EUROPEAN EVALUATION HELPDESK FOR RURAL DEVELOPMENT

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WORKING DOCUMENT

PRACTICES TO IDENTIFY, MONITOR AND ASSESS HNV FARMING IN RDPS 2014-2020

CASE STUDIES

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WORKING DOCUMENT

Practices to identify, monitor and assess HNV farming in RDPs 2014-2020

Case studies

November 2016

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SUMMARY OF CASE STUDIES

The case studies in the following chapters have been presented and discussed during the Good Practice Workshop co-organised by the Evaluation Helpdesk and the Federal Agency for Nature Conservation (BfN), “Preparing the assessment of High Nature Value farming in Rural Development Programmes 2014-2020” on June 7-8, 2016 in Bonn, Germany.

The case studies are used as one of the information source in the Working Document Practices to identify, monitor and assess HNV farming in RDPs 2014-2020, where brief extracts are presented.

The descriptions of the single case studies have been drafted by various authors (Benzler, A. & Fuchs, D.; Tambet Kikas, Iiri Raa, Uxue Iragui Yoldi, Martin Brink, Jesper Bladt, Andrea Povellato, Davide Longhitano, Author Antonella Trisorio) who have contributed with their wealth of knowledge to this working document.

1 MAPPING HNV FARMLAND IN GERMANY 2009 TO 2015[1]

Frame conditions

Farmland covers about 50% of the total area of Germany. Agriculture therefore has a considerable influence on the biodiversity of the open landscape. Progressive agricultural intensification has led to a dramatic decrease of low-intensity farmland and agricultural biodiversity after the mid-20th century. Therefore, to survey state and trends of the remains of HNV farmland in Germany, the following frame conditions have to be considered:

- Recent high nature value (HNV) farmland occurs mainly as small patches of extensively used agricultural land within the intensively managed agricultural area. With some minor exceptions, e.g. alpine farms in Bavaria, there are no farming systems in Germany, which would support as such the occurrence of HNV farmland. So HNV farmland cannot be identified classifying farms as HNV farmland supporting or not supporting.
- Available data on landscape and habitat structure proved too disparate and incomplete for use in assessing the HNV farmland indicator for Germany, failing to cover some important habitat types (e.g. species rich arable land or traditionally used orchards) and partly being gathered too infrequently for regular updating of the indicator value.

Considering this, the Federal Ministry of Food and Agriculture (BMEL), the Federal Environment Ministry (BMUB) and the Federal States agreed to establish a new, targeted and cost-effective concept for HNV monitoring, which was developed by the Federal Agency for Nature Conservation (BfN) in cooperation with private consultancies. The following prerequisites had to be met:

- Statistical reliability should be ensured.
- The HNV farmland monitoring should provide adequate sensitivity regarding changes in farmland biodiversity.
- The temporal resolution should be sufficient; at minimum the reporting requirements of the CAP should be met.
- Not only the extent of HNV farmland should be monitored, but also its quality.
- Small areas of HNV farmland should be detectable.
- Costs should be reasonable compared to other existing monitoring programmes.
- Monitoring should be homogenous at the national level.

Taking these prerequisites into account, the Federal States and the Federal Government have established a joint monitoring scheme for the HNV farmland indicator. The Federal States commission experienced field ecologists to conduct the field work within the sample plots. The Federal Agency for Nature Conservation is responsible for data management, conducts a comprehensive quality management and extrapolates the data from the samples to calculate the indicator value on the national and the Federal States level.

Methods

The method is based on an already existing stratified random sample design, which was originally developed to implement an advanced biodiversity monitoring programme, and is recently used by the German Common Breeding Bird Survey. It consists of a base sample comprising 1,000 sample plots

[1] Authors Benzler, A. & Fuchs, D.

of 1 km² each. For more detailed results, an extended sample consisting of about 2,600 plots can be used. Monitoring started using the base sample within 11 Federal States and the extended sample within 2 Federal States Plots comprising 95% or more of forest or urban area were excluded in order to keep the costs for field mapping on a moderate level. Up to now, more Federal States have implemented the extended sample. To date, about 1,200 plots are mapped nationwide on a regular basis.

The first complete survey took place in 2009 (first baseline for the state of HNV farmland in Germany). Up to now, roughly ¼ of the total sample is re-surveyed every year, so that in 2013 a second complete survey was achieved (second baseline).

HNV farmland in Germany consists of species-rich grassland, extensively managed arable land, traditional orchards, vineyards and temporary set-aside. Landscape elements, which provide habitats for many species, also count as HNV elements. The following table shows area types and landscape elements, which, depending on their quality could be regarded as HNV farmland:

Area types of HNV farmland
Arable land
Set aside
Grassland, extensively farmed pasture and meadows
Agriculturally used habitat types according to Annex I of the Habitats Directive
Orchards
Vineyards
Landscape elements counting as HNV farmland
Tree rows, tree avenues, single trees
Hedges, scrub including fringe vegetation, and copses (up to 1 ha size) including fringe vegetation
Complex elements like field margins and banks with woody vegetation
Natural stone and other dry stone walls, and stone and rock, sand, clay and loess walls
Ruderal and herbaceous plots and fringes, including tall herbaceous perennials and tall grasses
Sedge and reedbeds, herbaceous waterbody fringes, wetland elements (e.g. reed beds) up to 1 ha size
Pools, ponds and weirs, eutrophied oxbows up to 1 ha size
Ditches, standing and flowing
Waterways and springs, streams including associated alder and ash woodlands up to 5 m breadth
Unsurfaced farm lanes/sunken lanes

To make changes in quality of HNV farmland visible, three quality levels of HNV farmland are assessed during field work.

Quality levels of grassland, arable, set aside, orchards and vineyards are assessed using plant character taxa. For arable land and vineyards, character species are defined on national level. Grassland character species are defined on regional level, resulting in seven different character species lists for Germany due to the fact, that species composition in grassland differs between the regions. In all potential HNV plots, character taxa are counted on a standaradized transect of 30 m length and 2 m width. Assignment is as follows:

4 to 5 character taxa:	moderately high nature value	HNV III
6 to 7 character taxa:	very high nature value	HNV II
8 character taxa and above:	extraordinarily high nature value	HNV I

Plots with less than 4-character species are regarded as having no high nature value.

Landscape elements are assigned to one of the quality levels using structural criteria specific to each type, which are laid down in the field manual.

Extrapolation

The sample design uses two criteria for stratification:

1. landcover aggregated in 6 landcover classes (arable, grassland, woodland, special crops, special habitats, settlements)
2. ecoregions; to identify the ecoregions, the parameters of potential natural vegetation (pnV), elevation above sea level, soil type, annual evaporation, annual precipitation, annual ambient temperature and global radiation from March to November were used in a GIS based clustering. A total of 21 maximally homogeneous ecoregions concerning abiotic conditions were obtained, into which the entire surface of Germany was divided.

The mapping results are extrapolated for every stratum using the “combined ratio estimator” according to Cochran (1977) and then summed up. The indicator value is reported as HNV farmland share of the total agricultural area. Extrapolation is effected both on national level and on Federal States level. Sample error and significance of trends between two measurements are calculated as well. All calculations are performed every second year on the basis of the gliding mean of the previous four years mapping data.

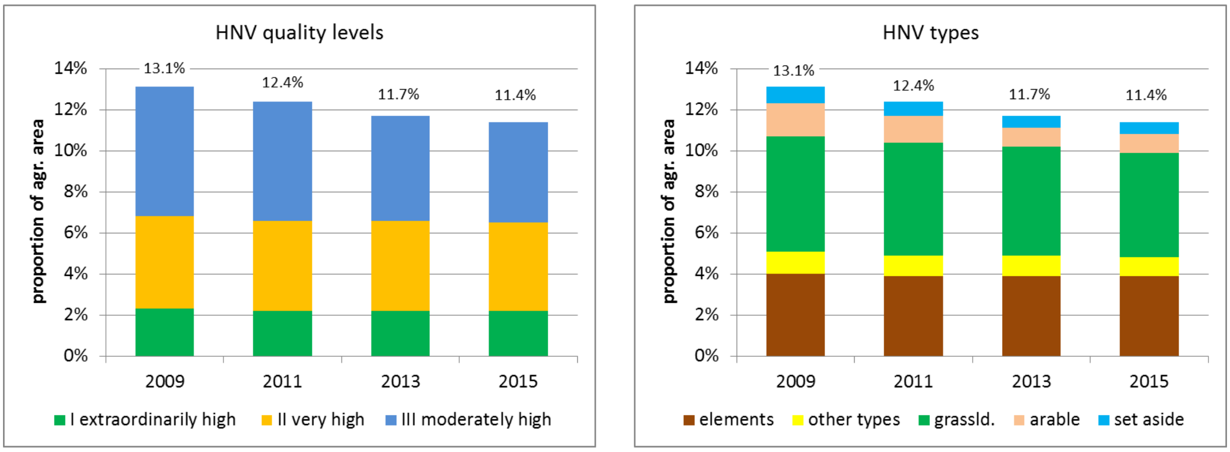
Quality management

Incoming data are subject to an exhaustive control procedure and quality evaluation, including checks for topological correctness, completeness, correct assessment of quality levels and completeness of the documentation. Additionally all mapping results are checked against the latest aerial photographs. Furthermore control mappings are conducted to assess the quality of the field mapping. Surveyor trainings are undertaken annually to care for harmonized field work and assessment on the national level.

