Agri-Environmental Footprint: Assessing the agri-environmental performance of farms in participatory and regionally adaptive ways

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Abstract: *Cultural landscapes are more and more perceived as an asset in the development of rural areas. Since the mid 1980's, agricultural policy reform has increasingly recognized the environmental dimension of farming. Farmers all over Europe are encouraged to farm in environmentally sensitive ways. The scope and aims of the various national schemes in support of environmentally friendly farming reflects a wide diversity of environmental priorities and national views on the relative importance of the various components of agri-environmental quality.*

The monitoring and assessment of changes in farming and in the interrelations between farming and landscape can help to reconcile different landscape-related interests, to reduce conflicts between different land uses and to strengthen the multifunctional role of landscapes. However, there is little consensus on how to successfully monitor and validate changes in farming and environmental impacts, and, related to that, the benefits of specific schemes. Overall, there is a clear need to develop more participatory and regionally adaptive methods for monitoring and evaluation. Such methods must be sufficiently generic to track overall European-wide performance, but customisable for the very wide variety of agronomic, environmental and cultural circumstances found across Europe.

In this contribution we discuss the possibility of a common methodological framework for monitoring and assessing changes in farming and in the interrelations between farming and landscape. The approach discussed in this paper can be described as a quantitative farm-level Agri-environmental Footprint Index (AFI) that aggregates the measurement of a range of farm and landscape-level indicators. The involvement of relevant stakeholder groups is critically important in the actual adaptation of the framework to the particular regional context (regionally-customising the index) and its actual application. The actors that are being involved in the regional index customisation comprise invited representatives of environmental NGOs, farmers' organisations, politicians and other researchers. The engagement of farmers' organisations in the process will forge stronger links between their perception of agri-environmental issues and awareness of their role as managers of the rural landscape. The contribution builds on the results of the EU funded AE-Footprint project which involves eight multidisciplinary research teams from seven European countries.

Keywords: *agriculture, environment, evaluation, environmental footprint, participatory*

Introduction

Cultural landscapes as an asset

The importance of agricultural land use for biodiversity has been recognized in many international documents, including for example the European Commission Biodiversity Strategy (European Commission, 1998), the *Pan-European Biological and Landscape Diversity Strategy* (Council of Europe, 1996), and the European Commission's Communication 'Directions towards sustainable agriculture' (European Commission, 1999). A large number of common species rely on agricultural land, at least for a part of their life cycle, as do many rare and threatened species. Without farming, the maintenance of high nature value areas and semi-natural pastoral habitats would hardly be possible or would be very costly. The high nature value of the countryside, in turn, provides an excellent basis for rural or green tourism which again has important longer-term multiplier effects in rural economies. The economic potential of the natural environment is manifested too in the state market for public environmental goods and the increasing importance of agri-environmental measures and payments for farmers (see for example Knickel, 2002; Knickel and Peter, 2005).

Since the mid 1980's, agricultural policy reform has increasingly recognized the environmental dimension of farming. The 1992 CAP reform included for the first time provisions for Member States to establish agri-environmental incentive schemes (AES; Reg. EEC No. 2078/92). Following Agenda 2000 reform, the Rural Development Regulation (Reg. EEC No. 1257/1999) now includes agri-environmental incentive measures. As a result, approximately 25% of agricultural land in the EU-15 is now managed under dedicated incentive schemes (EEA, 2006) with specified management packages describing farming obligations included in a contract (usually of 5 or 10 year duration) signed by individual farmers. Reflecting a wide diversity of AE priorities and national views on the relative importance of the various components of AE quality, there is considerable variation in the scope and aims of the various national schemes and farmer uptake is variable. AES with voluntary participation are intended to function as *'carrots'*, encouraging environmentally sensitive farming and environmental management practices in agriculture that go beyond the requirements of legislative controls that can be regarded as a means to enforce minimum environmental standards and prevent environmental degradation beyond agreed reference points (Bromley, 1997; Pearce, 2005).

