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How to evaluate the impact of agrienvironmental policies on biodiversity in rural areas. The case of High Nature Value Farming systems

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ABSTRACT

Amongst all environmental public goods provided by farming, biodiversity is probably the most difficult to describe due to its multidimensional character that encompasses agronomic, environmental, social, cultural and economic dimensions. In spite of the efforts to guarantee a reasonable level of analysis in the different countries, to date methodologies applied for the evaluation have had limited success in detecting impacts. There are many reasons from lack of monitoring data to difficulties of establishing robust causal linkages between the action/measure/programme and impacts on biodiversity.

An attempt to assess the impacts of RDP measures on farm-related public good, such as high nature value farmland, has been carried out in a case study area dealing with different data availability and approaches for comparison groups. The aim of the study is to show how different methodologies can be used with fine- and coarse-scale variables, to disentangle the influence of site-specific circumstances and other intervening factors. In the context of rural policy spatial and temporal dimensions are interlinked with social dynamics while biodiversity responds to agricultural practices at different spatial and temporal scales. It is a methodological challenge to create consistent linkages between micro level, usually represented by beneficiary farms, and macro level that gives a comprehensive assessment of the RDP impacts.

Keywords: Biodiversity, Agrienvironment Policy, High Nature Value Farmland [9] Capturing the environmental impact of agricultural activities

PAPER

1. Introduction

The High Nature Value concept (HNV) was introduced in the research fields and policy arena in the beginning of the 1990s, aiming to demonstrate the role of certain farming systems in maintaining the biodiversity of the European countryside. This concept is grounded on the assumption that low intensity agriculturalmanagement often corresponds to an overall biological and landscape diversity in farmland (Baldock at al. 1993; Beaufoyet al. 1994; Bignal and McCracken, 2000; Cooper et al. 2007). A significant proportion of the European HNV farmland is located in Southern Europe mainly because agriculture in the Mediterranean region did not undergo the same levels of specialization and intensification as in the rest of Europe. As a consequence, it partially maintains its traditional farming systems (Beaufoy et al. 1994; Paracchini et al. 2008), especially those dependent on livestock grazing (Cooper et al. 2007).

The inclusion of the HNV concept into European policy, in the more general context of the integration of environmental objectivesin sectoral policies such as the Common Agricultural Policy (CAP), dated at the beginning of the first programming period 2000-2006 of the rural development policy under regulation (EC) 1957/1999. Only more recently the issue of farm-related biodiversity has been integrated among the measures of the first pillar of the CAP mainly focused on direct payments aimed to support farm income, through the greening practices established by regulation (EU) 1307/2013. Unfortunately, it does not produce reliable effects on the evolution of biodiversity, still under pressure with continuing loss of habitats associated with agriculture support threatened and declining species (Henle et al. 2008; Polákováet al., 2011; Pe'er et al., 2014).Agricultural intensification and land abandonment are important global drivers of biodiversity loss and ecosystem degradation.Market pressures and distortedfarm support policiesare increasingly making the farms in HNV areas economically unviable with the result of increasing processes of intensificationand land abandonmentthat adversely impact the HNVfarmland (Henle et al. 2008; Kleijn et al. 2009). The impact of policies on the evolution HNV areas was monitored and evaluated since the implementation of 2007-2014 Rural Development Programmes (RDP). In particular the Common Monitoring and Evaluation Framework (CMEF) foresaw a specific HNV indicator, mainly based on studies conducted at European level by European Environment Agency (Andersen et al. 2003) and the Joint research Centre (Paracchini et al. 2008; EEA, 2012). These first estimates were not considered exhaustive of the monitoring work to be done for targeting policy instruments at national or regional level. More context-based work needed within each Member States to estimate its extent and location. Among a range of efforts to develop HNV indicators atthe EU and Member States level (Keenleyside et al. 2014), it can be summarised three different types of approach to identify HNV farmland (HNVf): a) land cover characteristics; b) farming characteristics and practices; c) habitats or species of conservation concern. To some extent the farming system approach, based on investigations on the use of inputs, livestock density and other specific practices by farmers, presents more relationships with the implementation of agricultural policies where the beneficiaries are already directly monitored through surveys.

