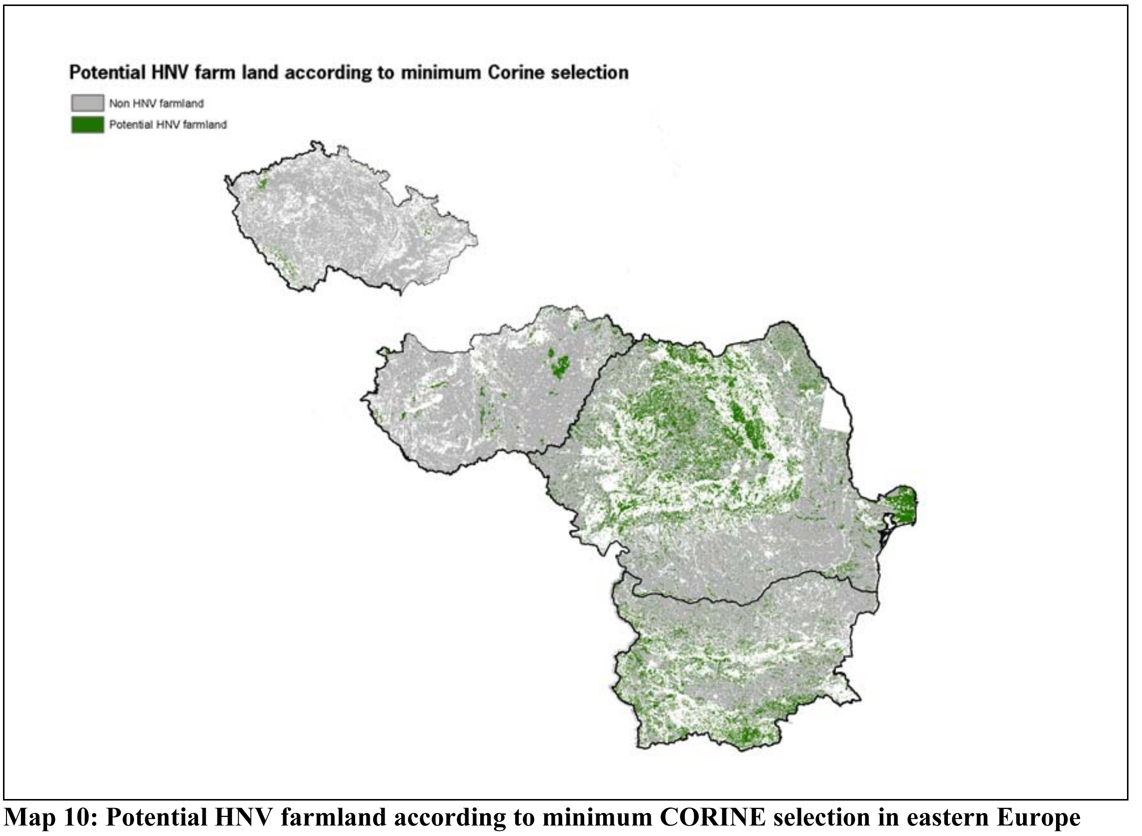
The primary focus of this study was the development of an indicator or indicators for HNV farming in the current EU but the potential for extending this to all EEA countries and also Switzerland was also to be considered. To this end, consideration was given to:

- The potential application of the land cover approach to identifying HNV farmland outside the EU.
- The potential application of the farm systems approach.
- The possible application of the species approach.
- The availability of relevant agricultural land cover and environmental data in the countries concerned.

