DESIGNING EFFICIENT AGRI-ENVIRONMENTAL SCHEMES UNDER CONSIDERATION OF THE COMMON AGRICULTURAL POLICY (CAP) IN EUROPE

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Abstract

Based on a perennial ex-post evaluation of the current agri-environmental program in the federal state of Brandenburg (Germany), we have developed two approaches for implementing more efficient agri-environmental measures (AEM) that are in line with the Common Agricultural Policy (CAP). These two approaches address two crucial environmental issues: the preservation of biodiversity in the context of the Convention on Biological Diversity (CBD); and the improvement of water quality through the implementation of the European Water Framework Directive (WFD).

We suggest a so called result-oriented or performance-oriented approach. In this approach, the payment correlates directly to specific environmental conditions, i.e. certain types of plants. The essential element of the result-oriented AEM (roAEM) approach is that farmers are able to decide how they will approach production in order to achieve the environmental goal. With such an approach, the diversity of site conditions can be considered by each individual farmer.

For the maintenance of biodiversity, we have developed an AEM for species-rich grassland in Brandenburg. We also recommend the use of defined grassland habitat types within the Natura 2000 network to link agri-environmental premiums directly to the habitat quality.
Our second approach deals with the issue of nutrient surplus reduction within the context of the WFD implementation. To solve the problem of non-point pollution, we outlined the use of simulated nitrate leaching figures to develop a roAEM in Brandenburg.

Keywords

Agri-environmental measures, grassland, Natura 2000, nitrate leaching, result-oriented

1. INTRODUCTION

Agri-environment schemes are payments (including implicit transfers such as tax and interest concessions) to farmers and other landholders to address environmental problems and/or promote the provision of environmental amenities (OECD 2003). Agri-environment measures are generally considered as belonging to the so called 'green box' of the WTO negotiation.

In this paper, we look at area-based agri-environmental measures (AEM) as the most important part of payments for improving environmental objectives in agriculture. In the framework of the current European rural development policy under the Council Regulation (EC) No 1698/2005 and the former Council Regulation (EC) No 1257/1999, AEM summarized in agri-environmental programs (AEP) are the only mandatory part of Rural Development Plans (RDP). AEP are implemented in all European member states at different spatial and administrative levels. Within the subsidiarity principle, there is much room for the Member States and regional authorities to design specific agri-environmental measures. During the last planning period (2000-2007) alone 68 RDPs were implemented in the old EU Member States (n=15) (COM 2003). However, the number of agri-environmental programs was probably double (compare Buller (2000) for the planning period 1992-1999).

Currently, nearly all AEM are action-oriented. Payments of action-oriented AEM are based on farm practices, for example the reduction of livestock density.

An important distinction has been made between 'broad and shallow versus deep and narrow' schemes (sometimes known also as 'light green versus dark green' schemes). 'Broad and shallow' or horizontal schemes tend to include a large number of farmers, cover a wide area, make relatively modest demands on farmers' practices, and pay correspondingly little for the environmental service provided. 'Deep and narrow or dark green' schemes tend to target site-specific environmental issues, therefore including fewer farmers (COM 2005a). Horizontal measures, such as extensive grassland land management, represent the most important kind of AEM in terms of supported area. It is typical with this kind of AEM for environmental objectives to be quite general. Critics argue that ‘EU programs tend to be oriented towards multiple, sometimes nebulous goals’ (Baylis et al. 2005, p. 268). Without a goal-oriented approach it is not surprising that horizontal AEM are assessed as less effective, at least for specific environmental objectives (Primdahl et al. 2003, COM 2004, COM 2005b, Feehan et al. 2005, Knop et al. 2006, Kleijn et al. 2006). In particular, the lack of spatial equivalence for horizontal AES in is one of the main causes of effectiveness deficits (Piorr and Matzdorf 2004).

One way to improve spatial equivalence is to set up locally specific implementation areas. Such Environmentally Sensitive Areas (ESA) have been implemented in the United Kingdom since 1992. However, even in the United Kingdom, the biggest portion of AEM is implemented not site-specifically within the horizontal schemes such as Countryside Stewardship Schemes (JNCC 2007).

A forceful spatial management, based on ecologically defined regions and relationships, is ‘a challenging and radical departure from standard practice’ (Scrase and Sheate 2002) and ultimately a question of transaction costs (Falconer et al. 2001; Rodgers and Bishop 1999) as well as equity reasons. Potential transaction costs as well as equity reasons could be seen as the main rationale for the resistance of the competent administrative bodies with regard to these approaches.