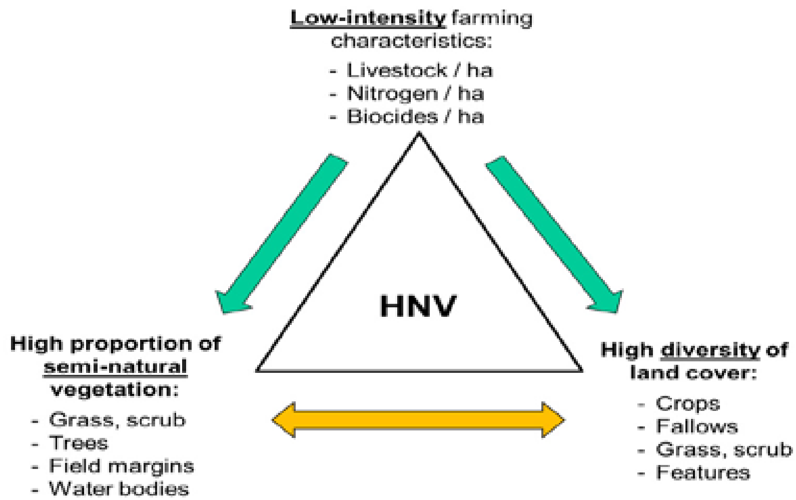
The identification of HNV farming systems (HNVfs) at farm level allows to show the links between nature values, agricultural practices and socio-economic characteristics where the farmer has seen as the main decision maker on (farm)land use and the key actor for adopting environmentally sensitive forms of farming also through the opportunity to obtain support under CAP policies. There were only few attempts to use farm level data to categorise HNVfs(Andersen et al. 2003; Pointereau et al. 2007) and even less to analyse the interrelationships among conservation efforts, production systems and policy implementation (Trisorio et al. 2008). In this paper, we discuss difficulties related to the development of HNV farming systems indicators, provide a short overview over current indicators, describe a specific approach to elaborate HNVfs indicators that are currently developed and give a short overview over the effects of policy instruments relevant to supporting HNV farming.

2. The concept of HNV farming systems

The European Environment Agency proposes three categories of HNVfarmland: 1) farmland with a high proportion of semi-natural vegetation; 2) farmland dominated by low-intensity agriculture or amosaic of semi-natural and cultivated land and small-scale features; and 3) farmland supporting rare species or a high proportionof European or world populations of conservation concern (Andersen et al. 2003). Although the third HNV farmland category may include intensively managed farming systemsthe vast majority of habitats for rare or significant species rely onextensive farming practices. On the contrary extensively or organically managed areas do not necessarily hold rare or endangered species but they have been recognized as potential HNV farmland areas.

Generally, the indicators able to assess the extent and location of HNV farmland are composed by sub-indicators considering all the three types of categories (Paracchini et. al. 2009). However,the physical extension of HNV farmland is mainly linked to both agricultural practices and farming systemsthat are essential for its maintenance. Some of the most critical nature conservation issues in Europe relate to changes to traditional farming practices on these habitats (Bignal and McCracken, 2000). To a certain extent the objective to produce maps of HNV farmland, excluding or including farms for the purpose of HNV support payments, is less important than using farm level indicators, adapted to local contexts, to assess the characteristics of HNV farming systems to increase the environmental effectiveness of the policy measures (Beaufoy and Cooper 2009; Poux and Pointereau2014; Keenleyside et al. 2014). According to the main studies on HNV (Andersen et al. 2003; Cooper et al. 2007) the key core characteristics of HNV farming systemsaround which a set of impact indicators can be set are: a) low intensity use of inputs and other technical means (fertiliser and pesticides, livestock, machinery); b) presence of semi-natural vegetation, such as unimproved grazing land and traditional hay meadows; and c) diversity of land cover with a mosaic of land cover and land use including unfarmed features (Figure 1).Generally farming systems,whose nature value results primarily from a high proportion of semi-natural vegetation or the presence of a diversity of land cover combined with semi-natural elements,are related to low input systems, corresponding to Type 1 and Type 2 of the HNV farmland categories. The difference between these farming and land use types is not perfectly dichotomous and many HNV farmland areas are a mix of different combinations at farm level.

Figure 1 - The Three Key Characteristics of HNV farming



Source: Cooper et al. 2007.