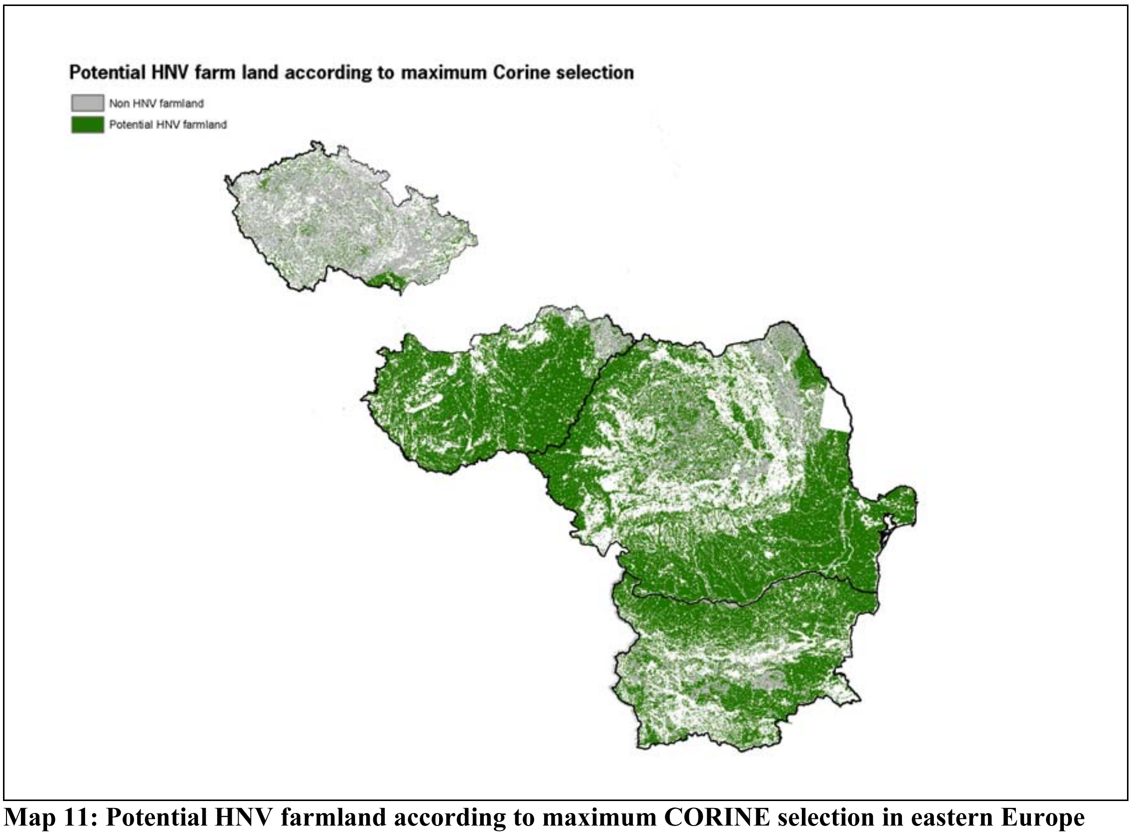
In addition, a number of experts from CEE were involved in the study, particularly commenting on the potential value and applicability of the approach in their countries. The results of this investigation are summarised briefly below.

The land cover approach

Several national experts from CEE countries were asked to follow part of the procedure adopted in EU countries under the land cover approach. They selected land cover classes that they judged could be used to indicate both the minimum potential locations of HNV farmland within their country and also the maximum potential location of such farmland (see section 3.1 for a fuller explanation). This exercise was



Map 10: Potential HNV farmland according to minimum CORINE selection in eastern Europe



Map 11: Potential HNV farmland according to maximum CORINE selection in eastern Europe

carried out in Bulgaria, the Czech Republic, Hungary, Lithuania and Romania[1], although the results can only be shown in a map form for countries which are currently covered by the CORINE database (Bulgaria, Czech Republic and Romania – see map 10 and 11). The initial results have not yet been peer-reviewed, but at first glance they do not appear to suggest any obvious problems over and above those associated with applying this approach in the EU, for example the treatment of woodland. On this basis the land cover approach appears suitable for use in CEECs, as most will be in the updated CORINE database that will be available from mid 2004. Some early results from three countries are shown in the table below.

