Integrated landscape planning and remuneration of agri-environmental services

Results of a case study in the Fuhrberg region of Germany

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Abstract

Until now, existing remuneration of environmental services has not sufficiently supported the goals of spending money more effectively on the environment and of motivating farmers. Only a small share of the budgets for agriculture in the EU, as well as in US and other countries, is available for buying environmental goods and services beyond the level of good farming practice (GFP). This combined with the insufficient targeting of compensation payments to areas where special measures are needed leads to an unsatisfactorily low impact of agri-environment measures compared to other driving forces that stimulate the intensification of farming. The goal of this paper is to propose a management concept that enhances the ecological and cost efficiency of agri-environment measures. Components of the concept are a comprehensive environmental information base with prioritised goals and targets (available in Germany from landscape planning) and new remuneration models, which complement conventional compensation payments that are based upon predetermined measures and cost. Comprehensive landscape planning locates and prioritises areas which require environmental action. It contains the information that authorities need to prioritise funding for environmental services and direct measures to sites which need environmental services beyond the level of GFP.

Also appropriate remuneration models, which can enhance the cost efficiency of public spending and the motivation of the farmers, can be applied on the base of landscape planning.

Testing of the planning methodology and of one of the remuneration models (success-oriented remuneration) in a case study area (‘‘Fuhrberger Feld’’ north of Hanover, Germany) demonstrated the usability of the concept and led to proposals for future development of the methodology and its application in combination with other approaches.

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1. Introduction: background and goals

Sustainable rural landscapes are not—and have never been—created solely as a by-product of agriculture and forestry. Although today’s agriculture may have positive effects on landscape functions like soil fertility or ground water recharge, serious problems and risks for the environment can spring from either intensive farming, on one hand, or abandonment of extensively used land on the other (a significant share of valuable habitats depend on extensive farming practices, see for example European Environmental Agency (EEA), 2006, p. 2). Nitrogen leaching and phosphorus output from agriculture are the dominant sources of nitrogen pollution in the rivers of the EU-15 and the nutrient charge of the North and Baltic seas (EEA, 2006; The German Advisory Council on the Environment (GACE), 2004b; INK, 2002; Lääne et al., 2002) Agriculture is also one of the main threats to biodiversity world wide (for Europe: Institute of European Environmental Policy (IEEP), 2004, p. 12). Simple compliance with “good farming practice” (GFP) is not sufficient to tackle these problems (see for example results of Simoncini, 2004). GFP is generally understood as the
type of farming that a reasonable farmer would follow in the region concerned, which entails as a minimum compliance with general statutory requirements concerning the environment, occupational safety, animal welfare, etc.” (IEEP and DLG, 2004). Every farmer has to fulfil the standards of GFP without being compensated for possible cuts in income (Fig. 1). The EU has defined these duties in a rather general way as a basis for their Agenda 2000 CAP reform and more specifically in EU directives, which need to be implemented through national legislation. In order to enable their farms to compete on the world market, most countries have chosen objectives for GFP which reflect environmental concerns but do not cause serious income reductions. If properly implemented, such objectives should suffice to achieve goals such as erosion prevention. However, without endangering the economic existence of farmers, these regulations do not have the power to implement the ‘polluter pays’ principle (for Germany, e.g. Di Fabio, 1995; Bielig, 2003), nor can they address more extensive site-specific problems, such as the special risk of ground water pollution or the existence of especially valuable habitats. Cross-compliance (CC) regulations do not significantly improve the degree of environmental consideration to a level which is needed for strong sustainability (definition according to Goodland and Daly, 1995; see also IEEP and DLG, 2004, p. 1 IEEP, 2004). CC has been recently introduced by the EU CAP-reforms of 2003. The regulations tie direct payments from the EU to the compliance of farming practice with certain environmental requirements.

In addition to legal instruments, some countries try to implement the polluter pays principle in agriculture by levying taxes or placing additional charges on fertiliser or nutrient surpluses (e.g. Denmark, or MINAS—the Dutch Manure and Fertiliser Policy OECD, 2005). These additional instruments improve the implementation of GFP and reduce pressure on sites with average ecological sensitivity. However, they do not take into account the sensitivity and value of the ecological and the aesthetic functions of specific sites, which require improved or alternative land use adaptation measures.