The way chosen at farm level to combine productive factors and land uses determines a continuum along which different varieties of interactions between farming systems and biodiversity can be found. Within this framework at farm level, the socioeconomic factors assume an important role because: This continuum can representsa sequence of changes over time towards both agricultural intensification orland abandoned, depending on local conditions,with loss of biodiversity value at parcel or landscape scale due to different levels of habitat fragmentation (Polákováet al. 2011; Keenleyside et al. 2014). 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 (Trisorio et al. 2008). 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 assessment of the socioeconomic characteristics of farms in connection to their environmental performance provides useful insights to policy design, allowing to better target instruments or to differentiate farming policies (O'Rourke and Kramm 2012; Keenleyside et al. 2014). Policy responses, indeed, are aimed at affecting farm behaviour that is mainly driven by economic and social factors. Therefore, also environmental performance of farms can be modified through economic measures.

Taking into consideration the above mentioned key characteristics of the conservation value of production systems and the nature of the land use decision making, HNV farming systems and the resulting farmland can be considered as socio-ecological systems, where human activities such as farming practices or crop and livestock breed selection have been influenced by local and regional socioeconomic, cultural and environmental conditions, and at the same time, ecosystems have been shaped by agricultural activities (Strohbachet al. 2015). HNV farming systems have in common that they are often, though not exclusively, based on traditional and extensive farming practices (Bignal and McCracken, 2000).

The variety of relationships among the different types of farming and land use creates a continuum of combinations that makesany 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 rankthrough 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 development of transparent composite indicators allows to identify which aspects of agricultural sustainability (HNV) are relevant in practice, considering the high variety of combinations of farming practices and land uses.Several studies applied different techniques to build sustainability indices, although the main guidance remained almost the same (Bockstaller et al. 2008; Gómez-Limón and Sanchez-Fernandez 2010; Purvis et al. 2009; Reig-Martínez 2011; Westbury et al. 2011). 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 intoadimensional 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 use of indices should be done with carefulness in all cases considering their pros and cons (OECD, EU and JRC 2008).

3. Materials and methods

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 hectaresaccording to the 2010 agricultural census data. 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), established in all the EU member States since 1965. 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 may in fact represent an interesting share of potentially HNV farms and in some areas they represent an important social pattern characterized by the presence of semi-natural elements (hedgerows, stonewalls, trees, etc.). However they generally have an extremely reduced significance in terms of farmland and income. Moreover, a considerable part of theirfarmed areas is run by contractor services or by other neighbouring farms and they may not show any particular difference from the large-size intensive farms.

The multi-criteria approach aims to assess a naturalness score which determine the level of HNVfor each farm. The method is based on different farming dimensions: management, cropping and livestock; and two relevant domains of definition HNV, namely: land use and farm biodiversity. In this case study nine measurable indicators are identified and calculated by FADN for each year. This allowed to define a score for each farm between 0 and 1 (0 min, 1 max), depending on the level of impact on biodiversity coming from the different farming practices taken into consideration in each farm. The values obtained were inferred to the regional population through a weighing operation of the sample FADN. The list of the base indicators with the weight associated and theiraverage values (with specific metric) with standard deviations are presented in Table 1.

After the identification of indicators, the normalization of indicator scales allowed to sum up different indicators. Indicator values were converted into scores according to the relationships between indicators values and level of sustainability. Relationships can be linear, non linear, and scaling can be categorical or binary. For each indicator scores are on a 0-to-1 scale. Before to aggregate the normalised indicators, a weight was assigned to each base indicators (table 1). The high variability of the parameters depends on the wide spectrum of typologies included in the FADN sample, representative of all the different type of farming and economic dimension of the regional farms.

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

The FADN dataset covers all the aspects related to farming intensity, although in some cases only with measurementin 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.

4. Results and discussion

In general the average value of HNV-score remains more or less constant for all comparative periods, reaching around to 0.29 in 2008-10 and 0.28 per 2011-13. For the socio-economic analysis we create three different classes of HNV-score: i) No-HNV (HNV score ↓0.27); ii) Low-Medium HNV (HNV-score of 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 order to imply the naive approach before-and-after the average score values for the period 2008-2010 vs. 2011-2013were considered.