Assessing changes in the interrelations between farming and landscape

The monitoring and assessment of changes in the interrelations between farming and landscape can help to reconcile different landscape-related interests. The term landscape as used in this paper represents an aggregate that comprises flora, fauna, habitats, soil and water, recreational and other *functions*. Monitoring and assessment can help to reduce conflicts between different land uses and to strengthen the *multifunctional* role of landscapes. As for AES, the evaluation of the environmental, agricultural and socio-economic impacts of their respective agri-environmental programmes is obligatory for member states. The evaluation process is intended to identify the extent to which policy objectives are being fulfilled, and to identify any changes necessary to bridge the gap between policy aims and outcomes. AES and evaluation can against this background be understood as supporting the shift from mono-production functions to societal multi-functions.

The challenge is to effectively monitor and assess changes in the interrelations between farming and landscape, or – related to a policy context – to validate the benefits of AES. The main weaknesses of existing approaches are:

- Previous evaluation systems have concentrated on administrative issues such as the levels of farmer participation and area of participating farmers and land, budgetary data, administrative structures, the extent of geographical targeting, obligations of participation and the levels of provision and support from extension services. This approach is most often chosen because of the relative ease of recording such information. However, participation in AES *per se* does not guarantee the actual delivery of environmental protection or improvement (Knickel and Schramek, 1998; Primdahl et al., 2003).
- The top-down approach towards evaluation embodied above all in the Common Monitoring and Evaluation Framework (CMEF) hinders evaluators to actually address the effectiveness of measures in more thorough locally targeted ways. The more and more detailed binding guidelines for monitoring and evaluation simply leave too little degrees of freedom. Moreover, since every officially stated objective needs to be evaluated according to the EU rules, there is a tendency to leave out objectives, which are difficult to evaluate (e.g. biodiversity related goals and measures).
- There is substantial dissatisfaction with the quality of evaluation reports. Very few evaluations had actually attempted to measure precise environmental outcomes (CEC, 2006). The key question in the assessment is whether schemes are indeed delivering the expected benefits for environment and nature protection, and how their effectiveness can be improved. Only the monitoring of actual performance and environmental outcomes can demonstrate the true worth of AES (Lee and Bradshaw, 1998). Ultimately, understanding why policy is working or not requires an understanding of a complex chain of relationships between policy design, implementation, farmer's decision-making, resultant practice, and consequent environmental outcomes. However, so far relatively few such approaches have actually been established.
- There are no agreed methodologies for 'tracking' the effects of ongoing change in landscapes and the agricultural and rural socio-economic conditions in European farming. The considerable variation in farming systems, practices, economic, physical and socio-cultural conditions

has to be taken into account. Kleijn and Sutherland (2003) found that in the majority of studies, the research design was inadequate to assess reliably the effectiveness of schemes.

- Environmental perspectives strongly influence the way in which stakeholders perceive and prioritise specific environmental issues/concerns, and their resulting perception of environmental outcomes. Environmental groups work with farmers to promote the ecological benefits of farming practices. Farmers' business decisions and responses in turn, are strongly influenced by social considerations that form a common background to understanding all these linkages (Knickel, 2000; King *et al*., 2004). Both aspects highlight the central role played by individual farmers as decision makers. The focus at farm level is important because incentive schemes strategically target the management actions of individual farmers.
- Agriculture and the potential of rural areas are no longer being evaluated in monofunctional terms. However, the integration of multifunctionality goals into assessment concepts and practice is a very recent question. A number of novel monitoring and management strategies based on recognition and reconciliation of apparent 'conflicts' have recently been proposed by Henle *et al*. (2008) and a more comprehensive methodology for assessing the wider impact of agriculture on the environment is proposed by Solagro (2000). Whilst these approaches are important, there is as yet no accepted common evaluation framework. The main challenge in assessing landscape changes and the environmental performance of farms is the inherent variation in landscapes, environmental conditions, agronomic practices and socio-economic circumstances.

Overall, there is a clear need to develop improved methods and a harmonised approach to changes in farming and in the interrelations between farming and landscape, and, against this background, the management of agri-environmental incentive schemes.