Consequently, the publicly desired ecological goods and services must be purchased from farmers either with private or public funds. Public “green payments” are generally defined as payments made to agricultural producers as compensation for environmental benefits that accrue at levels beyond what producers might otherwise achieve under existing market and farm income objectives (Hamrahan and Zinn, 2005, p. 1). In the EU and in many other countries, such as US or Japan, agri-environment programs have been set up to offer incentives for farmers to deliver these services (OECD, 2005). Generally, such compensation payments to farmers are not considered to be trade effective, and therefore, comply with the “green box” requirements set up by the World Trade Organization (WTO, 2002).

However, these compensation approaches also suffer from severe shortcomings in terms of environmental and cost effectiveness:

1. Only a small share of the budgets for agriculture in the EU as well as in the US and other countries is available for buying these environmental goods and services.
2. Compensation payments are not sufficiently targeted on areas in need of special measures beyond GFP. In combination with the previous point, this means there is an unsatisfactorily low impact of agri-environment measures compared to other driving forces that stimulate intensification of farming.
3. Furthermore, there is a sceptical attitude towards more demanding environmental services and a lack of training and awareness of the farmers, which further hinders the successful implementation of such programs (for example for Germany by Gay et al., 2004; for Greece in OECD, 2005).

Considering the unsatisfactory present situation and future prospects, ways should be found to better target agri-environmental payments and to motivate farmers to promote sustainability. A prerequisite for better targeting of such measures is the definition of concrete environmental goals and targets which define the ecological

Fig. 1. Land use intensities and remuneration.
“shipping lane” for the “ship” of sustainable rural development.

In view of this situation, the objectives of this paper are:

1. To develop and demonstrate ways in which landscape planning (a comprehensive environmental planning) can support the allocation of agro-environmental measures (as proposed by IEEP et al., 2004) and of different remuneration models.

2. To share experience about the suitability of new models for efficient remuneration which promise better gains for nature, improved motivation and environmental education of farmers or increased value for the money.

3. To propose a concept for spatially targeting of the application of these models for agri-environmental services (in which type of area should which type of remuneration be preferred?).

In order to demonstrate possible solutions, this paper makes reference to the findings of a research project (Bathke et al., 2003) carried out in the “Fuhrberger Feld”, a region north of Hanover, Germany. The goal of the project was to develop a system for the future management of multifunctional sustainable landscapes. In view of the occurrence of similar problems in many other European countries (see Section 2), the findings of this project should be applicable to other situations. The project focussed on integrating comprehensive nature conservation and specific water protection objectives with agriculture and with the requirements of municipalities through multilateral cooperation.

2. Current problems of agri-environment programs

Both the EU and the US demonstrate relatively low and ineffective levels of expenditure on agri-environment measures: The EU budget for agriculture and rural development for the time period 2007–2013 amounts to €371 billion (Council of the European Union, 2005). About 80% of the entire budget is spent on market-related expenditure and direct payments. This praxis of primarily unconditional subsidies counteracts the establishment of efficient markets for environmental services (Bielig, 2003, p. 502). Only about 20% of the EU agricultural budget from 2007 until 2013 will be spent on rural development, including expenditure on agri-environment measures. Until now (2000–2006) agri-environment measures have made up about 40% of the EU-15 budget for rural development (less than 10% of the whole budget), although this differs greatly among the member states, ranging from about 5% (Greece) to almost 70% or 80% in Sweden (Gay et al., 2005, p. 12). In Germany, almost 50% of the available rural development funds have been spent on agri-environmental measures. The rest was allocated to rural development measures, such as farm tracks and land consolidation, which have often counteracted environmental goals throughout the last decades. Furthermore, the spending on agri-environment programs is insufficiently targeted. The majority of the money and programs are available for measures which can be easily implemented by the farmer and do not require substantial changes in farming practices (European Commission DG Agriculture and Rural development, 2005, p. 16; Osterburg, 2002). These measures are funded on a first come, first serve basis. In Germany only about 20% of agri-environment measures have been tied to more demanding and site-specific requirements (Gay et al., 2004). As a consequence, agri-environment measures are not effectively targeted with respect to environmental needs. Such indiscriminate distribution (by what is called the “watering can principle” in Germany) has been documented for the majority of German agri-environment measures (GACE, 2002, 2004a; Osterburg, 2002). The situation in the EU as a whole seems to be similar (IEEP, 2004, p. 15): Statistical analysis shows, for example, that there is a poor geographical overlap of agri-environment schemes and Natura 2000 areas, which are of the highest importance for biodiversity in the EU-15 (EEA, 2006, p. 2; Gay et al., 2005). In practice, both insufficient funding and inadequate targeting of payments have resulted in the low impact of agri-environment measures in comparison to the other driving forces that stimulate farming intensification (Defra/Environment Agency, undated; GACE, 2004a). In contrast, many evaluations of the effectiveness of agri-environmental measures show the good results of regional and site-specific measures as well as measures linked to certain ecological conditions and problems. In terms of effectiveness, the policy measures have been producing positive results, particularly when clear targets or objectives have been set (OECD, 2005, p. 11). For example in Sweden, the most targeted form of support showed a substantially higher efficiency in terms of the positive effects obtained (OECD, 2005; similar: Niedersaechsisches Landesamt fuer Oekologie (NLO), 2003). However, environmental effectiveness studies also show that schemes are more successful at conserving the historical environment than at enhancing or developing biodiversity (e.g. results for England OECD, 2005, p. 20; Kleijn et al., 2001, 2006).