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. The most of UAA relates the permanent grassland in medium-high HNV farms, while arable crops are dominant for score low-medium farms, following the permanent crops. These dynamics are reasonable considering the farm reduction during the reporting period due to the economic situation. In fact, if in 2008-10 the economic situation has lowered the input costs, and it has increased the permanent grassland systems and extensive systems, in the latter period the worsening of the economic crisis has pushed out of the agricultural sector the marginal farms less intensive and uncompetitive. Similarly, the percentage of livestock farms is greater for holding with medium-high HNV score and in average fewer than 31 Livestock units (LU). Considering the LU on forage area, the ratio for HNV farms is very low compared to no-HNV farms (Table 3).

Table 2 - Percentage distribution of main economic indicators

	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

As for other features farms, there are not significant differences as to the farmers' age (values around 60 years for all classes considered). Taking into consideration a parameter measuring the percentage share of family annual worker units below 40 years old on the total worker units, any difference emerges. In fact, there is a tendency of youngFWU in the case of medium-high HNV score. However, the differences are very small and considered the socio-demographic factors - synthesised by the age proxies - do not seem to have such an effect on the farmers' choices as to generate differences between HNV scores of farms, probably due to the influence of other factors not currently taken into account. The size of HNV holdings is larger than non-HNV ones only in terms of farming area for both periods (17 ha vs. 11 ha), whereas the economic size as well as the number of worker units are basically larger in non-HNV farms (Table 3).

Table 3 - Structural profile of HNV and non-HNV farms

	No-HNV	Low-Medium HNV	Medium-High HNV	Total
		Average 2008-2010		
No. farms (sample)	481,7	150,3	171,0	803,0
Utilised Agricultural Area (UAA)	10,1	14,9	19,7	13,3
UAA distribution (%)				
- Arable crops	70,9	81,4	33,5	60,6
- Permanent crops	19,6	8,4	6,2	12,4
- Permanent grassland	0,7	1,5	45,1	15,8
Livestock farms (in % of total farms)	14,3	14,1	37,3	19,5
Livestock units (LU)	85,0	54,2	31,9	53,2
Livestock units / Forage area	12,2	5,9	1,6	3,7
		Average 2011-2013		
No. farms (sample)	434,0	128,0	140,0	702,0
Utilised Agricultural Area (UAA)	11,2	15,5	17,9	13,2
UAA distribution (%)				
- Arable crops	72,4	76,4	34,4	63,6
- Permanent crops	17,5	12,1	9,3	14,1
- Permanent grassland	0,5	1,9	41,1	11,2
Livestock farms (in % of total farms)	13,1	12,8	42,5	18,8
Livestock units (LU)	85,8	39,9	30,9	53,2
Livestock units / Forage area	10,2	3,0	1,4	3,6

Considering the comparison between the two periods, there has been a trend decline in the farm net value added for all classes of HNV farms, although more impressive for the high HNV score. The choice of adopting low intensive farming practices seems to depend mostly on soil-climatic factors. Nevertheless, the lack of good opportunities for the economic development seems to limit the ability of holdings to produce an adequate income. In terms of the subsidies, in general it detects a more or less equal distribution for all the years considered. 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 increasing of the labour productivity for the no-HNV farms by +26% between 2008-10 and 2011-13,while increasing the values onHNV farms, only respectively of + 6% for low-score and + 7% for medium-high score. However the gap of labour productivity between HNV and non-HNV farms increases from 10% to 23% in both periods (Table 4). 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. The greater difference between HNV and no HNV farms, located generally in mountain areas, where structural and social factors very likely determine a higher difference, is less intuitive.