Table 27: Share of total farmland where HNV farmland potentially could be located – minimum and maximum approach

Country	Total agricultural area (x 1,000 Ha)*	Maximum	Minimum
Bulgaria	7,040	89.6%	27.2%
Czech Republic	4,924	22.6%	2.2%
Romania	15,090	87.5%	31.0%

Source: CORINE land cover

The farming systems approach

Using the farming system approach described in section 3.2 to identify areas of HNV farmland has particular problems outside the EU, where the database does not exist. There are further limitations in the CEE context. Most significantly the majority of HNV farms in the region are likely to be below the minimum threshold for inclusion in FADN, which is governed by rules and procedures agreed in the EU, so excluded from the database. A detailed description of the implementation of the FADN system in EU Accession Countries is provided in box 4.

Other limitations with the FADN approach in the CEE in particular should also be noted. For instance, farm inputs in the region are typically very low at present and it would be difficult to set an appropriate threshold for input costs. It should be noted that some areas, such as orchards, are farmed almost without inputs. It would be beneficial if the thresholds chosen for EU conditions could be differentiated to take into account the differences between input costs in arable areas, grasslands and permanent crops. In addition, the land tenancy and grazing arrangements are often informal, so calculating stocking densities could be very difficult when stock is herded over a large area, and in particular where transhumance is carried out.

In the next decade input use and expenditure could increase significantly in large areas of CEE, although this would not be anticipated in other EEA countries. Any indicators based on input use or expenditure per hectare would require regular review.

[1] Other non-EU countries covered include Cyprus, Switzerland and Turkey.

Box 4: FADN implementation in EU Accession Countries

EU Accession Countries are required to implement the EU's FADN system fully after accession in May 2004, although progress towards meeting this target is varied. All ten of the first wave of Accession Countries became observers in the FADN committee in April 2003. Many began to implement FADN with sample sizes of ten per cent of the agricultural area in 2002. Five countries (Czech Republic, Hungary, Lithuania, Latvia and Estonia) have already put in place a system for the collection, control and preparation of accountancy data to be transmitted securely by their national administration to the FADN database (RICA-1). Poland also expects to have reached this stage by the end of 2003. The second and third stages of FADN administration (RICA-2, a database and analysis system, and RICA-3, an information system for reporting and dissemination) will be completed by all new Member States immediately after accession (FADN Committee, 2003).

Certain aspects of the of data gathering required under FADN differ between current Member States. The exact way in which FADN will operate in the new CEE Member States is not yet clear. The data is likely to be subject to specific limitations in relation to its potential use for indicating high nature value farmland due to the varying sample size in each country, the threshold set for 'commercial' farms (and potential exclusion of many small farms likely to be of high nature value) and informal grazing outside the official UAA of a farm (which will distort official grazing densities).

In Lithuania, for instance, there are 200-250,000 farms covering more than one hectare. Of these, it is expected that only 45-55,000 farms exceed 2 ESU, which is the size threshold for inclusion in FADN, although these commercial farms cover 85-95 per cent of UAA. The types of farm most likely to be excluded are mixed cropping, mixed grazing livestock and field crops with grazing livestock combined (FADN farm types 60, 71 and 81).

A summary of planned FADN implementation in ten Accession Countries

Country	Number of farms in sample	Number of regions for FADN purposes	Threshold for 'commercial' farms (in ESU)
Cyprus	500*	1	1 or 2*
Czech Republic	1,000*	1	1 or 2*
Estonia	500*	1	1 or 2*
Hungary	1,900	7	2
Latvia	500*	1	1 or 2*
Lithuania	1,300	1	2
Malta	500*	1	1 or 2*
Poland	12,000*	4 regions with 16 sub-regions	1 or 2*
Slovakia	600*	1	1 or 2*
Slovenia	500*	1	1 or 2*

* This is approximate information, based on what was discussed during technical meetings at DG Agri during 2003.

The total number of holdings in Hungary is 960-970,000 but only nine per cent of farms are above the 2 ESU threshold (90-92,000 based on data from 2000). The majority of those that are below the ESU threshold are considered by be semi-subsistence farms, often with a mix of arable and livestock production.