Compared to the EU, only a few compulsory environmental requirements apply to those farmers in the US who receive commodity payment. The goals of such CC are restricted to discouraging farmers from converting wetlands into farmland and from farming highly erodable land (Hanrahan and Zinn, 2005, pp. 3, 21). Only about 50% of the country’s two million farmers are affected by this CC. Voluntary agri-environment programs (“farm bill programs”) appear to be well targeted to certain problems. However, the share of money spent in the US on agri-environment programs has been relatively even less than in the EU (Hanrahan and Zinn, 2005, pp. 8, 20).

In the future, European agriculture will have to address new framework conditions that presumably will lead to further liberalisation of agricultural policy. These conditions include future WTO obligations, the cost of eastern
The reorientation of subsidies is a possible response to the liberalisation of the CAP. Targeting environmental objectives would also mitigate the effects of structural changes on farmers who have unfavourable agricultural conditions and are willing to deliver environmental goods and services. The more subsidies are reoriented in future, the more essential it will be to have a firm basis for landscape management such as the one outlined in this paper (cf. Royal Commission on Environmental Pollution (RCEP), 2002, p. 6).

3. Data and methods

3.1. Planning methods

In order to efficiently target remuneration for farmers, a broad base of spatial information about ecological and social landscape functions, as well as prioritised landscape development goals—including local residents’ preferences—are necessary. In Germany, landscape planning can provide such information and planning targets (see Kiemstedt et al., 1998; v. Haaren and Warren-Kretzschmar, 2006; Scholles and v. Haaren, 2004; v. Haaren, 2002).

Landscape planning is a comprehensive environmental planning and can contribute to the assessment of the value and resilience of an area and to the evaluation of impacts and resulting measures. Landscape planning is carried out with blanket coverage and coincidence at all levels of spatial and zoning planning (for the state level in the scale 1:200 000–1:500 000, for the region usually 1:50 000 and for small cities in the area actively participated in the development options. Using a geographical information system, the information was processed automatically and displayed in maps.

3.2. Methods for stakeholder-participation in data acquisition and planning

In the Fuhrberg project, the affected farmers, the farmers’ union, and the local authorities of the villages and small cities in the area actively participated in the entire data acquisition and planning process. About 20 farmers, most of who had been working with the advisory service of the drinking-water supply company in the region before, took active part in regular meetings. The first contact and invitation was made via the farmers union.
Table 1: Sources and interpretation of landscape information used in the Fuhrberg project