In addition to these constrains, centrally prescribed sensitive areas can be also ineffective, especially with a view to species and habitat diversity. With the issue of biodiversity, the entire range of site conditions, including historical use, has to be taken into account. Above all, the definition of inflexible management requirements is often less successful within the context of biodiversity. The impact assessment of AEM on biodiversity shows the specific issue (e.g. Kleijn et al. 2001, Swetnam et al. 2004, Herzog 2005,).

Due to this fact, it is not astonishing that first examples of result-oriented payments, as another opportunity to improve the effectiveness of AEM, are implemented to protect and to enhance biodiversity. Result-oriented payments are directly linked to the desired ecological good or objective (Gerowitt et al. 2003; Matzdorf 2004a). For example, a farmer may receive payments for a ‘species-rich wet meadow’. Action-oriented payments are linked to an adapted agricultural management that leads to the production of environmental goods. The farmer may receive payments for refraining from spreading manure in his meadow and for mowing it only once a year. The line between result-oriented and action-oriented approaches is blurred, and can be defined by the numbers of options for action.

In the case of incentives linked to specific environmental goals, farmers see environmental objectives as environmental goods and incorporate them into their economic calculation. Thus, farmers select the most appropriate (sensitive) areas in a decentralized way. They also enjoy greater flexibility in choosing methods for achieving the environmental objectives and their choice is determined by their individual rational decision.

For these reasons, result-oriented remuneration is considered to have many advantages, which, however, cannot be discussed here in detail. Result-oriented remuneration prompts farmers to pursue environmental objectives for their own benefit, increases innovation potential, reduces information asymmetries, promotes co-operation between farmers, and improves farmers' intrinsic motivation and interest in environmental objectives (Matzdorf, 2004b).

There are first implementations of roAEM in Switzerland and in the federal state of Baden-Wuerttemberg (BW) (Germany) in the field of grassland biodiversity (Oppermann and Gujer 2003). Considering the political framework, the implementation in BW within the regional AEP 'MEKA' is most interesting. BW is the first federal state in the whole EU which has introduced a roAEM within the regional agri-environmental program under Council Regulation 1257/1999 in 2000. This example has shown that such an approach is in line with the current institutional framework of CAP. The objective of the AEM titled 'Rewarding of a great variety of plant species on grassland' is to support the protection and maintenance of species-rich, extensively and traditionally managed grassland.

In our paper we give three examples how roAEM can be designed and implemented in AEPs under Council Regulation 1698/2005. We developed these approaches for the federal state of Brandenburg in Germany. Two examples deal with the issue of biodiversity on grassland, and one with N-non-point pollution and the issue of water quality.

2. APPROACHES FOR RESULT-ORIENTED AEM IN BRANDENBURG

2.1 Case Study Region

The federal state of Brandenburg is situated in the North-eastern German lowlands, which are dominated by landscapes formed in the Pleistocene (see Figure 2-1). Brandenburg has a total area of 2.9 million ha within approx. 45 % agricultural and 37 % forest land use. 78 % of agricultural land is arable land and 22 % grassland. Diluvial sandy soils dominate the landscape, alluvial loamy soils and bogs are limited mostly to the riverside areas. The long-term mean annual precipitation varies between 450 in the South-east and 650 mm y^{-1} in the North-west. The region is characterized by its varied, relatively sparsely populated rural areas (43 inhabitants/km^2).

In Brandenburg, agri-environmental measures have been applied since the beginning of 1990. The most important measures, in terms of area, are horizontal extensive grassland management and organic farming. In 2004, agri-environmental measures were applied to more than 50 % of Brandenburg's grassland (Matzdorf et al. 2005a).

During the last planning period (2000-2006), Brandenburg invested 275 mill. Euros for AEM (LVLV 2006) and will hold nearly that level during the next period (2007-2013) (MLUV 2007).

Figure2-2 gives an overview on the AEM offered in Brandenburg in 2004. The established AEM comprise both horizontal and targeted measures. Some AEM are bound by tighter obligations and can only be conducted in combination with certain 'base' measures and are therefore tagged 'top-up' measures.

The main aim of Brandenburg's AEM is the input reduction of fertilizer and pesticides. At least because of the high portion of horizontal AEM there is potential to improve the effectiveness of the AEP, especially with regard to the spatial equivalence (Piorr and Matzdorf 2004). The evaluations have shown a lack of consideration for biodiversity objectives. More goal-oriented approaches were recommended to improve effectiveness (Matzdorf et al. 2005a).