Results

As of December 2015 data for the baseline survey of 2009, the subsequent complete survey of 2010 to 2013 and of the partial surveys in 2014 and 2015 are available. Some results are shown in Figure 1. Since 2009 the indicator value was constantly decreasing on national level with strongest decrease of the lowest quality level. Decrease is caused mainly by loss of HNV arable, grassland and set aside, whereas no noteworthy changes occur in the extent of HNV landscape elements.

Figure 1



a) Trend of HNV farmland proportion of total agricultural area since 2009 for the 3 quality levels, b) Trend of HNV farmland proportion of total agricultural area between 2009 and 2015 for different types © BfN 2016; state of data 2015, North Rhine-Westphalia 2013

Future prospects

The practised methodology turned out to deliver statistically sound results. The HNV indicator supplies solid data on status and development of biological diversity in the agricultural landscape in an economical manner on NUTS 0 and NUTS1 level. It contributes essentially to the evaluation of national and European agricultural policy measures as well. Moreover, with the implementation of the HNV farmland monitoring, a new, valuable data basis with a high potential for various advanced research approaches and queries on biological diversity within the agricultural landscape is available. Meanwhile the HNV farmland indicator is integrated within the National Strategy on Biological Diversity of the German government.

To date the HNV farmland monitoring is purely descriptive and has limited potential concerning an impact assessment. The most important methodological extension for the next years would be the inclusion of IACS data in order to better evaluate the impact of CAP funding on the HNV quality of the agricultural landscape.

Recommended literature

Benzler, A., Fuchs, D. & Hünig, C. (2015): Methodik und erste Ergebnisse des Monitorings der Landwirtschaftsflächen mit hohem Naturwert in Deutschland. Beleg für aktuelle Biodiversitätsverluste in der Agrarlandschaft. Natur und Landschaft 90 (7), 309-316. (*in German with English abstract*)

2 IDENTIFICATION OF HIGH NATURE VALUE FARMING IN ESTONIA[2]

According to HNV agriculture, semi-natural habitats have been taken as the basis for the Baseline Indicator in Estonia. The Common Context Indicator no 37 HNV farming is 4,8% of total utilized agricultural area and is declared as 45 000 ha. In total there is more than 77 000 ha of semi-natural habitats in Natura 2000 network, but all of this is not maintained and there is no exact information on its quality and it is not considered as UAA, though, some of it has been used for the purpose in agriculture. There are many additional important HNV areas outside the Natura 2000 network, including further seminatural habitats and mosaic landscapes with low intensity managed small fields and numerous valuable landscape elements, including species-rich stripes and line structures.

National working group to work on methodology of identification of HNV farmland in Estonia was established in 2009 in ARC (Agricultural Research Centre). The working group aim was to create common understanding and development of HNV concept suitable for Estonian conditions. The group included representatives from the Ministry of Rural Affairs, Ministry of the Environment, and their agencies, universities as well as experts of different areas of activity. Also, experts from outside the working group have contributed to the work according to the need. The main objective of identifying the HNV farmland areas is to preserve the nature values and areas of farmland by means of agricultural activities.

Process of defining the HNV areas for Estonia

According to the decision of the Estonian HNV working group a grid solution is used to identify Estonian HNV farming areas. After consulting with specialists of other countries having developed HNV agriculture solutions for their states (e.g. ES –Navarra, NL), it was decided to use a grid with cells of 1×1 km that has also been proposed by the European Environmental Agency. During the data analysis different features which are being used for identification of valuable farming (qualitative and quantitative values of characteristics/indicators related to farming intensity, nature values and landscape mosaics) were related with the grid cells.

Twenty appropriate indicators were selected on the basis of the literature, the requirement for consistent national data sets and statistical analysis. Each variable was divided into four appropriate classes to produce indicator values according to expert judgement. These were added together for each 1 km square to give a single score to develop an expert system to define HNV farming areas. Statistical analysis showed there are few moderate correlations between the individual indicators, showing that their selection was sound. The HNV scores for all 1 km squares with agricultural land in Estonia show a normal distribution.

Division of the indicator parameters into even classes is not correct because in some cases high values may indicate low biodiversity e.g. large numbers of livestock units per hectare of Utilizable Agricultural Land (UAA) in 1 km squares. By contrast, in the case of other parameters the opposite applies, e.g. a high percentage of semi-natural habitats in 1 km squares indicate high biodiversity.

Different ranges are required for each variable to produce indicator values that can be combined into a single score to identify HNV agricultural land. In order to finalise the HNV value matrix scores for weights and values within the range of 0-5 were given to each group of indicators and those weights were aggregated to develop the final HNV value for each grid cell.

Datasets used in the identification of High Nature Value agricultural land:

- Estonian Nature Information System (EELIS).

[2] Authors Tambet Kikas, Iiri Raa

- Estonian Topographic Database (ETAK).
- Livestock data from the register of farm animals (retrieved from Estonian Agricultural Registers and Information Board (ARIB) information system, who also acts as Paying Agency for RDP).
- Utilized Agricultural Area (UAA) and farm characteristics (retrieved from the ARIB register of agricultural support and land parcels (IACS and LPIS data)).
- Estonian Breeding Bird Atlas
- Data base on Semi-Natural Habitats (SNH).
- Estonian Digital Soil Map scale 1:10 000 with 109 soil taxonomic units (EDS).

Indicators from four groups i.e. land use management, nature conservation, landscape diversity and inherent natural quality, have been selected to find the HNV value of a grid cell. All chosen indicators have been divided between those four groups as follows:

Group 1 - Land use management:

- G1 - 1 Share of permanent grassland on agricultural land (%).
- G1 - 2 Share of short-term grassland on agricultural land (derived from IACS/LPIS data as % of UAA).
- G1 - 3 Density of livestock units (by species per hectare of UAA within a 2 km buffer zone)
- G1 - 4 Share of organic farming area on agricultural land (derived from IACS/LPIS data as % of UAA).
- G1 - 5 Peat soils on agricultural land (derived from EDS data as % of UAA).

Group 2 - Nature conservation indicators:

- G2 - 1 Semi-Natural Habitats on agricultural land (derived from EELIS for SNH land as % of UAA).
- G2 - 2 Managed Semi-Natural Habitats on agricultural land (derived from EELIS for managed SNH land as % of UAA).
- G2 - 3 Occurrence of farmland birds (6 species - whinchat, skylark, pewit, curlew, corn crake and grey partridge) in 1km squares (derived from Estonian Breeding Bird Atlas data).
- G2 - 4 Protected areas and Natura 2000 sites on farmland (derived from the aggregated layer of EELIS and IACS as % of UAA).
- G2 - 5 Presence of protected species (I, II and III protection category by Estonian Nature Protection Law, derived from EELIS).

Group 3 - Landscape diversity indicators:

- G3 - 1 Simpson Landscape Diversity Index (using buffered linear features derived from ETAK added to surface features on agricultural land to derive the Index).
- G3 - 2 Length of selected linear elements on agricultural land (derived from ETAK).
- G3 - 3 Number of selected point elements on agricultural land (derived from ETAK).
- G3 - 4 Number of agricultural field parcels (derived from LPIS by using centroids of the physical units).
- G3 - 5 Total edge lengths of agricultural field parcels (m/1 km square) (derived from LPIS by summing up the lengths of the field margins).