<table>
<thead>
<tr>
<th>Information available in existing landscape plans</th>
<th>Additional data, data source</th>
<th>Improved methodology</th>
<th>Further interpretation and formulation of requirements for remuneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of environmental factors and evaluation of their functions (including sensitiveness, existing and proposed pressures, evaluation and prediction of impacts)</td>
<td>Goals, targets, measures and priorities*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment of natural potential for crop production (soil fertility, favourable mesoclimate, water conditions, data from official soil maps, available data about climatic factors); Sensitivity of soil for erosion and compaction; Pressure: allocation of cropland and grassland (statistical data about crop rotation, additional information about land use taken from habitat mapping); Impact/risks: certain crops on sensitive sites, cropping on bog soil</td>
<td>Yes</td>
<td>Irrigation data (from water supply company)</td>
<td>For overlapping areas with priority goals for soil, habitat, climate protection and recreation, the proposed measures were compared and synergies were identified. Because of the special importance of the area as an aquifer protection zone, measures which promoted both water quality/quantity management and other landscape functions (synergies) were given special priority for the cost effective remuneration</td>
</tr>
<tr>
<td>Groundwater recharge (deduced from soil, geology, precipitation); Sensitivity of groundwater to nitrogen input (soil and climate data from official sources); Pressure/impact: land use, land use intensity; Crops/crop rotation with high risk for nitrogen leaching</td>
<td>The LPs indicate that the entire area had a high groundwater recharge priority and high vulnerability (no differentiation possible with simple methods)</td>
<td>More comprehensive data about water catchment areas, flow rate of groundwater, nitrate load of untreated water (from water supply company, research data)</td>
<td>Additional maps which show opportunities for farmers to offer habitat management</td>
</tr>
<tr>
<td>Water retention on floodplains and storage capacity in the whole area (deduced from soil, geology, vegetation and land use parameters) Pressure: classification of housing and infrastructure based on degree of surface sealing Bioclimatic functions: no comprehensive analysis in the landscape plans, because settlements are small and have no considerable air pollution or climatic impairments. Therefore the agricultural area has no important microclimatic function Assessment of:</td>
<td>Yes</td>
<td>More comprehensive methodology and scenarios by hydrologists</td>
<td>In order to define priority or target sites for remuneration, the slightly different terms and categories of objectives in the different LPs had to be adjusted</td>
</tr>
<tr>
<td>● Habitat development potential (in 1 LP); ● Quality and density of existing habitats (data: aerial photographs, habitat mapping); ● Mapping of selected species</td>
<td>All LPs of the Fuhrberg region have a comprehensive information base and evaluation of the habitat functions</td>
<td>Use of the existing, very detailed soil data of the water supply company (LPs had used standard soil data)</td>
<td></td>
</tr>
<tr>
<td>Pressure: land use intensity (usually taken from habitat mapping) Recreation:</td>
<td>Yes</td>
<td>Adaptation of methodology for assessment of habitat development potential to detailed soil data</td>
<td></td>
</tr>
<tr>
<td>● Evaluation of landscape aesthetics (landscape attribute mapping). ● Need for recreational qualities of the landscape in areas close to settlements; Pressure: visual disturbance, noise emission</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Goals, targets, measures and priorities for conservation, rehabilitation or development (based on information about landscape value, sensitiveness, vulnerability)
This co-operation lead to substantial integration of the participants in the research work. Farmers took part in the development of some of the methodologies. They also took part in defining the preconditions for different scenarios, in which the rate of diffuse nitrate pollution was predicted by varying the amount of grassland that was ploughed or managed.

In fact, the participation of the farmers resulted in an additional analysis which was not originally planned. The convincing presentation of environmental issues motivated the farmers to represent their own interests more clearly. The identification of particularly important agricultural areas should help farmers and local authorities to decide where either agriculture or environmental goals should be given priority. In addition to the existing information about soil fertility in the landscape plans, current indicators for the description and evaluation of agrarian structure (commonly used in plans set up by the agricultural authorities in Lower Saxony) were then compiled and discussed with the farmers. A group of farmer’s representatives agreed on a set of indicators, which comprised factors such as size of farms, annual revenue, sites of irrigation farming, agriculturally used lanes. In order to produce a spatial evaluation of agricultural interests in the region, the indicators were applied to the information provided by the farmers: 22 representatives of the farmers union (1 for each village) collected the data for the existing 121 fulltime an 41 part time farmers mostly by questioning the local farmers in meetings. Some of them provided their own local knowledge. The application and interpretation of the data was the responsibility of the scientists from the University of Hanover.

3.3. Methods for efficient remuneration

In the Fuhrberg project, the farmer is viewed as an active producer of environmental goods who is interested in selling his goods in the market. The market is created primarily by the public’s demand for environmental services, which is represented by the goals and targets of landscape planning. This approach is a reversal of the traditional concept, which addresses the farmer, in principle, as an injured contracting party who must be compensated for financial losses. In order to test new remuneration models that were based on this concept in the Fuhrberg project, funds were required from sources other than the official agri-environment programs, which would not allow new approaches. The finances were supplied by the county of Hanover, the German environmental foundation (DBU) and in subsequent years by the State of Lower Saxony.