The species approach

The data needed to implement this approach, bird species of conservation concern for example, has not been examined in detail but there is good information for a numbers of species. In principle, this approach appears equally applicable outside and within the EU with the comparability of the data being the main concern. However, there are broader questions about how it is best developed and what it shows (see section 3.3) This approach would be expected to highlight the sizeable areas of HNV farmland in the area since there are large populations of many species of conservation concern.

Table 28: Examples of relevant data sources in non-EU EEA member countries

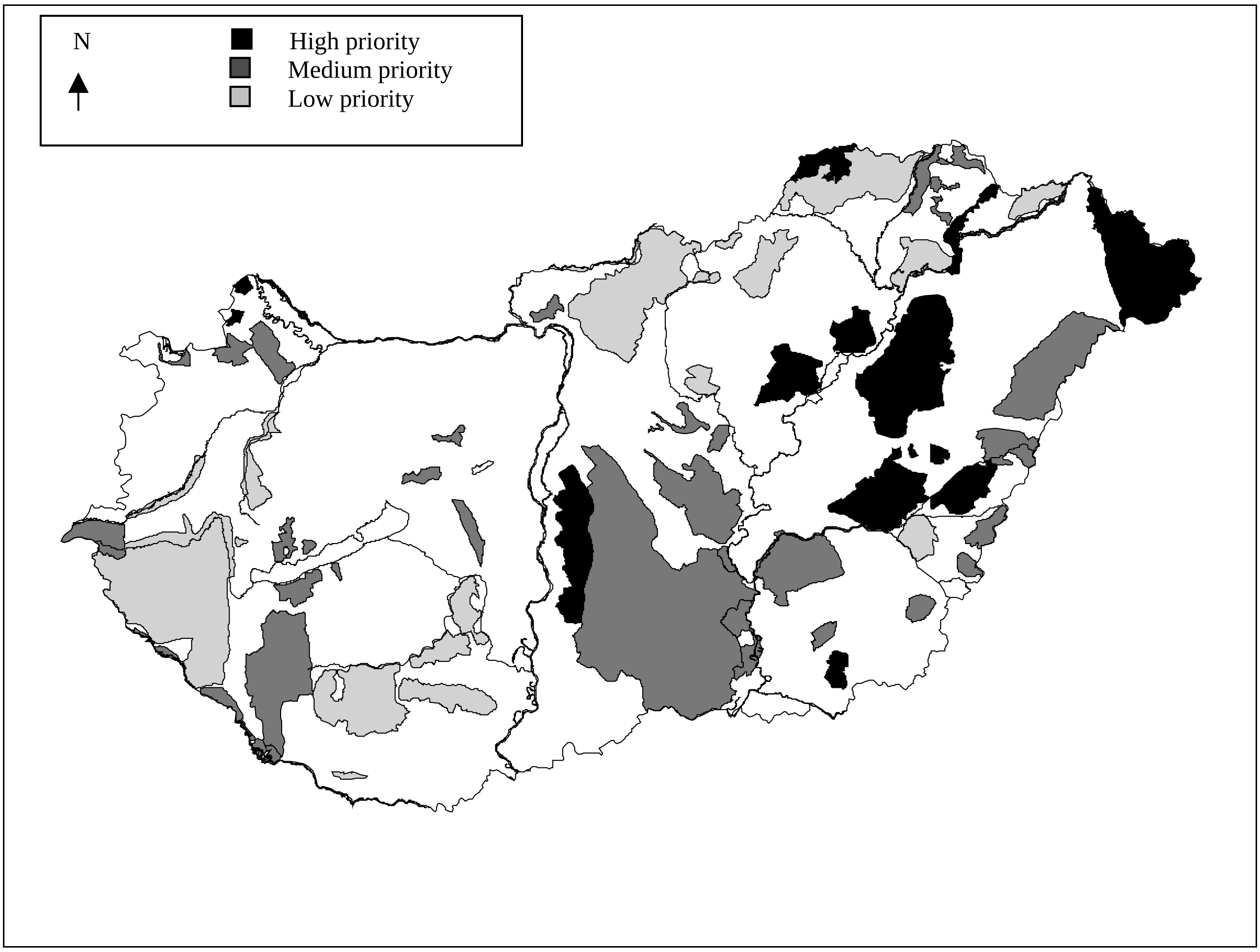
	Data type			
	Farm data		Natural values	
Country	**FADN**	**Other**	**CORINE**	**Other**
Bulgaria	Due in 2006	• The Ministry of Agriculture and Forestry and its related structures, including the Institutes of the former Agricultural Academy (Soil Institute, High Mountain Agriculture Institute, Executive Soil Agency, etc.) can supply farm data.	Already available	• Environmental data is available from the Ministry of Environment and Waters and its related structures, including the Executive Environmental Agency. • A grassland inventory is in preparation.
Cyprus	Due in 2004		Due in mid 2004	
Czech Rep	Due in 2004	• The Czech Statistical Office annually records land that is no longer farmed.	Already available	• The Agency for Nature Conservation and Landscape Protection (AOPK) runs the NATURA 2000 mapping project and is building up new information on flora and fauna, which, it is hoped, will ultimately take the form of repeat surveys, allowing a time series to be established. • Time series of farming related wildlife populations are maintained and published at the Ministry of Agriculture (www.mze.cz). • The Agency for Nature Conservation and Landscape Protection of the Czech Republic is preparing to publish a book that will inventory the habitats found in the Czech Republic, but as yet there is not enough data on the area they are covering and it is not expected that this work will be complete until NATURA 2000 is fully implemented. This inventory should be more detailed than the CORINE habitats database managed by AOPK.
Estonia	Due in 2004	• The Statistical Office of Estonia (SOE) collects data on the abandonment of arable land. This information is published in the yearbook series *Agriculture*. Data is	Already available	• Grassland inventory by Estonian Fund for Nature 2002. A GIS database is available at 1: 10,000. • The National Environmental Monitoring Programme (NEMP) is currently the most comprehensives data source for biodiversity and landscape issues.