The AE-Footprint philosophy and conceptual framework

In this contribution we discuss the possibility of a common methodological framework for agri-environmental assessment that is capable of evaluating the performance of agri-environmental schemes against both generic, European-wide and locally-specific objectives. The approach has been developed in an EU funded research programme with eight multidisciplinary research teams from seven European countries.[1] The project has been completed in 2008 and at the moment several countries are planning national level real life applications building on the positive test results obtained in a series of case study applications (Greece, Hungary, and Germany).

Understanding assessment as part of a continuous learning process

A regular monitoring and assessment of changes in farming and of the evolution of the interrelations between farming and landscape can help to improve the management of natural resources. Related to that it is also the basis for a continuous improvement of the efficiency of policy interventions. Policy evaluation and, more specifically, an integrated assessment of policy impacts are increasingly understood as part of a learning process. Evaluation should thus ideally result in an interactive, process-oriented co-operation of practitioners, evaluator and administration. In this process the evaluator can be seen as a moderator even more than a controller. Ideally evaluation promotes a discussion among the concerned actors and a collective learning process. A data based assessment can deliver valuable insights that are fed into this process. In reality evaluation does not normally function like this. While the awareness among policy-makers of the utility of assessment and evaluation has increased in recent years, policy-makers and administrations still often see evaluation as an instrument of control. The challenge is to reinforce the use of monitoring, assessment and evaluation as a useful tool for future decisions that is used pro-actively. As for evaluation tools it follows that they must support the joint learning of different actors and stakeholders. In this alternative perception evaluation is no longer a mere measurement of results and control of success but – even more – a comprehensive process of attendance and valuation.

[1] This paper is based on the work of a multidisciplinary EU-funded AE-Footprint project to develop a common generic methodology for evaluating the effectiveness of European Agri-environmental Schemes (SSPE-CT-2005-006491). We acknowledge the assistance of all members of the project consortium (details available at: http://www.footprint.rdg.ac.uk/) and the inputs and comments of the European researchers and policy specialists who served on a Panel of Other National Experts (PONE).

The Agri-environmental Footprint Index (AFI)

The Assessment Criteria Matrix (ACM) that is the basis for deriving the Agri-environmental Footprint Index (AFI) has two dimensions; first the main AE issues: abiotic natural resources (NR), biodiversity (B) and landscape quality (L); and second, the AE management foci (Figure 1).

For each cell in the ACM suitable agri-environmental indicators are selected together with experts at local and regional level (see Section 3). The quantitative farm-level AFI aggregates the measurement of these indicators. The resulting indicator matrix includes:

- a core of *universal* indicators for common agri-environmental aims that are relevant and applicable across all (or most) farm systems and EU Member States (reference will be made to agri-environmental indicators developed under different initiatives, including those of the OECD, EUROSTAT, JRC, EEA and DG Agriculture, and research projects such as ELISA and EASY);
- a set of locally relevant indicators for the *specific* aims of a scheme for a particular landscape in different farming systems and geographical regions within the EU.

		AE issues		
		Natural Resources (NR)	*Biodiversity (B)*	*Landscape (L)*
AE management foci	*Crop and Animal Husbandry (CAH)*	Reduction of crop inputs and stocking rates to reduce sources of diffuse water pollution	Use of local crop/animal species to increase genetic diversity; use of wildlife-friendly production systems to conserve natural biodiversity (e.g. hay making)	Maintenance of traditional farming systems to maintain the multifunctional value of the countryside (e.g. orchards, upland pastoral systems)
	Physical Farm Infrastructure (PFI)	Waste storage and disposal facilities to reduce point source water pollution	Provision and maintenance of hedgerows, field margins etc. to conserve natural biodiversity	Facilitate recreational public access to and use of specified countryside features through provision of footpaths etc
	Natural and Cultural Heritage (NCH)	Maintenance of traditional landscape structure to reduce water pollution (e.g. riparian buffer zones)	Maintenance and improvement of important wildlife habitats (woodland, wetlands etc.)	Farmer education to aid understanding about the importance of their care and maintenance of the wider environment

Figure 1. Assessment Criteria Matrix (ACM)

In a subsequent step, all AE issues, management strategies and the indicators are weighted against each other – again together with relevant stakeholder groups and experts. The local stakeholder groups that are being involved in the regional index customisation and prioritisation of local AES objectives by an ‘indicator weighting‘ process comprise invited representatives of environmental NGOs, farmers’ organisations, politicians and other researchers. The joint framing of the assessment is critically important in the actual adaptation of the framework to the particular regional context (regionally-customising the index) and its actual application. Additional AE issues can be added to the ACM.