Both current and new remuneration types have been analysed, assessed (based on existing evaluations) and tested in Fuhrberg in order to evaluate their “environmental success” and effects on the motivation of the farmers (Table 2).

Conventional remuneration is based on predetermined measures and costs, and therefore is considered by many to be deficient in terms of the cost effectiveness of public expenditure, and in motivating the farmers (e.g. Knauer, 1992). A considerable portion of the farmers in the Fuhrberger Feld expressed a lack of motivation in several farmers’ assemblies and in interviews (with 25 farmers) in a preliminary investigation before the start of the research project (Richter gen Kemmermann, 2001, p. 99). The majority of the farmers who were questioned
expressed willingness to participate in agri-environment measures in principle, but requested desirable rewards and measures, which were easy to integrate into farming practice. Seven of the 25 farmers were not interested in any participation at all. In addition to economic reasons, this negative attitude was motivated by the fact that farmers did not like the idea of being subject to directives (“being no entrepreneur”).

In order to overcome these shortcomings, new models such as tendering or success-oriented remuneration have been suggested by several authors (e.g. Glebe, 2005, pp. 14, 15). In Germany, a ground-breaking approach to remuneration is the invitation to tender a public bid to provide certain environmental services. When the price for the service is tendered, it is determined by market mechanisms. In the US “Conservation Reserve Program” a bidding procedure, in which bids are ranked on the basis of an environmental benefits index, is used to enhance environmental services. (Plankl, 1999; United States Department of Agriculture, USDA, 1997). This method was chosen to be applied in Fuhrberg, complemented by a regionally adapted benefits index for several environmental goods (water, soil, biodiversity, scenery, climate) and a spatial differentiation of possible remuneration according to the special needs of individual sites (Batheke et al., 2003, pp. 128, 129). Farmer’s assemblies were used to encourage farmers to participate and to identify possible objections. Another innovative type of remuneration is incentive based, or success-oriented remuneration developed on the basis of the MEKA (programme for the reduction of overproduction and cultural landscapes compensation) methodology from the German state of Baden-Wuerttemberg and the Swiss ecological quality guideline (Bronner et al., 1997; Ministerium für Ernährung und Ländlichen Raum Baden-Württemberg, 1999; Öko-Qualitätsverordnung-Schweizerischer Bundesrat, 2001). The approach calculates the appropriate fee which the farmer should receive, based on the degree of success in achieving the desired benefits. In the Fuhrberg project, this approach was developed and tested for the remuneration of biodiversity benefits. The success was assessed according to the number and abundance of indicator and target plant species that farmers can prove are present on their grassland. The hypothesis is, that the indicator species represent the desired ecological good “species-rich grassland” in a more realistic and direct way than the indirect way based on predefined measures. The measures for achieving such success were left up to the farmer. He was only given information about the potential of his land to successfully “produce” target species or habitats (supplied by the assessment of HDP from landscape planning). The farmers had to survey the abundance of selected indicator and target species themselves by using a simple transect method (developed for application by farmers in MEKA II, 1999). The number of indicator species were counted along a transect across a grassland site. Each transect was divided into three segments in which all indicator species growing within 1 m distance from the transect line were recorded. In the area of Fuhrberg, a list of 24 easily recognisable indicator species seemed to be sufficient to identify valuable grassland types. The species were selected by analysing regional data about the vegetation, with special consideration to species characteristic for grassland among the regional and endangered species. Continuing a success-oriented approach, an improved list was developed after 2004. Now target species were selected by analysing the plant communities of Lower Saxony searching for character species and rare differentiating species (according to the definition of Braun-Blanquet, 1964) of endangered grassland plant associations and alliances. In the beginning, 10 farmers participated in the success-oriented remuneration, in the following years the number rose to 17. The farmers were selected because of their willingness to participate and because they owned grassland with a good HDP. Every year a group of 6–12 farmers took part in a training course to better identify the species. The training courses were a good opportunity to discuss and exchange experiences and seemed to be important for the acceptance of the programme. On about 50% of the parcels the farmers’ results were checked using the same method and on 21 parcels by using vegetation records (according to Braun-Blanquet, 1964). In addition, the participating farmers were asked in one-to-one interviews and in plenaries about their appraisal of the method.