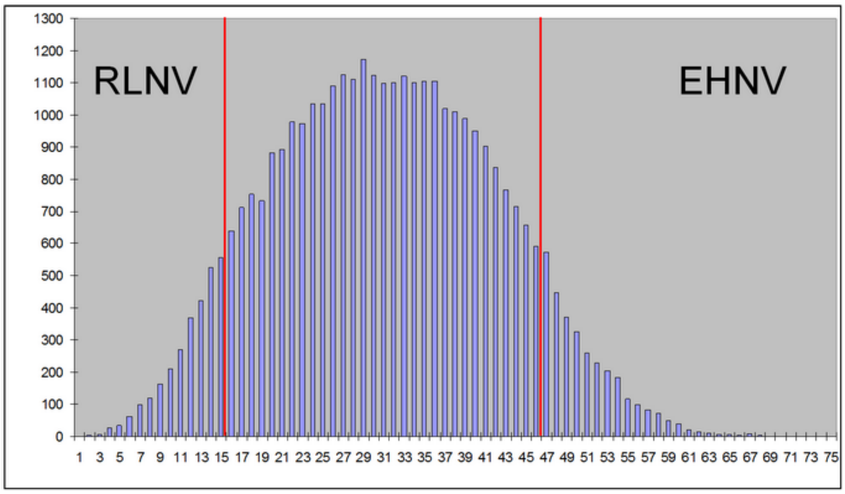
Group 4 - Natural quality indicators:

- G4 - 1 Length of altitude contours with intervals of 2,5m (derived from ETAK).
- G4 - 2 Number of spring fed fen soils on agricultural land.
- G4 - 3 Diversity of soils using the Simpson Index (calculated from the occurrence of different soil types on the EDS).
- G4 - 4 Length of natural rivers and streams (m) (derived from ETAK).
- G4 - 5 Weighted area of average soil quality on agricultural land (as % of UAA derived from EDS and IACS).

Results

According to the methodology all 20 HNV indicators were calculated across the country only for those grid cells that contained agricultural land. The highest HNV score reached was 75 points, the theoretical possible sum would be 100 points. The shape of the frequencies of the number of points in all 1 km squares corresponded to the normal distribution, as shown in Figure 2. and provides confirmation that a well-balanced set of indicators has been chosen. The top 10% are termed Exceptionally High HNV (EHNV), the central 40% Median HNV (MHNV) and the lowest 10% Relatively Low HNV (RLNV).

Figure 2. The frequency of scores of the total range of values for HNV in all the 1 km squares where agricultural land exists



Areas with higher scores are more concentrated in coastal areas and in the moraine landscapes of South-Eastern Estonia, whilst low scores characterize central plains of Estonia with good soils and therefore intensive agriculture. Correlation analysis shows that in general there are relatively few correlations between indicators which proves that besides the non-correlated group values, the selection of individual indicators was good as well and that as much variation as possible is included in the list, with minimal duplication.

HNV areas are relatively uniform in the proportions of permanent grasslands, semi-natural areas and presence of the six bird species associated with agriculture. Also, all five of the group III indicators (landscape diversity) are equally high. HNV also has almost 2.5 times higher proportion of natural streams than average agricultural land in Estonia and almost ten times more than low value squares. Almost the same applies in case of relative height differences – HNV has almost twice the elevation variation as the Estonian average and almost four times higher than low value squares that are usually in flat plains.

The distribution map (Figure 3) of Relatively High Nature Value and Exceptionally High Nature Value areas, are not only related to known patterns within Estonian landscapes, but also reflect gradients from high to low biodiversity in agricultural land.

Interpreting results based on HNV types

Type 1: Farmland with a high proportion of semi-natural vegetation.

Semi-natural habitats are present in almost 30% of EHNV squares (10 477 squares, in total approx 122 000 ha).

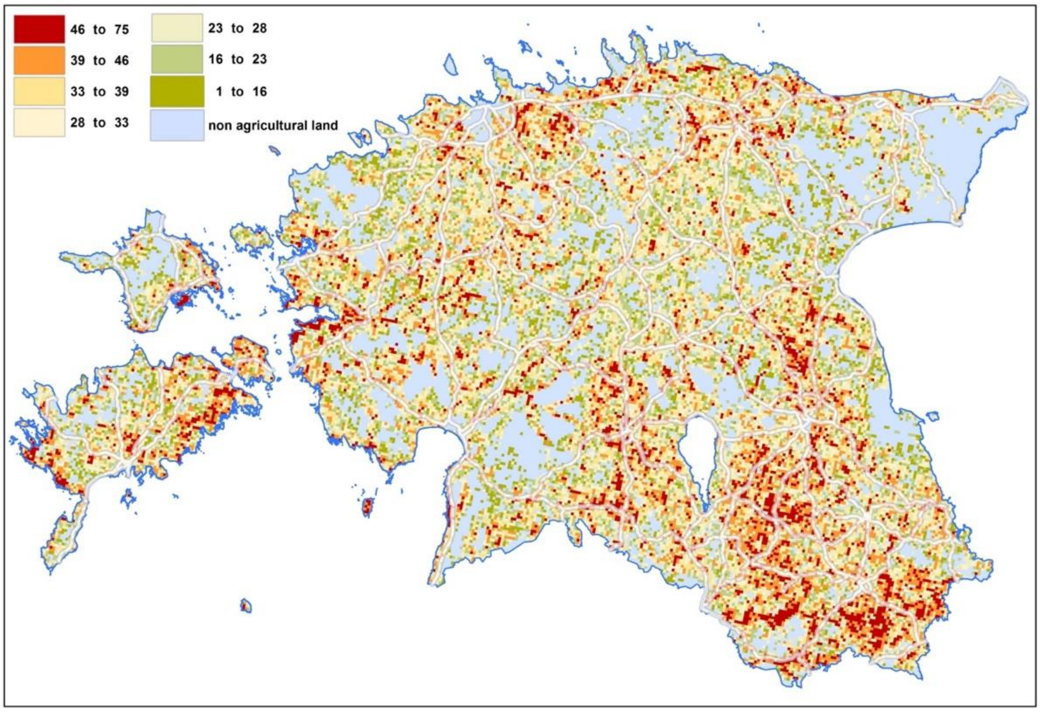
Type 2: Farmland dominated by low intensity agriculture or a mosaic of seminatural and cultivated land and small-scale features.

3,6% of total HNV squares (1271 squares, approx 66 717 ha). Consisting of 10% the most valuable part of group 1 and group 2 and managed semi-natural habitats. Cluster analyses indicated that in the squares with highest value characteristics describing low intensity and landscape heterogenity are in general rather high.

Type 3: Farmland supporting rare species or a high proportion of European or World populations.

11% of total HNV squares (3729 squares, approx ~ 114 344 ha) based on adding up first protection category and Group 2 highest results.

Figure 3 Distribution of calculated HNV values (Exceptionally High HNV (EHNV) ≥46 and Relatively Low HNV (RLNV) <16)



In conclusion. why is this HNV-tool important?

Based on real situation in HNV grid cells this provides possibilities to search deeper and define regional needs and adapt policy accordingly. Grid based approach enables to:

- bring out variations of HNV farmland and identify more valuable areas
- update and add new data operationally;
- use aggregated and analyzed grid cell information by different stakeholders;
- combine different data spacially (e.g. nature values & agricultural statistics);
- develop monitoring system

It is a workspace - the defined areas are not automatically support eligible, but provides the basis to work out measures if needed.

Proposal with methodology and calculations has been finalized and given over to Ministry of Rural Affairs in spring 2016.

3 APPROACH TO IMPLEMENTING THE HIGH NATURE VALUE INDICATOR IN NAVARRA (NORTHERN SPAIN)[3]

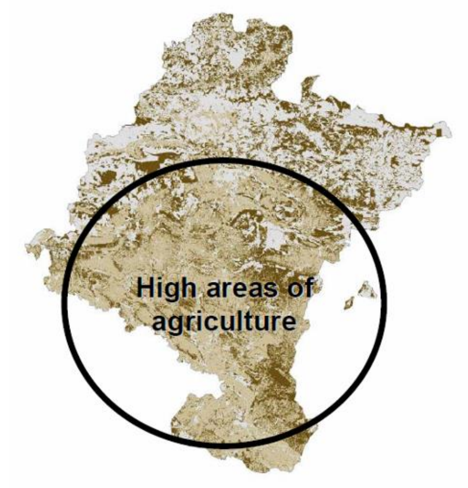
The Government of Navarra, together with GAN, has been working on the development of HNV farming indicators for monitoring the effects of Rural Development Programmes (RDPs) in this region of Northern Spain.