The basic idea is to have a common framework for the design and evaluation of EU policy that can be customised to locally relevant agri-environmental and public goods issues and circumstances. Evaluation can be strictly policy-focused or broader and more holistic in landscape-related assessments.

Applying the AE-Footprint approach in Rhineland-Palatinate

Aims and contents of the case study

In this section we will describe an actual application of the AFI methodology in Rhineland-Palatinate (RLP), Germany. In order to test the AFI methodology we concentrated on the *Support Programme for an Environmentally Sound Agriculture* (FUL). The aim is to test the AFI methodology in a comparison of the environmental performance of farms participating in selected agri-environmental measures with the performance of non-participating farms. The choice of the particular applications mainly followed the interest of the Service Centre 'Rural Development' Rhineland-Palatinate (DLR) – our 'client' and partner in the case study – and also took into account available data. For a more detailed presentation see Kasperczyk *et al.* (2008).

Actors involved in the case study

There had been long established contacts between relevant regional and state level administrations in RLP, in particular the DLR, as well as advisory services, environmental organisations, farmer associations and individual farmers and the research team from previous work. The responsible institutions in RLP have significant interest in this kind of research and they provide a good access to relevant data. The research team together with a team of four DLR employees, and at the same time members of the Technical Panel was involved in actually framing the case study. The motivation of the DLR to participate is a direct interest and the opportunity to gain new ideas and insights for their own work. The Technical Panel (TP) comprised nine experts: four experts of the regional Service Centre for Rural Areas, one expert of a nature conservation consultancy firm, one expert of the state environment agency, and three experts of university research and policy consulting. In the course of the case study we had a total of six meetings with the TP. More or less all members of the technical panel participated in all meetings. The second group participating in the case study comprised representatives of different interest groups (altogether 16 stakeholders):

- land users and land managers: one representative of the regional farmer's union, one representative of the regional association for organic farming, and one representative of the regional association for integrated farming;
- stakeholders that are concerned with the quality of local agri-environmental conditions and interrelations with farming practices: one representative of an environmental NGO;
- regulators targeting the agri-environment situation: local government division representatives; farm advisors; a state Ministry for the Environment representative; and a State Ministry for the Economy representative;
- a researcher related to a wildlife NGO; a representative of a nature conservation consulting firm; university researchers.

All stakeholders have a relationship to farming (either farmers) or are engaged in scheme design or implementation or address in their work the environmental consequences of farming in RLP. The two members of the relevant ministries (environment and economy) are directly involved in programming AES including funding conditions. All stakeholders know each other well since they work together every day in related fields. All participants have been invited officially from the "project team" and received detailed information about the project.

Data availability

The DLR has through its farm advisors (collecting farm data) and direct contacts (farmers, farmer organisations, environmental organisations etc.) developed their own data bank covering a total area of 100.000 ha from 500 farms (participants and non-participants for comparison) for the time period of 2001-2005 (2006). In the case study application we used the following data sources:

- FRIDA-data bank of the DLR: for all natural resources indicators and data; annual data available for the period 2001-5 (2006); farm data from IACS, farmer interviews and field measurements; additional data collected by DLR in field recordings in 2004 and 2005 for indicators 'floristic biodiversity on representative areas' and 'short- and long-distance visual appearance of the landscape'.
- LUWG-data bank of the provincial authority for environment and water protection: for indicators 'biotope types' and 'landscape effects'; data from monitoring and evaluation of areas for AEM and areas for habitat management; data from field mappings in 2002 and 2005; in most cases a total of four areas per farm were mapped; for our calculation we used a mean value for each farm.