Table 4 - Economic profile of HNV and non-HNV farms

	No-HNV	Low-Medium HNV	Medium-High HNV	Total
		Average 2008-2010		
Farm Net Value Added (NVA, euro)	40.229	30.856	34.825	36.979
NVA / UAA (euro)	3.948	2.063	1.799	2.776
NVA / AWU (euro)	31.225	32.430	28.104	30.739
Farm Net Income (FNI, euro)	31.293	21.490	31.033	29.148
Subsidies (euro)	6.307	7.503	7.638	6.854
Subsidies / UAA	612	502	394	513
Subsidies / AWU	4.869	7.889	6.190	5.696
Subsidies / NVA (%)	15,4	24,3	21,9	18,4
Distribution of subsides (%):				
- Direct payments	94,7	93,3	81,3	90,8
- Agri-environment payments	0,2	0,0	2,4	0,7
- LFA payments	0,0	0,0	4,8	1,3
- Other RDP subsides	4,9	5,0	10,4	6,5
- Other subsides	0,2	1,6	1,1	0,7
		Average 2011-2013		
Farm Net Value Added (NVA, euro)	48.477	35.413	39.567	43.314
NVA / UAA (euro)	4.314	2.292	2.164	3.273
NVA / AWU (euro)	39.190	34.347	30.066	36.274
Farm Net Income (FNI, euro)	34.808	24.877	27.833	30.923
Subsidies (euro)	7.986	10.06 5	11.20 4	8.950
Subsidies / UAA	710	652	637	677
Subsidies / AWU	6.462	9.747	8.708	7.496
Subsidies / NVA (%)	16,5	28,6	30,2	20,7
Distribution of subsides (%):				
- Direct payments	85,9	82,5	68,7	80,8
- Agri-environment payments	2,6	2,9	9,8	4,5
- LFA payments	0,0	0,0	6,5	1,6
- Other RDP subsides	9,3	13,3	13,5	11,3
- Other subsides	2,2	1,3	1,5	1,8

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 in the periods

2008-10 and 2011-13 the subsidies per AWU generally increase: + 41% for the farm HNV at high score; of + 24% for medium-low 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 the 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 non-HNV farms in 2011-13, whereas many more share in the previous period (83%) (Table 4).

The FADN dataset allows the analysis of the RDP impact on HNV farming systems. In the assessment of the RDP effects, we considered Measures 211, 214 and other RDP subsides. The sub-measures are not considered because FADN does not allow this differentiation. In general between 2008-10 and 2011-13 the beneficiaries farms located in HNV areas arise. In terms of distribution of all subsidies, those related to the RDP doubled from about 8% to 17% of the total. In particular, the share of subsidies related to agrienvironment payments increases from 2% to 10% of the total for HNV-farms at high score, as well as the payments for Less Favoured Area (LFA) which increased from 5% to 6.5% for HNV farms at high score. In general the same growth trend occurs for no-HNV farms and low-score (Table 4). The source of the subsidies is slightly different between HNV (low-medium and medium-high score) and non-HNV farms: the latter rely more on direct payments, whereas HNV farms received a more significant part of the payments through the agrienvironment payments and the LFA allowance. The higher share of HNV farms in mountain and other marginal areas can explain this difference. The choice to adopt a less intensive farming system should be favoured by the AES payments. In particular these results show that public expenditures play an important role in HNV farms. In fact, this subsides represent on average 30% of the net value added for medium-low and medium-high HNV score farms, against 16% registered in non-HNV farms in the 2011-13 period (while in the previous period the share of subsides on value added was respectively of 23% and 15%).

3. Conclusions

The availability of a farm sample yearly updated such as FADN gives the chance to monitor over time the evolution of HNV farmland at micro level. Structural characteristics and information on crop and livestock management already present in the current database allow to create good indicators that can lead to the final composite indicator measuring the nature value of the farming system. The FADN sample has the same structure all over European countries, so a relatively good comparison is possible among Member States.The integration with other statistical surveys such as the Farm Structure Survey(FSS) and administrative dataset such as the Integrated Administration and Control System (IACS) potentially could increase the whole information system at farm level.

FADN data allow for the distinction in comparison groups (participant/non participant) where the HNV characteristics can be assessed. A score at farm level - based on the aggregation of appropriate indicators previously standardised and weighted - has been set in order to calculate the HNV degree of farmed areas treated or not treated by RDP or other CAP measures. The efficiency analysis of HNV farms vs non-HNV farms would provide useful insights into the role of subsidies supporting biodiversity friendly practices. At the same time without an adequate knowledge of the economic and social mechanisms which regulate the farmers´ behaviour it is not possible to understand the cause-effect relation between farming and the preservation of biodiversity. The investigation of farming systems is therefore essential to provide a complete picture in order to design appropriate measures for HNV farming systems conservation. Well targeted measures design to reward for positive externalities generated by farming activities can motivate farmers to modify their behaviour.