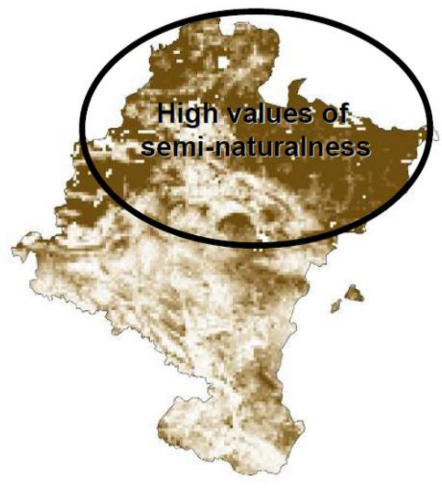
The aim of the initial work in 2010 was to identify, characterize and monitor High Nature Value (HNV) farming systems in Navarra, in order to set up a system of indicators that satisfies the requirements of the CMEF (Common Monitoring and Evaluation Framework applied to all RDPs in the EU), and that provides useful information on trends in farming to feed into policy.

In order to identify the areas of interest, a land use map that would satisfy the particularities of the HNV concept was created, defining 21 different types of land uses, mostly related to farming uses, in a 1:5000 scale. Different sources of information were intersected, the most relevant being the LPIS data base (1:5000), land use map (1:25000), and annual farmland data bases (where the farmers specify which crop they grow in which plots), which are updated annually.

The process of identification of HNV in Navarra was done following the definition given by the European Evaluation Network for Rural Development (2008), including the technically known as Type 1, Type 2 and Type 3 HNV areas. The first step was to select the categories of farmland that are broadly semi-natural in character (Type 1 HNV farmland), as these are the core of HNV farmland. They consist of a range of permanent pasture, grassland and meadow categories. The study was able to identify the extent and distribution of these semi-natural land-cover (Figure 4). The approximate extent of semi-natural farmland can be updated regularly using the available data sources, and the location of any significant changes can be identified on the map, to be investigated in more detail.

Figure 4 To the left, farmland in Navarra (in dark, semi-natural farmland, in light, non-semi-natural farmland), and to the right, % of semi-naturalness per 1km² cell (semi-natural farmland compared to the total agrarian land in the cell). Even though the South of Navarra has more farmland cover, the semi-naturalness is mostly found in the North.





[3] Author Uxue Iragui Yoldi

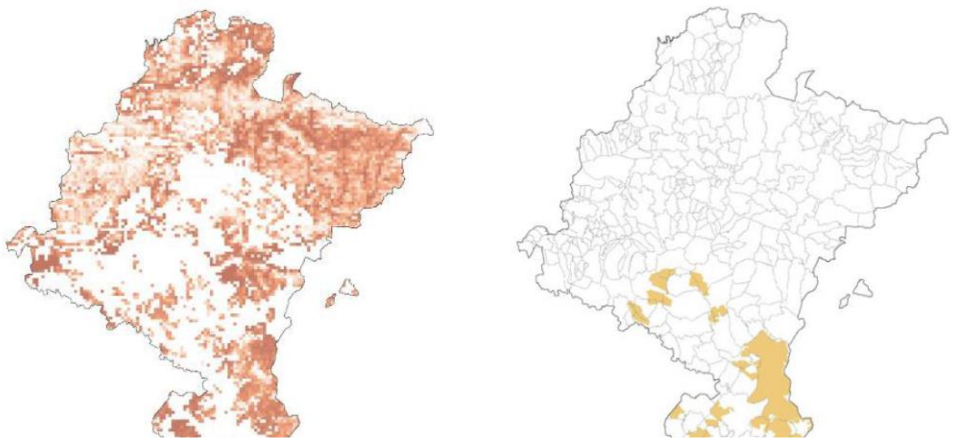
The second step was to identify landscapes with a high diversity of low-intensity land uses in mosaic patterns (Type 2 HNV farmland). The land uses considered as low-intensity were dry land permanent crops (olive groves, vineyards, almond trees...), arable fallows, and semi-natural land cover types.

Three parameters were calculated in each cell: the patch size (ha), density of borders (km/ha), and diversity of Simpson (no units). The values of each of the parameters were normalized and re-scaled from 0 to 50. The heterogeneity value was calculated by an intersection of the three parameters, giving each cell the lowest value from 0 to 50 obtained by any of the three parameters (Figure 5, map to the left). This means that a cell with a high value has good values in all three mosaic parameters (low average patch size, high density of patch borders, high diversity of land uses). The average cell value in Navarra was 26.62 in 2008. As with the map of semi-natural farmland, this data can be regularly updated to provide an indication of trends in mosaic landscapes at a regional and local level.

There are areas of considerable overlap with the map of semi-natural farmland (Figure 4), but there are also distinct areas of low-intensity mosaics that do not coincide with the predominantly semi-natural landscapes.

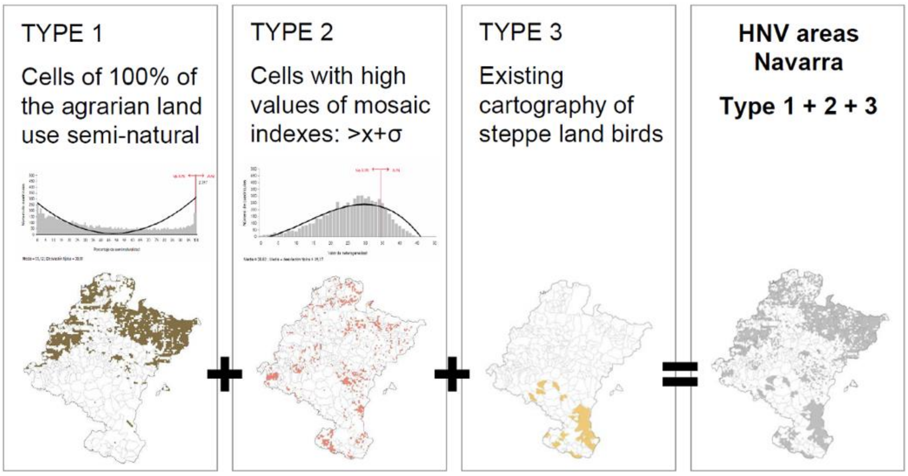
The next step was to identify areas of Type 3 HNV farmland. After consulting 11 experts in flora and fauna, it was stated that the two previous approaches (semi-natural land uses and low-intensity mosaics) did not capture certain agricultural areas known to be of importance for steppe land bird species of conservation concern. This type of HNV area was identified using existing cartography on bird distribution data (Figure 5, map to the right).

Figure 5 To the left, farmland heterogeneity levels in Navarra (darker cells have higher values), and to the right, areas with main steppe land bird populations.



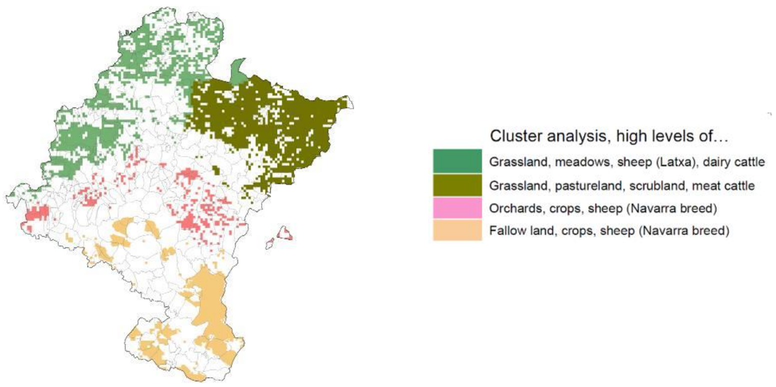
To show not only the farming value areas, but rather the HIGH farming value areas in Navarra (HNV), a combined map was produced between the Type 1, 2 and 3 distribution. The areas with the highest concentrations of the three types of HNV farmland were selected and combined (Figure 6). The intention was not to define or calculate the extent of exclusive "HNV farmland zones" (HNV farmland is clearly quite widespread outside these areas, as shown by Figure 4). Rather, the usefulness of identifying areas dominated by certain types of HNV farmland was that they provided a basis for characterizing the HNV farming systems using this land, and for designing indicators for monitoring these systems.

Figure 6 Selection of the most valuable AREAS in Navarra, combining the highest cell values of Type 1, Type 2 and Type 3 characteristics.



A cluster analysis was done using land use and grazing livestock data, in order to define the distribution of each farming system. As a result, four distinct HNV farming systems were identified at the regional level, as shown in Figure 7.