		available for at least the last five years. The last edition is from 2001. Data on abandoned natural grasslands is inadequate, but when the Agricultural Census 2001 is published more data is likely to be available.		
Hungary	Due in 2004		Due in mid 2004	• Grassland inventory by Authority for Nature Conservation 2002. • Environmentally Sensitive Areas map, by a variety of institutions. • Biodiversity monitoring data available from the Authority for Nature Conservation.
Iceland	No plans for inclusion		?	
Latvia	Due in 2004	• Data on nutrient loads is available from the Latvian Environment Agency (LEA) and is updated annually.	Already available	• Grassland inventory is in preparation. • The Latvian State Environment Inspectorate (SEI) manages a database on protected plant species. The database was created in 1990 and updated in 1995. • The LEA collects and processes data on the overall status of flora and fauna. This data is updated annually and is available for public access on the LEA website.
Lithuania	Due in 2004	See annex G for details.	Already available	See annex G for details.
Malta	Due in 2004		Already available	
Norway	No plans for inclusion		?	
Romania	Due in 2006		Already available	Grassland inventory in preparation.
Slovakia	Due in 2004		Due in mid 2004	• Grassland database available from Seffer et al 2002. • The State Nature Conservancy office is creating a comprehensive information system with the Central database that will collect and analyse data on biodiversity in Slovakia. • The Slovak Environmental Agency (www.sazp.sk/index_en.html) also provides environmental data.
Slovenia	Due in 2004	• Has national register of agricultural holdings, cadastre of actual agricultural land use, central animal register and location of LFAs.	Due in mid 2004	• There is a programme 'National Environmental Monitoring of Slovenia', but consists of randomly selected research studies rather than regular monitoring. • Inventory of Most Important Natural Heritage in eastern and central Slovenia has been published; for western Slovenia it is in preparation. • The Anton Melik Geographical Institute (www.zrc-sazu.si/gi/landscapes.htm) has data on landscape features and geology. • A grassland inventory is in preparation.
Switzerland	No plans for inclusion		Due in mid 2004	