Figure 2-1: Location of the federal state Brandenburg in Germany

Figure 2-2: Amount of AEM in Brandenburg implemented from 1994-2006 (data source: LVLF Brandenburg)

2.2 Result-oriented Grassland AUM Targeting on Biodiversity

2.2.1 Weaknesses of the current grassland AEM

The conservation and the enhancement of species-rich grassland as an important feature of the European cultural landscape is a major goal of many AEP in Europe as well as in Brandenburg (MLUR 2000). Grassland AEM, including organic farming management of grassland, cover a vast area. The horizontal grassland AEM "extensive grassland management" (A1) is supported on 91,592 ha. This is approx. 30 % of the total grassland in

Brandenburg. 60 % of the total expenditure for AEM went to this horizontal AEM. A1 requires the extensive management of grassland areas and is restricted to extensive livestock or mixed farms with a livestock density of 0.3 to 1.4 livestock units per ha. This measure includes at least one usage per year (mowing or grazing or mulching) and prohibits the use of synthetic chemical fertilizers and pesticides. Since 2004, farmers have had to participate with the whole farm grassland. Only in exceptional cases and for nature conservation reasons, can farmers participate in A1 with single grassland fields.

The maintenance of extensively used grassland for landscape diversity reasons was the major goal of A1 in the past. Due to the implementation of cross compliance into the CAP in 2005, the maintenance of grassland is required to get direct payments (Council Regulation No 1782/2003 and Commission Regulation No 796/2004). The environmental effects of A1 on the nutrient-input and nutrient surplus reduction are relatively low. Reasons for the relative low effectiveness of A1 are:a low intensive agricultural management, even among conventional farms in Brandenburg, and specific site conditions including climatic conditions (Kersebaum et al. 2006). Taking these into account, the conservation and enhancement of species-rich grassland can be seen as the main objective of A1 in Brandenburg.

There is no doubt about the positive impact of extensive grassland management on floristic biodiversity objectives[1] in principle (recently e.g. Tallowin 2005, Schmitzberger 2005, Askew et al. 2007, Klimek 2007). With regard to AEM, a noteworthy question is whether the most implemented horizontal grassland AEM do this effectively. On the one hand, for instance, Knop et al. (2006) and Dietschi et al. (2007) emphasize the importance of horizontal grassland AEM to maintain species-rich grassland in Germany and Switzerland. On the other hand, the possibility to enhance species-rich grassland by that kind of AEM is suspect (Kaiser 2000, Kleijn et al. 2005, Herzog 2005). It is argued that species-rich grassland depends essentially on historically extensive use (e.g. Knop et al. 2006). Furthermore, the temporal aspect has to be considered. Swetnam et al. (2004) suggest reminding policy makers that ensuring a successful and maintained reversal of floral decline may take many decades.

Unfortunately, no floristic time series of supported areas was available within the evaluation of the horizontal extensive grassland management AEM (A1) in Brandenburg. Some evidence of a light positive influence of A1 are given by a counterfactual comparison (supported and non-supported areas) using numbers of species, number of species indicating extensive grassland use, and number of endangered species as assessment criteria (HU 2003, Matzdorf

[1] Biodiversity is used as nature conservation concept

et al. 2005b). Nevertheless, in consideration of the quite long participation of farmers in this AEM the effectiveness has to improve (Matzdorf et al. 2003, Matzdorf et al. 2005a).

Within the discussion of AEM aimed at biodiversity objectives, the closely linked European Habitat Directive (Directive 92/43/EEC) and Birds Directive (79/409/EEC) has to be considered. Member States have to maintain or restore a favorable conservation status, natural habitats and species of wild flora and fauna of Community interest (Article 2, Directive 92/43/EEC). A central element of the Habitats Directive relates to the establishment, safeguarding and management named Special Areas of Conservation (SAC). Together with the Special Protection Areas (SPA) of the Birds Directive, they form a European network of protected sites - the named Natura 2000 network. AEM are important management instruments to achieve the objectives in Natura 2000 areas (COM 2000).

Despite the fact that Natura 2000 sites are nature conservation target areas, keep in mind we recommend a different design of result-oriented incentives inside and outside of Natura 2000 areas. 26 % of the area of Brandenburg is part of the Natura 2000 network (Figure 2-3) with a high proportion of grassland. Our spatial analysis shows that approx. 50 % of A1 areas were situated in Natura 2000 areas in 2004.