Figure 7 Distribution of the broad HNV farming SYSTEMA in Navarra.



From this analysis at the regional level, it was possible to devise a set of basic indicators of trends in HNV land cover patterns, such as semi-natural farmland and low-intensity mosaics. Additional indicators were selected to provide an indication at regional level of changes in farming systems. For example, the regional number of livestock of native breeds is one indicator, since the shift to more intensive, non-HNV livestock systems is generally accompanied by a change to non-native breeds. The idea was to produce a set of indicators that can be divided into three categories:

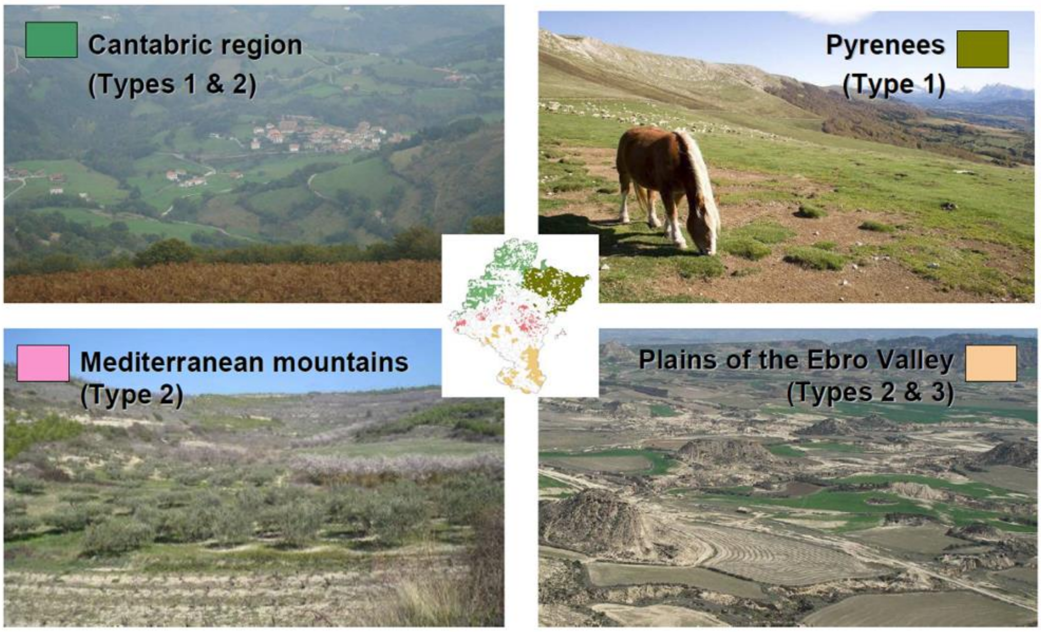
* **Land cover types** that are characteristic of the system and of its biodiversity value, and that may be most vulnerable to change. At a regional level the percentage of HNV land over the total territory in Navarra was of 31.98% in 2008. And at a farming system level, in the case of the Cantabrian mountain livestock system, 49.24% of the farmer's land was of HNV in 2010.

* **Farming practices** that are characteristic of the system and of its biodiversity value, and that may be most vulnerable to change. For example, in Navarra the proportion of native livestock breeds was of 54,97%, and in the case of the Pyrenean mountain livestock system, a relevant practice would be

the use of native sheep breeds that practice seasonal transhumance between mountains and lowlands.

*** Target wildlife species** that are characteristic of the system and of its biodiversity value, and that may be most vulnerable to change. For example, the populations of steppe land birds, particularly for the system of the Plains of the Ebro Valley, which was selected by the Type 3 HNVF land.

Figure 8 Representative images of the different farming systems found in Navarra.



Regional-level indicators were calculated for 2008. However, they have a limited scope to provide meaningful information on trends in HNV farming. The most useful indicators are those that tell us the trends affecting distinct HNV farming systems in particular, and their associated practices. Having identified four broad HNV farming systems, the next step to take forward is to investigate and understand the characteristics of these different farming systems, their biodiversity values, and the tendencies affecting them. This analysis will make it possible to devise a set of indicators that will provide meaningful data on trends in farming systems, and that can help to inform the evaluation of rural development policy.

In this sense, two additional studies have been carried out at a farming system level: in the Cantabric region (2012) and the Mediterranean mountains of Navarra (2016). Studies at a system level are crucial to understand the link between farming characteristics and biodiversity, and to see more in depth the profile of the farmers that are maintaining the HNV value in the area. It is also useful to design future management schemes. For example, currently a pilot project is taking place to maintain the HNV areas of the Mediterranean mountains of Navarra, using a Results Based Payment Scheme approach with 21 participating farmers.

Using data that is frequently updated for all the territory allows to repeat the process whenever needed. In Navarra, the data used is updated on a yearly basis for the whole territory, so the same methodology can be repeated every year if required or wanted. Currently a study is being done (2016) where the identification of the HNV areas is being calculated again, using the same methodology as applied in 2010. This study will show the situation found in the field in 2013, and will illustrate the changes that occurred between the initial and current studies (data of 2008 and 2013). Breaking down the information in the different types of HNV farmland (1, 2 and 3) in the different farming systems, and knowing the spatial distribution in the territory, is very interesting to give a general idea of the evolution that the farming areas have going through in the past years. The results will be ready at the end of 2016.

Further information

Further information about the different studies done in Navarra related to HNV farming, that have been mentioned in the text, can be found in:

- **European Forum on Nature Conservation and Pastoralism:** http://www.efncp.org/projects/projects-spain-navarra/navarra/
- **Government of Navarra (in Spanish):** http://www.navarra.es/NR/rdonlyres/8F2D0367-55B2-4D41-BA20-9FC03245AA19/187446/SAVNNavarra.pdf and http://www.navarra.es/NR/rdonlyres/8F2D0367-55B2-4D41-BA20-9FC03245AA19/251315/Sistemaganaderodealtovalornaturalenlazonacantabric.pdf
- **Results Based Agri-environmental Payment Schemes (RBAPS) pilot project:** https://rbaps.eu/pilot-areas/navarra-spain/

4 HNV (HIGH NATURE VALUE) IN DENMARK[4]

The HNV map for Denmark was developed by Aarhus University and financed by the Ministry of Environment and Food of Denmark. The map is based on existing knowledge on biodiversity, and on that basis, it points out the most important high nature value areas in Denmark. The aim is to target means for biodiversity in the most cost effective way, especially rural development (RDP) support for grazing or cutting of seminatural areas outside Natura 2000.

14 parameters form the map

The HNV map consists of 14 parameters, each one of them chosen because they indicate a higher level of biodiversity related to a specific area. It is a criterion for selection that it is possible to assemble data for the whole country. For each parameter, it is possible to score either 0 or 1.

3 parameters are landscape based

Some landscapes uphold more biodiversity than others do. In any case intensively managed fields receive no score.

- * Coastal areas (a 1 km zone fringing the marine coastline)
- * Steep slopes (a slope of more than 15 degrees)
- * Low-lying areas (Danish wetlands based on a historic map)

3 habitat based parameters

Certain habitats – especially seminatural habitats such as dry grasslands, heathland or meadows uphold higher biodiversity than the average farmed landscape.

- * Protected seminatural habitats
- * Proximity to protected areas (the above mentioned + a 50 meter zone around them)

One parameter was selected to represent the higher nature value in a mosaic landscapes

* Proximity to small biotopes (a 50-meter zone around or adjacent to e.g. woodland, hedges, water course)

2 land use based parameters

These parameters where chosen because nature value is higher on areas with no traditional intensive farming practice.

- * Extensive farming (e.g. no farming, permanent grassland with low yield)
- * Organic farming (all organically grown fields)

6 species based parameters

The species based parameters are the best indicators of nature value. Monitoring of species is not complete for any groups of species in Denmark, but all accessible and reliable data is included.

Three parameters where included because of the presence of character plants which are a strong indicator for nature value on different seminatural areas. The responsible authorities report plant lists. Data is valid for 15 years.