The FADN sample is more suitable than the one created by the Farm Structure Survey, since the survey of economic and financial aspects allows a more appropriate description of farm-holders´ behaviour. In order to exploit to the best the economic and financial information contained in FADN it is necessary to integrate data gathering with information about farming practices, agricultural land use and the management of the unfarmed features within the holdings. A major data limitation, observed in the case study and cited in other references of this paper, concerns the lack of information on the extent of semi-natural features in the farms and more generally in terms of land cover. Semi-natural vegetation plays a major role in the provision of green infrastructures that increase significantly the biodiversity values of a farmland area. Until now other indicators have proved not to be sufficiently informed to create good proxy indicators. On the other hand the increasing availability of data concerning large and small patches of perennial vegetation detected in fine-resolution satellite images should increase the reliability of land cover in agro-ecosystems at reasonable monitoring costs (García-Feced et al. 2015).

An important challenge for the future regards georeferencing FADN data which might permit an upscaling to regional level. The complexity of the georeferencing process – in spite of the progresses achieved in recent years in terms of information technologies – further widens the difficulties related to the availability of resources for this kind of surveys. It is necessary a better statistical representativeness for more robust extrapolation from the FADN sample to regional estimations. Of course this could increase the number of observations needed to have a sufficient statistical significance of the estimated parameters and, consequently, the cost of the analysis. An alternative option could come from a link between FADN and FSS samples and IACS databases that could guaranteed a more appropriated georeference for the farm samples. In this case special attention has to be given to data access that at the moment represent one of the major obstacles for a better use of already existing databases both from statistics institutes, monitoring agencies and administrative bodies.

References

Andersen E. (ed.) (2003) Developing a high nature value farming area indicator. Internal report, European Environment Agency, Copenhagen.

Baldock, D., Beaufoy, G., Bennett, G. and Clark, J. (1993)Nature Conservation and New Directions in the Common Agricultural Policy. Institute for European Environmental Policy (IEEP), London.

Beaufoy G., Baldock D.,Clark J. (1994) The Nature of Farming: Low Intensity Farming in Nine European Countries. London, UK: Institute for European Environmental Policy.

Beaufoy G, Cooper T (2009) The application of the High Nature Value impact indicator. Evaluation Expert Network for Rural Development, Brussels.

Bignal, E.M. and McCracken, D.I. (2000) The nature conservation value of European traditional farming systems. Environmental Reviews, 8, 149-171.

Bockstaller, C., Guichard, L., Makowski, D., Aveline, A., Girardin, P., Plantureux, S. (2008).Agri-Environmental indicators to assess cropping and farming systems.A review.Agronomy for Sustainable Development, 28: 139–149.

Cooper, T., Arblaster, K., Baldock, D., Farmer, M., Beaufoy, G., Jones, G., Poux, X.,McCracken, D., Bignal, E., Elbersen, B., Wascher, D., Angelstam, P., Roberge, J.-M.,Pointereau, P., Seffer, J., Galvanek, D. (2007) Final report for the study on HNVindicators for evaluation. Report for the European Commission, DG Agriculture,contract notice 2006-G4-04. Institute for European Environmental Policy (IEEP),London, pp. 190.

EEA (2012) Updated High Nature Value Farmland in Europe. An estimate of the distribution patterns on the basis of CORINE Land Cover 2006 and biodiversity data. European Environment Agency, Copenhagen.

García-Feced C, Weissteiner C, Baraldi A, Paracchini M, Maes J, Zulian G, Kempen M, Elbersen B, Pérez-Soba M (2015) Semi-natural vegetation in agricultural land: European map and links to ecosystem service supply. Agronomy for Sustainable Development 35(1): 273-283.

Gómez-Limón J.A., Sanchez-Fernandez G., (2010) Empirical evaluation of agricultural sustainability using composite indicators, Ecological Economics, Volume 69, Issue 5:1062-1075.

Henle, K., Alard, D., Clitherow, J., Cobb, P., Firbank, L., Kull, T., ...&Wascher, D. (2008). Identifying and managing the conflicts between agriculture and biodiversity conservation in Europe–A review. Agriculture, Ecosystems & Environment, 124(1), 60-71.