Actually, some natural habitat types of Community interest are grassland habitats (see Annex 1 of the Habitat Directive). In Brandenburg, three grassland habitats, with relevance for agricultural use, have to be considered (Table 2-3). Even though, these habitat types have specific management requirements, there are no targeted AEM for these habitat types within the AEP in Brandenburg.

Figure 2-3: Natura 2000 area in Brandenburg (SPA light gray, SAC dark gray; data source: LUA 2004)

2.2.2 Supporting of species-rich grassland outside of Natura 2000 areas

We recommended, with the up-date of the mid-term evaluation of the AEP in Brandenburg, replacing A1 outside of Natura 2000 areas with result-oriented AEM (Matzdorf et al. 2005a). The objectives are i) to identify species-rich and agricultural-used grassland areas (relevant for nature conservation), ii) to support only areas with a minimum of nature conservation quality and iii) to realize the advantages of that kind of approach, especially the higher management flexibility for farmers (see above).

For the design of this AEM we used the successful indicator approach implemented in Switzerland and Baden-Wuerttemberg. The core of these approaches is a list of floristic species which indicate regional typical species-rich grassland. Farmers have to find a minimum number of indicator species each year per field to receive the result-oriented remuneration (Oppermann and Gujer (eds.) 2003). In BW, farmers are responsible for checking their own eligibility of supported areas.

We derived, for Brandenburg, a regional typical indicator species list by using expert knowledge and statistical crosschecks with a database of over 1550 pre-existing vegetation samples. In this database we integrated different kinds of existing monitoring data (Matzdorf et al. 2007).

First, the database of 1551 samples was used for an expert-based identification of 318 species, which are typical for extensively used grassland in Brandenburg. For the first selection of indicator species these 318 species were reviewed using the following criteria: high frequency in specific grassland communities (different demands on water supply), and simple identification. In addition to these positive criteria, poisonousness was used as exclusion criterion. Finally, a comparison with other existing regional checklists (Baden-Wuerttemberg and Lower Saxony) helped to derive our draft list.

Second, the suitability of this indicator species list was proved by addressing the question of whether the number of our selected indicator species was correlated i) with the number plant species, ii) with the number of species indicating extensive use, and iii) the number of endangered species. All trend functions are statistically significant (Matzdorf et al. 2007).

In the end, we came up with an indicator checklist (Table 2-1), applicable for the roAEM. Table 2-1 gives a comprehensive overview about the indicator species and species groups. We used only vascular plants and mostly herbs because of their easy recognizability. As shown in Table 2-1 all relevant site types are considered.

Table 2-1: Tentative checklist of indicator species for result-oriented grassland AEM in Brandenburg outside of Natura 2000 areas (Matzdorf et al. 2007, slightly changed)

Table 2-2 shows the quality of the grassland samples for two different thresholds. Ultimately, the threshold of four indicator species has been recommended. Besides the fact that our findings have shown that this number correlates with grassland of good nature conservation quality, it was also a pragmatic decision. Using this threshold, Brandenburg is able to realize a co-finance model within the German federal program ‘Gemeinschaftsaufgabe Agrarstruktur und Kuestenschutz’ (Deutscher Bundestag 2005). However, the definition of a threshold for eligible areas is finally a political decision.

Approx. 30 % of the total grassland in our database would meet the threshold of four indicator species. The percentage of the areas supported by A1 is little higher (36 %). We could demonstrate with our results that eligible sites are distributed throughout Brandenburg and on all relevant sites (Matzdorf et al. 2007).

Nevertheless, these findings are based on a heterogeneous secondary data set. Moreover, a method for a simple and robust eligibility check of the indicator species has to be defined, one that is suitable for use by farmers. Therefore, during the summer 2007 over 200 field samples were investigated to verify the indicator checklist and to test a proper method for the eligibility check.

In 2008 Brandenburg is introducing a test run of a roAEM using the verified indicator check list. Admittedly, this roAEM will be offered in addition to the A1. For this reason, this roAEM could be interesting for farmers who are not able or not willing to use their whole grassland in line with the A1 requirements. These farmers can participate with single grassland fields in the case that these fields exhibit the required quality.

Table 2-2: Quality criteria corresponding with two thresholds of indicator species

2.2.3 Supporting high nature value grassland habitat types inside of Natura 2000 areas

In opposition to our recommendation outside of Natura 2000 areas, we suggest supporting a horizontal grassland AEM in terms of A1 within these areas. The Habitat Directive requires not only a long-term conservation, but also an enhancement of the nature conservation quality of Natura 2000 areas. In these target areas for nature conservation, the society should have to accept the risk associated with the potential lengthy process of enhancing the quality of grassland.