- Plant sub-indicator 1, 2 og 3 (the best areas with many character plants and few non character plants score all three points)

Three parameters where selected, because of registered red listed and EU annex species on the locality. Red listed species in accordance with the national official red list, and EU annex species

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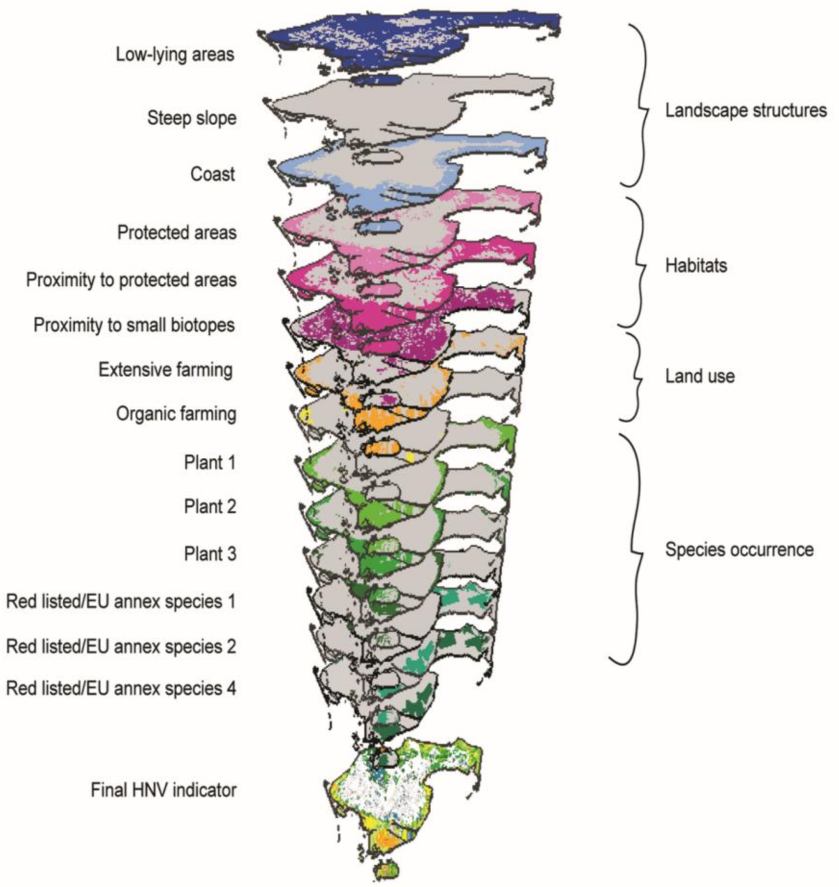
listed in the Habitats directive annex II or IV. Data is valid for 10 years, but 15 years for plants and mushrooms.

* Red listed and EU annex species 1, 2, og 3 (one point for one species registered, two for two species and three points for four species)

Data derive from several sources, among these voluntary reported data (citizen science data) from the web page www.fugleognatur.dk. For mobile species, such as birds and butterflies, distribution maps drawn up by experts is used to localize the habitat of these species.

Figure 9 Map content



RDP support for HNV areas?

Based on analysis made by Aarhus University the AgriFish Agency has chosen areas reaching at least 5 points as HNV areas (HNV score 5-13).

Nearly all of these HNV areas are at the same time protected by Danish legislation as seminatural areas with a ban on intensive farming practice, and at the same time score on one or more of the six species based parameters.

When applying for support for grazing or cutting in the Rural Development Programme (RDP) the areas with the highest HNV score obtain the highest priority. Only 0,1 ha of a field need to have a HNV score between 5 and 13 for the farmer to be able to apply for the whole field, and the field is prioritized according to the highest HNV score on the field.

Yearly update of the map

All 14 parameters are updated on a yearly basis. Only data that are official and have undergone a quality check in the respective data source is included in the map.

Where to find the HNV map

The map is available www.arealinfo.dk. The HNV theme is placed under “Naturdata”, and can be seen when you zoom into a specific area.

For application for support farmers have to enter the application system of the AgriFish Agency

www.naturerhverv.dk.

Direct link to more information on HNV (primarily in Danish): http://naturerhverv.dk/landbrug/natur-og-miljoe/hnv-kortet-high-nature-value/#c22691

5 ASSESSING HNV FARMS FROM FADN. LINKAGES BETWEEN HNV LEVEL OF FARMING INTENSITY AND FARM SUPPORT[5] (ITALY)

The identification of HNV farming systems (HNVfs) at farm level allows to show the links between nature values, agricultural practices and socio-economic characteristics where the farmer has seen as the main decision maker on (farm)land use and the key actor for adopting environmentally sensitive forms of farming also through the opportunity to obtain support under CAP policies. The socioeconomic factors assume an important role because: a) the farm is the crucial level at which decisions are taken on land use and management; and b) the economic viability is the first condition for farm being at work. Indeed, one of the main threats to HNV farmland, that is abandonment or intensification of farming, strictly derives from the vulnerable economy of the farming systems associated. Moreover, the level of economic viability might affect the farm responsiveness to policy measures or, conversely, the policy measures in order to be effective should be differentiated according to the economic viability of farms.

The variety of relationships among the different types of farming and land use creates a continuum of combinations that makes any classification quite difficult to assess. Andersen et al. (2003) used a categorical classification only based on few parameters (input cost; livestock; grassland; irrigation; set-aside) with clear-cut thresholds that do not allow to take into account all the different combinations showed by each farming systems. An alternative approach may be provided by the calculation of composite indicator that summarises the environmental characteristics of the farm and allows to rank through scores the level of nature value at farm level.

The use of composite indicators in order to analyse agricultural sustainability, or any other multi-dimensional concept such as HNV, is useful as a means of summarising the information provided by several specific indicators in an overall judgement or assessment of farm (environmental) performance. The construction of composite indicators starts with a) the selection of relevant indicator based on data availability and a solid theoretical framework on the informative characteristics of each single indicator; b) the normalization of indicators that transform base indicators into adimensional variables; c) the aggregation of indicators into one final index allowed by the normalization that makes indicators mathematically operational; d) the weighting of indicators if a different importance to each dimension/indicator has been assigned in the aggregation process, taking into account society's preferences if possible.

The case study area is represented by Veneto region (NUTS 2 level) located in North East of Italy. The territory is 56% low-lying, 15% hilly and 29% mountainous and the regional Utilised Agricultural Area (UAA) amounts to 811,440 hectares. There are around 120,000 regional farms, with approximately 75,000 employed units. Veneto is located within the Po Valley, one of the most intensive agricultural areas of Italy. The sample used for the analysis is based on the Farm Accountancy Data Network (FADN). Data on individual holdings are available for the period 2008 to 2013 which covers most of the years of the 2007-2013 RDP programming period. For each year a number of observations variable from 691 to 879 farms was collected and processed.

One of the advantages of using the FADN dataset is that it includes information on the intensity of farming that cannot be found in other EU wide datasets and, due to the common framework across the Member States and the yearly update, enables its use for monitoring purposes and comparative analysis at EU level. On the other hand there are also disadvantages due to the exclusion of economically small farms and “non-professional” farms that generally have an extremely reduced

[5] Authors Andrea Povellato, Davide Longhitano

significance in terms of farmland and income. Another data limitation concerns the lack of information on the extent of semi-natural features in the farms and, more generally, in terms of land cover.

In this case study nine measurable indicators are identified and calculated by FADN for each year (Table 1). The FADN dataset covers all the aspects related to farming intensity, although in some cases only with measurement in monetary terms (input costs), and also gives some information on farm biodiversity (number of crops, type of grassland). The only aspect not covered by this survey concerns the presence of semi-natural vegetation and unfarmed features that require extra-time for surveying without any advantaged from the point of view of economic situation of the farms. The use of some proxies (e.g. presence of unproductive land or small patches of forest areas) did not prove very effective to identify other variables useful to assess some of the topics of Type 1 or Type 2 criteria for the classification of HNV farming systems. For each indicator normalised scores are on a 0-to-1 scale.

Table 1 List of base indicators used in the analysis

Indicators	Weight	Mean	Stand. Dev.
Permanent grassland (% of UAA)	0,24	9,6	26,0
Livestock Units per forage area	0,13	1,5	25,7
Irrigated UAA (% of UAA)	0,10	35,0	42,4
Fertilizer expenses per hectar (euros)	0,07	409	1.462
Pesticide expenses per hectar (euros)	0,08	296	707
Feed expenses per hectar (euros)	0,10	433	4.410
Organic farm (dummy Y = 1, N=0)	0,08	0,02	0,1
Number of crops	0,14	2,4	1,3
Set aside (% of UAA)	0,06	2,0	9,1

Sources: our estimates from FADN

Three different classes of HNV score were created: i) No-HNV (HNV score <0.27); ii) Low-Medium HNV (HNV score between 0.27- 0.35); iii) Medium-High HNV (HNV score > 0.35). The definition of classes took into account the frequency and distribution of the median HNV score values of each year. In general the average value of HNV score shows a slight decrease in the period 2008-13 reaching around to 0.29 in 2008-10 and 0.28 per 2011-13. In terms of relative distribution of HNV farms (Table 2), there is a slight decrease of the number of farms from the first to the second period (from 44% in 2008-10 to 41% in 2011-13). In particular, this reduction pertains to farms with medium-high HNV scores. The same trend occurs to Utilised Agricultural Area potentially classified as HNV switches from 33% (2008-10) to 26% (2011-13) for the medium-high HNV farms, while it is stable in the medium-low score. Similarly decreases the Farm Net Value Added in HNV farms, while the percentages distribution of Annual Work Unit and subsidies remain constant.