The actual application

Farming systems in RLP are very heterogeneous due to differences in natural conditions such as soil, climate, precipitation and slope as well as differences in settlement, agricultural and land use structures. 42% of the total area of RLP is used for agriculture and RLP is Germany's leading wine region. The types of farming consist of 44% permanent crops (thereof 87% viticulture), 25% grazing livestock, 21% field crops, 2% pigs and poultry and 8% others.

On the basis of the state-level AE incentive scheme 'Support Programme for an Environmentally Sound Agriculture' (FUL) 3 out of 16 measures were chosen for testing the AFI methodology. In the following we present the measure 'extensive grassland management' for illustration. The application or this measure is open to all farmers, i.e. it is not spatially targeted (Table 1).

Table 1. Extensive grassland management: stated objectives and agreement obligations

Stated objectives	*Agreement obligations*
• reduce soil erosion and leaching of nutrients • maintain and improve surface and groundwater quality • maintain and enhance regional and site specific grassland habitats and species diversity (fauna and flora) • maintain and enhance regional and site specific grassland and cultural landscape	• stocking limited to 0.3 – maximum 1.4 rough grazing livestock units • no use of pesticides • no conversion of grassland to arable land • no cultivation of maize • use of fertilizer limited to an amount corresponding to 1.4 rough grazing livestock unit per hectare

Source: RLP (2007)

The process-oriented, participatory nature of the application

Organizing a stepwise transparent process

In a first step the Assessment Criteria Matrix (ACM) comprising AE issues and management foci (see Section 2.2) was completed via round table discussions by the evaluators (IfLS), the 'client' (DLR) and technical panel. According to the definition of the selected measures only the first management focus (CAH) was addressed which resulted in a completed matrix with only the first row (CAH). Then we discussed additional environmental aspects which were not covered so far by the official text and should be included. In this first step it was decided to supplement other objectives (for example, biodiversity for extensive grassland management).

In the second step the ACM was finalized in a joint meeting of the expert and the stakeholder group, and eventually approved. A workshop was organized for this purpose. The aim was to engage the stakeholders in an active exchange of ideas and to use this process of learning directly for approving the matrix and weighting the issues and foci. In the workshop all participants were extraordinarily motivated and contributed actively in constructive, consensus-oriented discussions. Several participants stressed that the way to discuss these questions is critically important for them in respect of acceptance for AEM and the evaluation of their effectiveness and, at the same time, not a common practice.

Paying attention to open discussions and joint transparent decisions

During the round table discussions some objectives stated in the AE programme FUL were modified in order to capture more fully the precise objectives, others were added to the matrix in order to obtain a more meaningful assessment outcome. The relative importance of different AE objectives was discussed without explicitly asking for this. One example was the objective to improve the quality of surface and groundwater in relation to the creation of field margins. The importance of objectives and impacts relating to different regions and sites were critically reviewed during the discussion as well. The new or modified objectives were added into the matrix of the presentation as a common basis for the following step of weighting the issues.

The process of weighting was explained and the formulated task presented on a large screen to all participants using a beamer. Emphasis was on obtaining a process that is as transparent, participatory and inclusive as possible. For each measure the group was asked to divide 100% points between the three AE issues. Since we had only one relevant management focus, the CAH, the weighting was not necessary and 100 points were given to CAH. Each stakeholder was provided with a total of 5 questionnaires (1 for field margins, 1 for organic farming and 3 for grassland management for RLP and for two more homogeneous sub-regions). The questionnaires had different colours for each measure so that they could be easily distinguished by the stakeholders and later on for calculating the average weights. The weighting took place first individually and anonymously. After a break the average weights with minimum and maximum values for each dimension were presented and discussed with the stakeholders. A consensus was eventually obtained for all weights needed for the AFI calculation. After the weighting process the proposed selection of indicators was also presented to the stakeholders including their respective weights.