The approach was not carried forward and applied to ground water or soil protection services because principal methodological difficulties arose. Either the control and documentation of success turned out to be very difficult or the success could not be proven by the individual farmer but only by a large group of farmers in the catchment area, which would have required collective participation.

In order to enhance the ecological effectiveness of the remuneration for soil and water in the other remuneration schemes, a ranking of the ecological effects of protection measures was carried out. The information basis for the ranking consisted of empirical data from the control programme of the water company about nitrogen leaching and from previous research in the Fuhrberger Feld (e.g. Boettcher et al., 1992; Heumann et al., 2001) as well as from other areas with comparable geohydrological conditions.

4. Results of the case study

4.1. Use of landscape planning for targeting of compensation payments

The information, which the landscape plan provided on a GIS basis, proved to be useful for the following applications:

- Suitable priorising of sites with need for environmental action
The environmental information basis which landscape planning provides made it possible to prioritise goals and targets, in order to direct funds from agri-environmental measures into those areas where urgent environmental action was most needed. The output of the assessment of the HDP offers environmental authorities information that can be used to decide where limited funds should be concentrated for the development of new habitats. As a basis of the success-oriented remuneration, farmers could choose the site with the best prospects for success.

The information is applicable as a basis for all possible remuneration models, which aim at targeting agri-environment measures in areas with environmental priority. Exceptions are a few measures, which were assumed to have general beneficial effects beyond the level of GFP for all locations—such as organic agriculture. These measures may be offered on an area wide basis.

- Identification of synergies between different landscape functions provides a basis for co-operation
- The information from the landscape plan was also used to identify positive synergies and potential conflicts by determining areas where different priorities overlapped. The analysis thus offered the option of creating measures which promised the best synergetic results without interfering with other landscape functions. For example, measures taken to enhance habitat qualities had the potential to affect water supply functions favourably or adversely. With this in mind, funds from different sources (like water protection and nature conservation) could be consolidated to create co-ordinated projects.
- Spatial concretion of GFP

Using information from the landscape plan, it was also possible to transform many general legal obligations of the GFP (as defined in the German legislation) into spatially concrete information. For example, it was possible to identify grassland in flood plains or on sites with a high ground water table. The conservation of such grassland is demanded by the federal nature conservation law as part of GFP. Such spatially concrete information which is relevant to mandatory standards was important to farmers as well as to authorities because compensation payments to the farmers are not meant to cover the implementation of mandatory obligations.

4.2. Results of the contribution of farmers to the information base

The participatory approach that was used to add local knowledge to the information base revealed several aspects of the approach. On one hand, the farmers contributed valuable information and corrections about the actual land use or soil specifics to the environmental information base. Also, in the field of the assessment of the agricultural conditions of the area, which was not covered by the landscape planning, they personally involved in developing a set of indicators and collecting farm data.

On the other hand, their biased interests in the results of the assessment of the agrarian structure were not favourable to a transparent information base. Once the farmers saw the results of the application of the indicators, they became very sensitive about making this information public or available to the authorities. The reason for this was that the spatial distribution of agricultural priority areas was not in the interest of individual farmers whose land was indirectly disqualified as being non-priority. The farmers, therefore, decided to exclude such “incriminating” information and to significantly limit the area-specific information which was presented publicly.

4.3. Validity and acceptability of new remuneration models

The approach involving tendering a public bid to provide certain environmental services could not be tested in Fuhrberg because the farmers were not willing to participate in it. When questioned about the reason for this, the farmers did not deny the economic logic of the approach. However, they feared that this would put the social balance in the farming community at risk and make the provision of environmental services even less attractive.

Success-oriented remuneration turned out to be much more acceptable. Most farmers saw that it led to an improvement in their image and were in favour of the concept of being treated as entrepreneurs instead of as the subjects of directives. Willingness to participate in the scheme rose significantly in the second year (Table 3) from 10 to 17. During the following years more farmers wanted to participate. However, expenditure on the scheme was capped and the number of farmers who could participate was limited.