Table 2 Distribution of HNV typologies (%)

	No-HNV	Low-Medium HNV	Medium-High HNV	Total
Average 2008-2010				
No. farms	56,1	21,5	22,4	100,0
Utilised Agricultural Area	42,6	24,1	33,3	100,0

Annual Work Units	59,7	17,0	23,3	100,0
Farm Net Value Added	60,6	18,0	21,4	100,0
Subsidies	50,7	23,8	25,5	100,0
Average 2011-2013				
No. farms	58,9	21,7	19,4	100,0
Utilised Agricultural Area	50,0	24,4	25,7	100,0
Annual Work Units	60,9	18,4	20,7	100,0
Farm Net Value Added	65,9	17,0	17,1	100,0
Subsidies	52,5	23,5	24,1	100,0

Sources: our estimates from FADN

The larger economic size and the possibility of allocating the production factors in a more effective way determine a remarkable difference in terms of labour productivity (Net Value Added per AWU), that is higher in non HNV farms than in the HNV ones. In particular the analysis shows the increase of the labour productivity for the no-HNV farms by +26% between 2008-10 and 2011-13, while the values on HNV farms, only increase respectively of +6% for low-score and +7% for medium-high score. As a consequence, the gap of labour productivity between HNV and non HNV farms increases from 10% to 23% in both periods (Figure 10). The differences described above can be explained by the hypothesis that more favourable soil-climatic conditions (generally in lowland farms) allow the farmer to choose among a larger number of productive combinations, thus favouring the specialised and intensive holdings.

This analysis confirms the essential contribution of the subsidies to the economic viability of the HNV farms. The subsidies per Annual Worker Unit are greater in HNV farms compared to non HNV farms, where the amount of subsidies reaches higher levels in terms of area units. More precisely, between the periods 2008-10 and 2011-13 the subsidies per AWU generally increase: +41% for the farm HNV at high-medium score; of +24% for low-medium score; +33% for no-HNV farms. Also the gap between no-HNV and HNV farms increases, from 27% to 35%. At least, comparing the net-of-subsidies labour productivity (net value added minus subsidies per AWU) the difference between the two periods for all HNV farm types comes out very clearly: the "net" labour productivity of the medium-high HNV score farms (coming from the market) is about two-thirds than the productivity of no-HNV farms in 2011-13 (Figure 11).

Figure 10 Net Value Added per Annual Working Unit (euros)

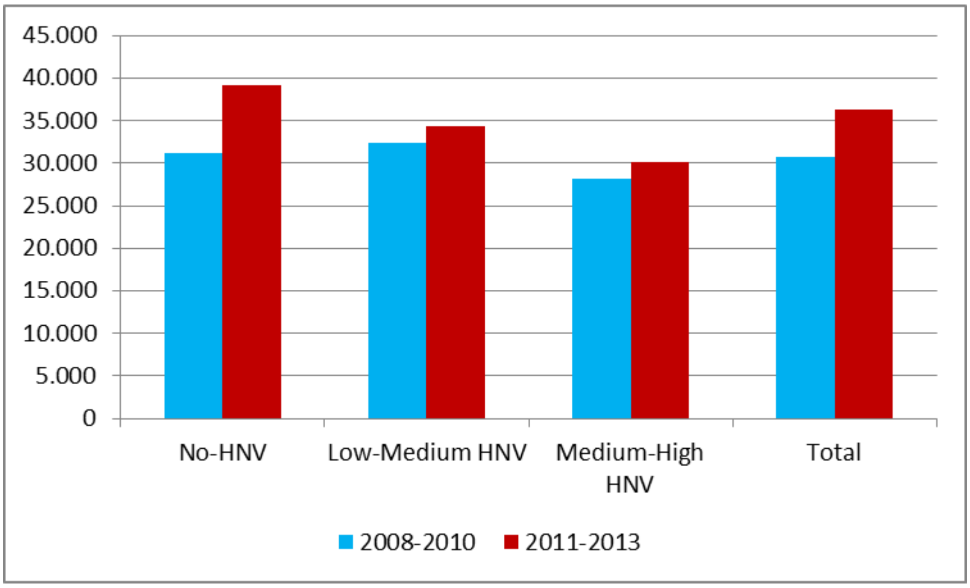
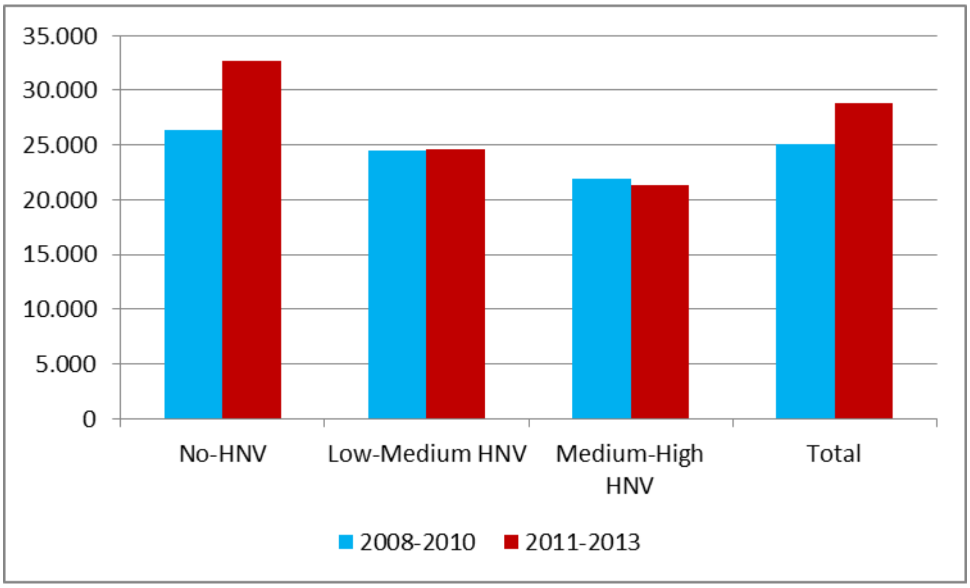


Figure 11 Net Value Added per Annual Working Unit without subsidies (euros)



6 HNV FARMLAND-CONTEXT INDICATOR 37. LAND COVER APPROACH[6] (ITALY)

Most of the work on HNV farming in Italy has been done in order to respond to the CMEF requirements, in the context of rural development Programmes (RDP) for the 2007-2013 programming period. Because of the lack of both a common understanding of HNV farming concept and a common method of identification at the beginning of programming period, estimates on HNV Farmland (HNVF) were realized by each regional Managing Authority in Italy on the basis of different approaches, methods and type of data. Most of them followed the land cover approach.

In order to provide a national framework, the National Institute of Agricultural Economics (INEA), within the activities of the Italian Rural Network, has provided estimates at national level based on a common method following the EC Guidance document (EENRD, 2009), pursuing, in particular, both the farming systems and land cover approach.

This work was also aimed at supporting the Managing Authorities in the identification of HNVF through the provision of both a common method and following estimates, and through the facilitation of the increasing of a common understanding of the HNVF concept. In addition, this work was aimed at providing the Ministry of Agriculture with a consistent estimate of HNVF at national level (with a regional detail) in order to overcome the problem arising from the aggregation of the different type of estimates provided by the RDPs.

The following note describes the work based on land cover approach.