In the third step the technical panel and the evaluators met and decided on the selection of indicators via round table discussions. The selection was mainly driven by the required quality of indicators and available data. Especially the latter led to some compromises. A particular lack of biodiversity and landscape related indicators and data was identified by stakeholders and experts.

During this meeting also the weight of the different indicators in the matrix was decided upon, having in mind that adjustments in the indicators might be needed in case of substantial changes in ACM following the stakeholder participation. The advantage of this change of timing was that also the indicators could be presented to the stakeholders and valuable information on this could be obtained. To explain the way of calculating the index was part of the second meeting with all stakeholders when also the calculated index was presented and the overall results discussed with the stakeholders.

The results

The ACM for the AE measure ‘Extensive grassland management’ is given in Table 2. The table shows that the stakeholder and expert group has been particularly concerned with the higher land use intensity and the resulting (potential) negative impacts on soil, water and air in the more intensive farming area Bitburg. In the Kusel/Westpfalz area more or less equal weight is given to the three AE issues.

Table 3 gives the indicators chosen for the three AE issues and their respective weights. The table shows that for soil, water and air four different indicators have been used, while for the other two AE issue only one each. Under the assumption that changes in biodiversity occur over a longer period of several years, the data for biodiversity and landscape indicators were averaged and the mean value for each year was used to calculate the AFI for the time series (2001-2005).

Table 2. ACM for ‘Extensive grassland management’, and relative weights given by AE issue for RLP, and sub-regions Bitburg and Kusel/Westpfalz

		AE issue		
		Soil, water, air	*Biodiversity*	*Landscape*
Related objectives	Land use	reduce soil erosion; reduce leaching of nutrients; maintain and improve surface and groundwater quality	maintain and enhance regional and site specific grassland habitats and species diversity	Maintain and enhance regional and site specific grassland and cultural landscape
			Weight	
RLP	Heterogeneous	0.36	0.30	0.34
Sub-region Bitburg	Intensive	0.44	0.25	0.31
Sub-region Kusel/Westpfalz	Extensive	0.33	0.32	0.35

Source: Own compilation

Table 3. AE indicators chosen and their respective weights

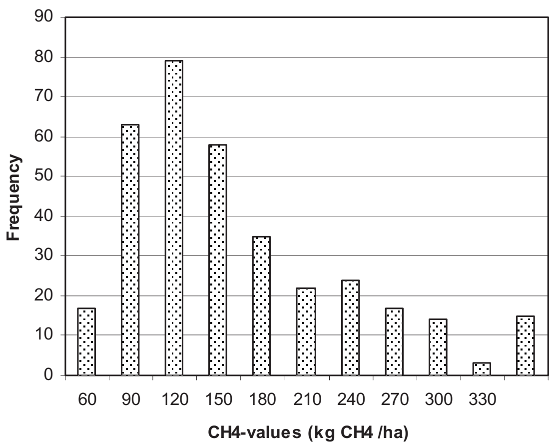
	AE issue		
	Soil, water, air	*Biodiversity*	*Landscape*
RLP, Bitburg and Kusel/Westpfalz	N-balance (kg/ha) – w_i=0,33 N-Input (kg/ha) – w_i=0,22 Livestock density (LU/ha grassland) – w_i=0,28 CH_4-emission (kg CH_4/ha grassland) – w_i=0,17	Floristic biodiversity on representative areas – w_i=1	Short- and long-distance visual appearance of landscape – w_i=1

w_i = indicator weight; Source: Own compilation

In the fourth step the transformation functions for each indicator had to be defined and agreed upon. The basic idea of this is to have different indicators expressed on a comparable 1-10 score scale. In a group meeting with all members of the technical panel the transformation functions were decided upon. Expert knowledge of the technical panel and in some cases the value range of data was taken into account for determining the functions. The starting point was the definition of the 0, 5 and 10 scores for each of the following indicator data: N-balance, N-Input, stock density, CH_4-emission, soil coverage, quantity of active agents of pesticides, floristic biodiversity as well as the indicator 'short- and long-distance visual appearance of landscape'. On the basis of these three scores (for each indicator) a line plot was calculated with corresponding trend lines in Excel. The function of this trend line intersecting with the scores 0, 5 and 10 was used as the transformation function for calculating farm-specific scores. In most cases the technical panel had the (regional) knowledge and practical experience and felt confident with the process. Figure 1 gives the data ranges and transformation of CH_4 emissions as an example.[2]

In the fifth and final step the AFI was calculated. For testing the AEM 'Extensive grassland management' farm level data for 23 participants and 25 non-participants were analysed resulting in the calculation of an AFI for each single farm. A sensitivity analysis was conducted in order to test the robustness of the AFI related to indicator selection and the weighting of AE issues and AE indicators chosen.