In general, farmers participated because of a general interest in the scheme and because they hoped for a positive reaction of the public. All questioned 17 farmers said that

| Participation of farmers, and parcels included in the success-oriented remuneration scheme (Fuhrberg, Germany) |
|-------------------------------------------------|--------|--------|--------|--------|
| Number of farmers                               | 10     | 17     | 17     | 17     |
| Number of fields being surveyed                 | 33     | 79     | 73     | 92     |
| Number of fields with more than three indicator species in each segment | 19     | 32     | 50     | 64     |
| Area being surveyed (ha)                        | 70     | 249    | 210    | 269    |

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they made positive experiences with the programme and none of them dropped out during the following years. An open question about what they especially liked about the programme was answered by seven farmers: Besides the positive reaction of the public, their own raised attention to plants and nature conservation and the flexible uncomplicated approach seemed to be most attractive. Two farmers pointed out how important it was that the list of target species should only contain species that may occur in the Fuhrberg region.

The transect survey method that the farmers used proved to be sound. For the most part, the control checks led to the same results with only few discrepancies (for field margins see Braband et al., 2003). In some cases, the farmers had difficulty differentiating *Cirsium palustre* and *Cirsium vulgaris*. *Senecio*-species were also taken out of the list because they were often identified incorrectly. In 2004 two members of the Country Women’s Association voluntarily supported the surveying of the target species as well. In general, the acceptance of the scheme was very good.

The results of the vegetation mapping and the monitoring of the farmers survey show the method to be successful in delivering the environmental service of “species-rich grassland. The number of indicator and target species was positively correlated with the total number of species. Endangered species (target species) were found exclusively on parcels with the highest number of indicator species. On mowed parcels as well as on pastures, high numbers of indicator species were clearly correlated to a low input of fertiliser.

However, the farmers stated that they only changed their land use practice slightly or not at all (on 70% of 66 parcels) during the first 2 years. They hoped for target species without further activities. The most frequent changes on the other parcels were to mow later in the year and apply no pesticides. In order to produce more target species most farmers considered late mowing and the reduction of fertiliser input as the best measures. Only one farmer mentioned wetting of grassland.

For moist grassland (very wet grassland was not included in the scheme), the use of the “HDP” approach proved to be useful as a basis for selecting suitable sites (Fig. 2).

The soil moisture which had been used in the HDP as criteria for selecting the valuable sites was positively correlated to the number of target and indicator species. For dry grassland habitats, no such correlation could be proven. This may be explained by the predominant influence of fertilisation, the generally intensive cultivation of these grasslands in the Fuhrberg region and the short examination period, which did not allow enough time to observe substantial changes in the presence of target species.

5. Discussion

The key findings of the study are:

- that comprehensive information about landscape functions and goals provides a suitable base for targeting agri-environmental services,
- identifying opportunities for co-operation and consolidation of funding from different sources and showing site-specific implications of the GFP,
- that farmers voluntarily contribute valuable data if given the opportunity to hold back data which they do not want to be published,
- that farmers had reservations about tendering but showed high acceptance of success-oriented remuneration,
- that nature conservation authorities accepted success-oriented remuneration except for its application in very valuable habitats,
- that the methods seem to be suitable but need improvements in detail.

These findings can be interpreted in the view of the further development of the methodology and their transformation to other cases.
The comprehensive information base which is needed for targeting agri-environment funding is best provided by landscape planning (in Germany). However, some additional data and methods (e.g. prioritising goals and targets in order to support decisions about an appropriate remuneration approach, site-specific information about GFP, and assessment of HDP) should be incorporated into the “standard German concept” of landscape planning. The methods used in German landscape planning are transferable to other countries in principle but probably not always in every detail because the available data differs between countries. However, the possibility of adapting the concept to other conditions has been demonstrated by the development of landscape planning in Russia (Antipov, 2006). Approaches similar to those in Germany are used in other countries (overview for Europe: v. Haaren et al., 2000; examples for UK e.g. RCEP, 2002; for US, e.g. Steinitz, 1990). To date in few countries, comprehensive spatial data from landscape planning is available with blanket coverage. This may change rapidly in the future for the 26 European countries that have already ratified the European Landscape Convention, which contains the obligation to establish landscape planning (Council of Europe, 2000). The water framework directive also contains planning obligations that can be used to establish a sound environmental information base (for UK: Cullingworth and Nadin, 2006, p. 270).

The involvement of land users into the compilation of the information base of the landscape planning has proved a useful approach for incorporating local knowledge and enhancing credibility and acceptability of the information provided. However, if the interests of the farm enterprises are involved—as was the case in the assessment of the agrarian structure—this approach shows ambivalent implications. On one hand the results for the whole process were very favourable, because the approach greatly increased the farmers’ willingness to co-operate in the project. On the other hand scientific completeness and integrity of the results were partly sacrificed.