Land cover approach. Materials and methods

The analysis was based on various sources of territorial data available on a national scale:

Data processing by the AGRIT 2010 database of the Ministry of Agriculture; such database was supplied to INEA for the purposes of this study, which shows the percentage of the UAA (Utilised Agricultural Area) and some land uses (Table 1) which are considered of interest for HNV farmland; the data refer to the 2725 cells of a grid made of square of size 10x10 km, which covers the entire Italian territory; estimates are derived from an integration of the results of two sampling phases. The first phase consisted of photo interpretation (on orthophotographs scaled 1:10.000) of sample points distributed across a 500 x 500 m square grid, whereas the second phase consisted of field surveys;

[6] Author Antonella Trisorio

Table 3 Land cover selected for analysis

Arable	Rice Alfalfa Temporary meadows Fallow land or land without crops in place
Woody crops	Grapevine Olive tree Nut tree
Permanent grassland	Permanent meadows Pastures
Family vegetable gardens and orchards annexed to farms	
Trees outside forests	

- Data processing of the CLC vector map, referred to 2000 (EEA2005), used at the highest hierarchical level, as a source of information on the linear development of the borders of natural and semi-natural environments (boundaries of the polygons assigned to Class 3: forests and semi-natural areas);
- The Natura 2000 database of the Ministry of Environment (ftp://ftp.dpn.minambiente.it/Cartografie/Natura2000), which reports for all sites - SCIs (Sites of Community Interest) and SPAs (Special Protected Areas) - the geographical coordinates of a centroid point of reference and the list of endangered plant and animal species; bird species, mammals, insects (including lepidopters) and plant species were taken into consideration that Paracchini et al. (2008) listed as Habitat Directive species associated with high nature value farming.

On these three themes, a geographic information system was created in order to superimpose the AGRIT cells to the CLC map and at the centroid points of Natura 2000 sites.

The assessment has been reported to the minimum unit for which data was available for all the three layers of information, namely the 10x10 km2 AGRIT cell, on the basis of the presence of low intensity farming and of three criteria derived from the above mentioned types identified by Andersen (2003):

1) A high proportion of semi-natural vegetation;
2) The presence of natural, semi-natural and structural elements of the landscape;
3) The presence of species of interest for the conservation of biodiversity at the European level.

The preliminary step for the analysis of the nature value for all three criteria was the selection of the AGRIT land cover classes supposed to be farmed at low intensity, shown in Table 1. During selection, only the areas currently under active management were considered, including fallow land. The two subclasses relating to permanent grassland (permanent pastures and meadows) were considered to be the most fitting to meet the first criteria, whereas other land uses in the Table were considered for the application of the second criteria. At the level of each cell, the presence of such land cover has allowed us to estimate a preliminary agricultural area of potential HNV. Before proceeding with an assessment, for each criterion a minimum threshold (equal to 2% of the area of each cell) was established for type of land cover linked to it, in order to exclude the analysis of those cases where the potential HNV farmland's size was too limited. The 2% threshold takes up the similar threshold set out by Tscharntke et al. (2005), according to which landscapes with less than 2 % of semi-natural habitat should be considered as 'cleared landscapes', since the basic absence of habitats which serve as sources of species limits the possibility of conserving biodiversity.

In order to distinguish different degrees of nature value, the cells interested by the presence of the types of land cover of nature value were assigned scores on the basis of the following characteristics:

the percentage of permanent grassland (criterion 1), the density of two landscape structural elements (criterion 2): trees outside forests (in terms of percentage cover) and the borders of natural and semi-natural environments (in terms of linear density measured in m/ha), and, finally, the number of threatened species (as mentioned above) in the sites of the NATURA2000 network which fall within the cells (criterion 3). For each characteristic an increasing indicator was calculated linked to its frequency distribution in the different cells. All indicators have been standardized (such as the share between variance from the average and standard deviation), in order to make them comparable.

Using an approach similar to Pointereau's (2007), the units of analysis, i.e. in our case the cells, were assigned scores for each of the three criteria, combining (with a simple sum) the scores obtained for the relative indicators: in the case of criteria 1 and 3, the score corresponded to the score of the only indicator taken into consideration. These continuous scores were converted into increasing ordinal scores on the basis of several position indices (75th, 90th and 98th percentile) of their distribution in the different cells, thus giving the maximum value to the cells positioned within the higher percentiles (greater than 98th) as shown in Table 2.

Table 4 Method of assigning a score to the cells for various criteria

Percentile position of the cell	Score
<75th percentile	1
≥75th e <90th percentile	2
≥90th e <98th percentile	3
≥98th percentile	4

Finally, the results of these ranking were combined in a concise new ranking giving each cell the highest class among those assigned according to the individual criteria.

Comments

The summary map obtained, in which the cells containing potential HNV farmland are highlighted, is an overall representation of the biodiversity and seems to have captured the main peculiarities of rural Italy. Obviously, the final quality of the results depends on the quality of data used for analysis; in particular, it should be noted the that soil cover estimates available for the AGRIT cells and the grainy resolution of the CLC map used, the minimum mappable unit of which is by definition equal to 25 ha, are data taken from sample surveys. Even the solution of identifying the position of the points of the Natura 2000 sites and of including them in the AGRT cells only starting from the position of the sites' centroid points constitute s a considerable simplification. Despite these limitations, the results are encouraging and the approach used could constitute an important starting point for local or regional applications.

Step forwards

In order to improve estimates, overcoming main weaknesses of the method described above, the Italian Rural Network 2014-2020 is carrying out a refinement of the method based on new and improved data. In particular, AGRIT survey on land cover has been enriched by some parameters allowing a better distinction between intensive and extensive farming. For all land cover classes are detected: presence/absence and type of irrigation; for permanent crops classes: the presence of land cover, the tree density, the management condition (managed/abandoned), presence of terraces; for meadows and permanent pastures classes: the sign of grazing.

Moreover, the analysis will rely on spatialized and more detailed data on species and habitats on Natura2000 (based on the last national report on Natura 2000), on new ecological data on meadows and permanent grasslands, on farmland birds. Biodiversity data will be provided by the Ministry of environment thanks to a collaboration activated by the the NRN, farmland birds data will be provided by Birdlife Italy (LIPU).

In the second part of the 2016 will start a pilot project aimed at the integration of AGRIT data with territorial (LPIS) and agronomic data from National Information system (SIAN) allowing the linkage of land cover data to farm/RDPs data. The use of IACS data will allow progress towards the use of HNVF indicator as an Impact indicator.

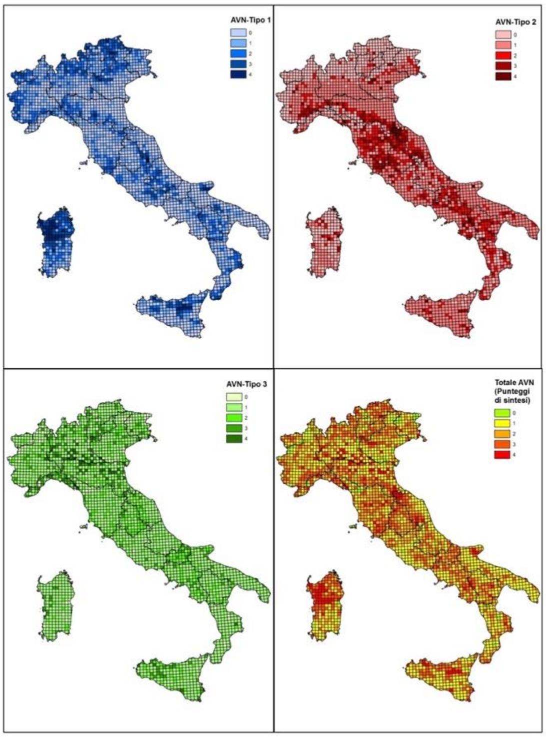
Moreover, AGRIT data will be spatialized on a smaller geographical scale in order to provide a more detailed analysis of Italian territory.

Final remarks

HNV farmland Indicator is a complex indicator, thus resource and time consuming. It requires different type of data, and the latter implies the involvement of many data providers introducing respectively many possible constraints to the work. The implementation and the update of the HNV indicators make it necessary to work on the governance of the whole system, and assure the provision of adequate resources.

Linkages between HNV farming systems/farms to HNV farmland is the challenge. This would enable at the same time targeting measures, monitoring HNVF trends and assessing impacts. To this aim key HNVF characteristics should be integrated into agricultural statistics (i.e. Agricultural census, Farm Structure Surveys, FADN) and LPIS-IACS databases. Moreover, the potential usefulness for the whole work on HNV farming of LPIS/IACS data is generally recognized, therefore they should be more easily available.

Figure 12 Distribution maps of HNV farmland in Italy, by classes of nature value according criterion (Type) 1, 2 and 3, and synthesis map derived by the combination of the three criteria (Types)



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