Data considerations

There is a limited range of relevant data on agricultural and environmental data available at the Pan European or EFTA scale, FAO farm statistics being one of the most important exceptions. CORINE will be available for an increasing number of countries from 2004 onwards, including for Switzerland. In the enlarged EU the agricultural statistics required of Member States will be collected over a larger area and FADN will eventually become available for Bulgaria and Romania as well as the EU 25. However, it will have major weaknesses as a tool for identifying potential HNV farmland, as described above.

National statistics on a range of relevant topics are collected by government agencies, academic institutions, NGOS and others. A selection of the type of information collected by different sources, some as time series data, is given in table 28. Some countries have particularly relevant information. See annex G for a detailed description of relevant data available in Lithuania. The data available in Hungary, for example, goes beyond that available in many current EU Member States in complexity, resolution and coverage. A great deal of information on soil, altitude, farm and environmental characteristics is published in map form in. Data can be overlaid in order to identify potential environmentally sensitive areas, for instance (see Map 12).



Map 12: Environmentally Sensitive Areas in Hungary (after Bartram *et al* 1998)

5. Conclusions and recommendations for future work

Conclusions

In the project a simple definition of HNV farmland and a dichotomous key for identifying three different types of HNV farmland land has been established. We believe that these definitions are relatively robust and contribute to further work on HNV farmland by providing a basis for other approaches (more detailed and regionally based) to the broad characterisation of HNV farmland for others interests.

The different approaches that have been used for identifying, localising and characterising HNV farmland at a European scale and utilising European data are as follows:

Firstly, a land cover approach was developed to identify and analyse land cover classes indicating HNV farmland. Secondly, a farming system approach was developed to identify and analyse farming systems likely to manage HNV farmland. Thirdly, a bird species approach was developed to identify habitats linked to HNV farmland. Finally, because rare species associated with European farmland would not be located by these approaches, we explored the value of using European species distribution data using birds, because of the availability of data for species of European Conservation concern.

The output of the land cover approach was a prediction of the distribution of HNV farmland. Though some inconsistencies still occur on the maps, they do, in our opinion, give a fair picture of the potential location of HNV farmland in Europe at a broad scale. However, the maps cannot be used for analysing the extent of the HNV farmland and the possibilities for using the approach to monitor any changes in the extent of HNV farmland are very small. This is due to both to the limitations stemming from to the rationale behind the accessible Pan-European data (CORINE) and to the updating frequency of the data. As the new version of CORINE becomes available and the number of participating countries increases, the land cover approach will become more useful at a European scale.

There are limited sources of data available for applying a farm systems approach at a European scale. FADN seems the best available in the EU. The output of the farming system approach was maps showing the regional distribution of different farming systems potential to be HNV and profiles presenting the main characteristics of these systems. The approach was developed through several stages but needs considerable further refinement and general level validation before it could be used as a strong predictive tool. Though problems of representatively in the underlying data source (FADN) have been identified, the results of the farming systems approach would be able to give a fair indication of the farming systems managing HNV farmland, of their distribution and of their characteristics once the variables and threshold proposed have been further testified. For the different systems the data can be used to give a general assessment of the environmental performance regarding for example stocking densities, input use etc. indicating the pressure (positive as well as negative) from these systems in relation to HNV farmland. Due to the yearly update of the underlying data the potential for using the approach for monitoring short term changes in HNV farming is much greater than for the land cover approach.

The output of the bird species approach to predicting the occurrence of habitats associated with HNV farmland was disappointing. Pan-European data have been identified and tested but the methods necessitate many assumptions and value judgements making it difficult to produce results that can be interpreted with any confidence at this stage.