Keenleyside C, Beaufoy G, Tucker G, Jones G (2014) High Nature Value farming throughout EU-27 and its financial support under the CAP. Report Prepared for DG Environment, Contract No ENVB.1/ETU/2012/0035, Institute for European Environmental Policy, London

Kleijn, D., Kohler, F., Báldi, A., Batáry, P., Concepción, E. D., Clough, Y., ...&Kovács, A. (2009). On the relationship between farmland biodiversity and land-use intensity in Europe.Proceedings of the Royal Society of London B: Biological Sciences, 276(1658), 903-909

Longhitano D., Bodini A., Povellato A., Scardera A. (2012) Use of FADN for monitoring farm sustainability: strengths and weaknesses of current database. In: Vrolijk H. (ed.), Pacioli 19, The Role of FADN after the CAP Reform, LEI Memorandum 12-014, Wageningen.

Mortimer S, Park J, Mauchline A, Haysom K, Westbury D, Purvis G, Louwagie G, Northey G, Finn J, Knickel K, Kasperczyk N, Primdahl J, Vejre H, Vesterager J, Kristensen L, Teilman K, Podmaniczky L, Balázs K, Vlahos G, Christopoulos S, Kröger L, Aakkula J, Yli-Viikari A, Peltola J (2008) The Agri-Environmental Footprint Index: User's Manual, Available from: www.footprint.rdg.ac.uk/afimanual

OECD, EU and JRC (2008)Handbook on Constructing Composite Indicators: Methodology and User Guide, OECD Publishing, Paris.

O'Rourke, E., and Kramm, N. (2012).High nature value (HNV) farming and the management of upland diversity.A review.European Countryside, 4(2), 116-133.

Paracchini, M.L., Petersen, J., Hoogeveen, Y., Bamps, C., Burfield, I., van Swaay, C. (2008)High nature value farmland in Europe. JRC Scientific and Technical Reports.

Pe'er, G., Dicks, L. V., Visconti, P., Arlettaz, R., Báldi, A., Benton, T. G., ...& Henle, K. (2014) EU agricultural reform fails on biodiversity. Science, 344(6188), 1090-1092.

Pointereau P, Paracchini M, Terres J, Jiguet F, Bas Y, Biala K (2007) Identification of High Nature Value farmland in France through statistical information and farm practice surveys.JRC Scientific and Technical Reports.EUR, 22786.

Poláková, J, Tucker, G, Hart, K, Dwyer, J, Rayment, M (2011) Addressing biodiversity and habitat preservation through Measures applied under the Common Agricultural Policy. Report Prepared for DG Agriculture and Rural Development, Contract No. 30-CE-0388497/00-44. Institute for European Environmental Policy: London.

PouxX., Pointereau P. (2014) L'agriculture à "haute valeurnaturelle" en France métropolitaine. Un indicateur pour le suivi de la biodiversité et l'évaluation de la politique de développementrural.

Rapport d'étudeauMinistère de l'agriculture de l'agroalimentaire et dela forêt. AScA, SOLAGRO.

Purvis, G., Louwagie, G., Northey, G., Mortimer, S., Park, J., Mauchline, A., Finn, J., Primdahl, J., Vejre, H., Vesterager, J.P., Knickel, K., Kasperczyk, N., Balazs, K., Vlahos, G., Christopoulos, S., Peltola, J., (2009). Conceptual development of a harmonized method for tracking change and evaluating policy in the agri-environment: the Agri-Environmental Footprint Index. Environmental Science & Policy 12.

Strohbach, M. W., Kohler, M. L., Dauber, J., Klimek, S. (2015). High Nature Value farming: From indication to conservation. Ecological Indicators, 57, 557-563.

Trisorio A., Povellato A. and Bortolozzo D. (2008) High Nature Value Farming Systems in Italy: an Economic Perspective, in Proceedings of the International conference "Using Evaluation to Enhance the Rural Development Value of Agri-environmental Measures" Pärnu (Estonia), June 17-19, 2008.

Westbury, D.B., Park, J.R., Mauchline, A.L., Crane, R.T., Mortimer, S.R. (2011). Assessing the environmental performance of UK arable and livestock holdings using data from the Farm Accountancy Data Network (FADN), Journal of Environmental Management 92.