Some key results of the application of the AE-Footprint method for the measure 'extensive grassland management' are given in the following figures. The calculation of the mean AFI score included 23 participating and 25 non-participating farms and represents the average score of a time series from 2001-2005. Overall, the mean AFI score for participating farms was significantly higher (P= 0,000) than the mean score for non-participating farms. The difference between means was tested using the Mann-Whitney U-Test with 5% confidence level.



Values (kg CH4/ ha)	Score
<=60	**10**
61-90	**9**
91-120	**8**
121-150	**7**
151-180	**6**
181-210	**5**
211-240	**4**
241-270	**3**
271-300	**2**
301-330	**1**
>=331	**0**

Figure 1. Data ranges and transformation function for CH_4 emissions

Figure 2 shows that the AFI methodology also provides a useful insight where precisely the scheme has resulted in a higher environmental footprint of participating farms. The bar chart below shows that participating farms score more highly in all issues. Whereas the increase in the area 'Natural Resources' is highly significant (P=0,000), the increases for 'Landscape' and 'Biodiversity' are not significant (p= 0.710 and p= 0.260).

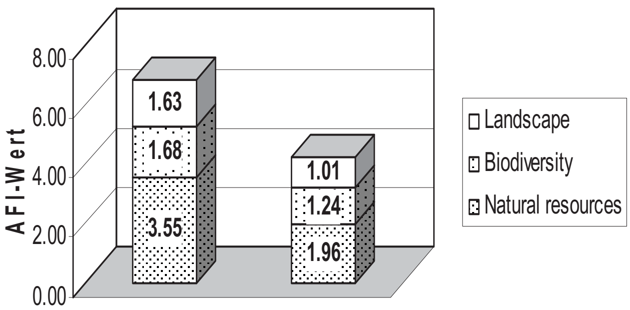


Figure 2. Composition of AFI scores for individual AE issues for farms participating in the 'extensive grassland management' measure (GV1) and non-participating farms (GV1_VGL); mean 2001-5

Figure 3 illustrates the distribution of participating and non-participating farms to AFI classes. A very significant result is that no participating farm has an AFI score in the lowermost quarter in contrast to the non-participating farms with 20%. More than half of the non-participating farms (56%) reach an AFI score between 2.6 to 5, whereas 52% of the participating farms reach the next higher AFI quarter (5.1-

[2] The CH_4-values of the data bank are calculated on the basis of the number of animals as well as on the species composition of animals. Since no 'official' limiting values (threshold value) exist in literature, we calculated the range of available data and distributed the CH_4-values by different classes of quantity

7.5). In the highest segment (7.6-10) we find 35% of the participants and only 8% of the non-participants.

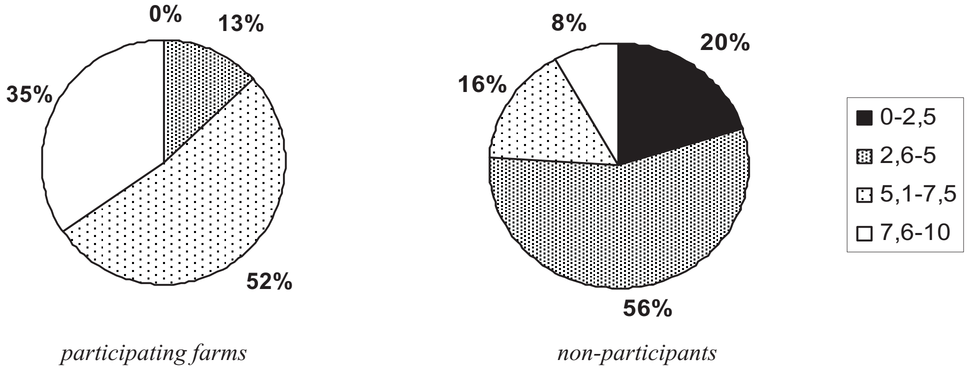


Figure 3. Distribution of participating and non-participating farms to AFI classes (0-2,5 = poor environmental performance …… 7,6-10 = very good)