One avenue for developing the species approach would be locally and not restrict it to bird species. It is possible that invertebrates would be a better group with which to further investigate the potential value of this approach, if adequate data was available. Despite these difficulties, a species based approach is needed to complement the others, particularly in the definition of Type 3 HNV farmland.

To sum up the different approaches have different strengths and weakness. The Land Cover approach gives the most precise and most detailed picture of where there are higher probabilities of finding HNV farmland in Europe. The map showing the maximum extent of HNV farmland and the map showing the minimum extent of HNV farmland both include valuable information and should be seen as complementary. However, we would regard the map of the minimum extent of HNV farmland as showing the core areas of HNV farmland in Europe. The maps have the potential to be updated in the future with newer data. This might give a visible impression of changes, but it cannot be used to analyse and monitor changes until the presumed link with land cover on the map and the actual occurrence of HNV farmland on the ground has been validated.

The extent of HNV farmland can at present best be monitored using the farming system approach. This approach cannot provide exact figures on the development in the extent of HNV farmland, but reliable indications of certain trends of relevance to nature value are achievable. Furthermore, the farming system approach can provide information on the characteristics of different types of HNV farming systems and changes in selected management practices detrimental or not to HNV farmland. The output of the species approach so far can be used for qualitative assessments of the results from the other approaches, but should be seen as the first step in using species to develop HNV farmland indicators. Further work is required – thus avenues for taking this forward are referred to.

The fundamental differences in the three approaches make it difficult to combine them into a single indicator or map. At this stage, the ‘minimum’ land cover approach would be regarded as the most indicative single map, subject to the caveats set out above.

Potential Policy Applications

The maintenance of HNV farmland and farms has been referred to as an objective in a number of EU policy documents and now appears explicitly in the Rural Development Regulation and both Agenda 2000 and the Mid-Term Review of the CAP. In some cases it may be an objective in its own right, in others it may be a means of pursuing related objectives, such as the conservation of biodiversity or the continuation of genuinely multi-functional agriculture at a time of significant economic pressures. Up to now it has been difficult to characterise this farmland or identify either its extent or location within Europe, other than in the broadest terms. This has greatly restricted the utility of the concept other than as a signpost to an important issue. Further information at both the European and national level is required to allow the concept to play a greater role in different aspects of policy development and implementation.

Ideally this information should be authoritative, unambiguous, consistent, up to date and expressible in different forms (e.g. in both maps and statistical presentations).

This level of data quality is difficult to achieve in practice, and policy decisions frequently have to be made on the basis of less good data. Provided that the precise character and main weaknesses of data sources are understood they can be used to inform policy in a measured way. In the sphere of agricultural policy the number of consistent and comprehensive data sources at European level is rather few, so expert judgement often has to be deployed. There is considerable scope to inform policy decisions with data of the kind presented in this report, even though the key indicators are subject to significant caveats and data shortcomings discussed in earlier chapters. However, we are still some distance from having a single authoritative data base that could be used for targeting policy very precisely. If the outputs achieved so far could be validated on the ground it would strongly support the idea of further developing the approach - both in a more refined form in the EU and, subject to greater limitations (especially regarding FADN) in a wider Europe.

In the interim, a range of possible applications can be considered:

- In the preparation of impact assessments for new policy proposals, for example in the agricultural, regional and nature conservation spheres. Information on the extent and distribution of potential HNV farmland and the key agricultural characteristics of farming systems apparently associated with it may be relevant to several types of question. Which Member States, regions and farming sectors would be most affected by measures aimed explicitly at HNV agriculture? Which areas are potentially sensitive to large-scale development projects (infrastructure, dams, irrigation, commercial forests etc). Is the impact of new policy measures aimed at grazing livestock, fallow land or other relevant aspects of agriculture predictable?

- In the evaluation of current policies. How far have these affected the principal areas of HNV farmland or relevant aspects of agriculture? How does policy targeting at EU or national level correspond to areas likely to have a substantial endowment of HNV farmland? The information presented in this report could be useful in assessing progress in integrating agricultural and nature conservation measures or evaluating the accuracy of reports on related topics.