The testing of the success-oriented remuneration scheme showed generally satisfactory results but also potential for improvement. For example, the list of indicator and target species based only on the analysis of the regional vegetation did not produce results which could be compared to those of other regions. This in turn will require including character species of plant communities, which are valuable or endangered on different spatial scales (European, national, state or regional level). For Lower Saxony this work has been completed in the meantime. This approach generates a much larger number of target species. However, a shorter regional list can be extracted from the long overall (state) lists. The list of target species should also not be restricted to flowering plants which are easy to recognise (like in the MEKA concept) but should be expanded by including grass- and sedge-species to enhance the representation of species-rich habitats like wet, extensively farmed grassland. This in turn will require that the farmers receive additional training. Technical assistance for developing farm conservation plans and financial or cost sharing assistance to implement plans are both offered in some countries (e.g. US: Hanrahan and Zinn, 2005, p. 21; Kloepper, 2006) but not in Germany. This may change in future as the new EU rural development program offers funding for environmental farm advice. An apparent reluctance by some of the farmers to introduce new farming practices in order to produce target species may be explained, in part, by the short-term perspective of the scheme. (Initially, financing was secured for only 1 year.) Additional research in this area is, however, necessary.

Although success-oriented remuneration seems to be a successful approach, experience in the Fuhrberg project showed that it cannot be promoted as the only compensation model. The methodology is generally not suitable for achieving goals that require development over a long time period or for goals which cannot be monitored by simple indicators of the type discussed here. Furthermore, the nature conservation authorities considered it too perilous to leave the choice of the measures for priority habitat protection areas to the discretion of the farmers. Therefore, remuneration, based upon predetermined measures and associated costs, may maintain its place in nature reserves, especially vulnerable zones, and other priority nature conservation areas. However, this recommendation should be further verified in the future.

As a consequence, the range of approaches should be applied differentially in appropriate situations and according to the priority attached to different environmental goals presented in landscape planning (Fig. 3).

In areas with less priority but special demand for environmental services because of special value, vulnerability, development potential or impairment of the environment the success-oriented remuneration has obvious advantages. It improves the motivation and educational value for farmers and increases the value for the money. The course of environmental development can be more flexible here than in high priority areas. Larger areas with general environmental goals and a larger number of farmers potentially able to supply the demanded service are necessary for successful introduction of the tendering process. In this case, predetermined agri-environment measures whose ecological effectiveness does not depend on an area-specific demand can be offered in a tendering process. In the future, additional incentives for co-ordinated and collective action that have larger cumulative benefits, e.g. for ground water quality or habitat networks than actions on individual farms should also be considered (Hanrahan and Zinn, 2005, p. 20).

6. Conclusion

In conclusion, a comprehensive and adapted landscape plan provides a suitable information basis for targeting remuneration for agri-environmental services to sites with
an explicit demand for such services. The output can be used by environmental authorities to decide where the limited funds available should be concentrated. Agri-environmental programs should demand such information as a precondition for targeted remuneration. Farmers who have access to this information can also actively offer environmental services on agricultural land which offers the best prospects for success. Giving farmers the choice between several different development opportunities may help to motivate them to actively participate in a success-oriented remuneration programme. The very high level of participation of farmers even in methodological questions and data acquisitions resulted in some advantages, such as increased co-operation and high acceptance of the project, but it also had disadvantages. The approach may not be recommended if complete and publicly transparent information is crucial.

For the new remuneration models it can be concluded that success-oriented remuneration seems to be a valid and sound approach to measuring the present biodiversity services delivered by the farmers. However, long-term research is necessary to show whether positive changes occur on sites funded under this scheme and to better prove the value of the “HDP” assessment technique to select the best sites. Further research is also necessary to explore the potential of the success-oriented approach for soil and groundwater protection services, considering the identified methodological difficulties.

Tendering or bidding appears, in principle, also to be a very useful approach that could improve the efficient spending of public money. The negative reaction of the Fuhrberg farmers to this approach is not necessarily representative of German or European farmers in general. It should be kept in mind that it is common procedure in the US to let farmers bid competitively in soil conservation programmes.

A final question which remains unanswered is how much the transaction cost for the implementation of such funding schemes will be. This too needs to be addressed in future research (OECD, 2005, p. 13).

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