The main lessons learned and future perspectives

The main lessons learned from the practical testing of the AE-Footprint Index (AFI) can be summarized in the following seven points (supported further by the experiences gained in other case studies):

1. The assessment of the agri-environmental performance of farms in participatory and regionally adaptive ways is technically feasible and its implementation does not require significant additional resources if compared with standard EU level AE evaluation procedures.
2. The AFI approach has a particular strength in allowing for diversity in cultural, natural and farm structural conditions while at the same time providing a common conceptual and analytical framework. The regional level adaptation of the common framework taking into account regional policy priorities and using indicator selection and weighting works.
3. The conceptualisation and structuring of the AFI framework is intuitive, thus facilitating stakeholder participation. It makes possible a holistic, carefully structured systematic assessment.
4. The application of a participatory approach can significantly enhance the quality of the evaluation and the potential use of evaluation results in the policy cycle.
5. Stakeholders can actually reach consensus even on issues normally seen as very controversial – such as land use related biodiversity goals or groundwater protection measures – if the process is organized in a carefully structured, stepwise, transparent and inclusive way.
6. The results of the assessment can effectively be linked with the targeting of farm advisory activities. The presentation of the results can be disaggregated for environmental issues and management foci. Strengths and weaknesses in farm structure and management can be clearly identified.
7. The application of a participatory and regionally adaptive process in the assessment of the agri-environmental performance of farms can substantially raise farmers' awareness about the multifunctional role of landscapes and can effectively support a more continuous learning process.

The potential future use of the AFI by decision makers and programme designers as a tool with which to audit and monitor the wider environmental impact of different types of agriculture in different climatic conditions and geographic regions seems enormous. The index structure is flexible, and can be responsive to changing local needs. The use of the AFI methodology offers the possibility of a common overall approach, customised by the selection of local assessment parameters within the major components of the AFI equation that best address locally important agri-environmental and public goods issues and circumstances. The assessment is based on a holistic integration of assessment across the multiple dimensions of agri-environment. It helps to identify unintended 'side-effects' of policy. Evaluation of both the positive and negative impacts of changes in agriculture, including but not restricted to change induced by agri-environmental policy is possible, taking cognisance of relevant agri-environmental obligations such as Cross Compliance requirements. The structure of the AFI facilitates post-evaluation analysis of relative performance in different dimensions of the agri-environment, permitting identification of current strengths and weaknesses, and enabling future improvement in policy design. The AFI is responsive to changing local needs and thus as a valuable tool with which decision makers can change AE priorities and set targets relevant to national or regional scales through adjustment of the weightings given to particular parameters or indicators used in the index. Such weighting can be used to provide the necessary incentives to achieve particular objectives.

The joint framing of the assessment with relevant stakeholder groups and local and regional level experts and, linked with that, specification of the precise assessment framework is fundamental. It is critically important in the actual adaptation of the framework to the particular regional context (regionally-customising the index) and its actual application. It is the key feature that allows assessing the agri-environmental performance of farms (and, at a higher level, of incentive schemes) in participatory and regionally adaptive ways. The process of index construction is interactive, engaging farmers and all relevant stakeholders in a transparent decision making process. The engagement of farmers (organisations) in the decision making process of weighting the parameters used in the AFI methodology at the regional level, can ensure an improved understanding of local agri-environmental priorities and acceptance of the outcome. It will help to forge stronger links between farmer's perception of agri-environmental issues and awareness of their role as managers of the rural landscape.

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