- There is some scope for targeting policies on the basis of the land cover and farming systems approaches but with due regard to the various data limitations caveats and other potential deficiencies identified in the report. At this stage the land cover approach is most relevant for this purpose, where the requirement is for a characterisation of the areas where most HNV farmland is concentrated.

Recommendations on future work

The essential first next step is to validate the outcomes from both the land cover and farming systems approaches on the ground. In addition to ensuring that both these approaches are reflecting reality on the ground, this validation process should also include an assessment of the likely sensitivity to change of the variables used within each approach.

There is a need for additional information/understanding of the characteristics of many likely-HNV systems, especially in CEEC, and particularly with regard to knowing whether or not they will be identified by any of the approaches used in the report. Further work is therefore needed in the form of sample studies to get more detailed information on the HNV farming systems including detailed information on management practices important in relation to the HNV issue and appropriate thresholds for grazing densities, inputs etc. Gathering data on the characteristics of HNV farmland in new Member States should be given high priority, since these farming systems are likely to be subject to powerful policy drivers after accession to the EU by many of these countries in 2004. Other Central and Eastern European countries are also a priority. Case studies to determine appropriate methods of identifying HNV farmland (through the current methodology, therefore requiring some work on appropriate thresholds and data sources, and exploring alternative methodologies that may be more appropriate to the region) should be undertaken. Further work should also be done with national experts to ensure appropriate selections of CORINE habitats and investigate how the results from the various approaches relate to their perception of the situation on the ground.

In relation to the land cover approach advantage should be taken of the more consistent data of the new version of CORINE currently being processed. Additionally, (national) spatial data sources can be used to further improve the Corine LCC selections based on smaller mapping entities and/or aimed at identifying semi-natural vegetation types, mosaic farmland and landscape features. These additional spatial data sources could be inventories of non-improved grasslands, and/or national land cover maps which can be considered of better quality for indicating where the HNV farming areas are than CORINE.

In relation to the farming systems approach four tasks needs attention in the future. Firstly, we recommend that the possibility for using the farming system approach to monitor changes over time is explored for example by analysing trends in the development in HNV farming systems in the last fifteen years. Secondly, we recommend that both the pros and cons of a unified typology and further regionalisation are explored further. There is for example a need for more detailed considerations as to whether or not there are any consistent stocking density levels of HNV which are ’common’ across all/parts of Europe - especially with regard to underlying ’state/condition’ of the HNV farmland. Thirdly, the possibilities for enhancing the strategy and content of the FADN sampling in relation to agri-environmental issues in general and more specifically to HNV farming issues should be explored. This also includes consideration on the problems caused by the large size of the sampling regions and the fact that the number of sample farms within these in FADN is too small or do not target HNV relevant farming systems. Finally, the new FADN data from the accession countries should be analysed as soon as they become available.

Case studies of means of enriching or validating the FADN approach for example using IACS data also would be valuable. Also, neglecting the statistical significance, LUCAS data may provide some ancillary information that may give insight into issues such as the diversity of different land cover types, the crop diversity, or the presence of linear landscape elements (hedges, grass margins etc.).

In relation to the species approach there is a need to develop this further, for example in relation to the habitat/species data interlinkages, the possibilities of using non-bird species, the potential for more localised mapping etc. A concentration on species of conservation concern is particularly needed to identify Type 3 farmland.

In relation to combining the different approaches at EU level, further work is needed to combine the information on HNV farming systems to specific land cover classes. It is obvious that HNV Cropping systems do not link to natural grassland and that the HNV rough grassland systems do not link to the mosaic type land cover classes. If these links could be quantified satisfactorily, information on the HNV farming systems could be added as attributes to the land cover based map of HNV farmland. This might also be a feasible approach for presenting combined information at levels below the HARM1 regions, which is currently only possible for the CORINE based land cover information and the species information. This and other means of strengthening the complementarily of the approach need further research.

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