Still, there are very good conditions for using result-oriented incentives as an additional measure. Thanks to the spatial identification and a specific definition of the habitat types of community interest inside of Natura 2000 areas by characteristic species, incentives are quite easy to design and to implement.

We recommended, with the up-date of the mid-term evaluation of the AEP in Brandenburg, implementing a result-oriented top-up AEM (in addition to the horizontal AEM) for the three grassland habitat types of Community interest shown in Table 2-3.

The objectives of this top-up roAEM are i) to preserve and enhance previously identified high nature value grassland habitat types respective of the Habitat Directive and ii) to realize individual adapted management systems with high flexibility for farmers.

An extensive use as required in A1 or even in organic faming grassland management is at least necessary to prevent an intensive use of these typical habitats formed by traditional extensive management systems. However, in order to conserve and to enhance these landscape features, specific management is needed (COM 1999, Beutler and Beutler 2002).

Standardized management guidelines, as typical for action-oriented AEM, do not seem to be an appropriate instrument. In fact, an individually adapted management, considering the current status of each habitat, would be much more effective. The design and implementation of the result-oriented incentives could be linked to the mandatory monitoring systems for these habitat types to reduce transaction costs. Characteristic indicator species for each habitat type are still defined and could be used directly for result-oriented approaches.

Table 2-3: agriculture-depending grassland habitat types of the Habit Directive in Brandenburg

2.3 Designing Result-oriented AUM Aiming at Water Quality

2.3.1 Weaknesses of the current support system

The reduction of water pollution is the main objective of the Water Framework Directive (WTD) (Directive 2000/60/EC). In Germany, agriculture has been estimated to contribute 62 % of non-point-source pollution of surface waters (UBA 2004). WTD aims for a “good ecological status” of surface waters by 2015. For this goal to be realized, integrated river basin management plans need to be in place by 2009. With regard to the reduction of water pollution, legal instruments (command-and-control) play an essential role under consideration of the polluter-pays-principle. Cross-compliance links the legal requirements with the subsidy system of the CAP. However, even voluntary AEM can make a contribution to the integrated water management with regard to the reduction of non-point-source pollution. But there are reasonable doubts about their effective contribution. ‘Thus it is questionable how far AEPs can contribute effectively to resolving chronic problems of water pollution’ (Baldock et al. 2002: 76). On the one hand, horizontal AEM can make a contribution in supporting extensive management systems in a broad area. On the other hand, the effectiveness depends highly on the specific site conditions. To make a serious contribution for the WFD AEM have to be more target-oriented. Otherwise, the positive impact of horizontal AEM can be seen more as a ‘by-product’ of the AEM. Our impact assessment of the AEM on water quality in Brandenburg illustrates this issue.

The reduction of fertilizer input is a main objective of the AEP in Brandenburg (MLUR 2000). The environmental data show that there is no need for further reduction of agricultural-sourced phosphorus and potassium in Brandenburg (Matzdorf et al. 2005). Even though the nitrate surplus on the agricultural land in Brandenburg is relatively low (Kersebaum et al. 2006), the reduction of N-loss from agriculture represents the main environmental objective with regard to water quality (MLUV 2005).

In 2004, subsequent AEM caused a reduction of N-input or a run-off of fertilizer: A1, A2, B1, B3, B4, B5, B6 (for explanation see figure 2-2). These are 83 % of all AEM (Matzdorf et al. 2005). The portion of both horizontal AEM 'extensive grassland management' (A1) and organic farming (B3) on these relevant AEM is 85 %. The N-reduction effect of A1 amounted to 68 % and B3 amounted to 72 % compared to the permitted N-fertiliser input of 210 kg/ha/yr, according to the national standard of the 'Good Agricultural Practice' (GAP) (Piorr and Matzdorf 2004). In fact, because of the relatively low N-input, even for conventional (not supported) management and animal husbandry in Brandenburg, the effective potential to reduce N-leaching is relatively low. For instance, the average livestock density was only 0.6 LU/ha (Kersebaum et al. 2006). Additionally, climatic conditions in many parts of Brandenburg lead only to small amounts of groundwater recharge, especially in the groundwater-affected areas, where the water balance during the summer is sometimes negative. This reduces the overall risk of N-leaching. Taking the site-specifics into account, 73 % of Utilized Agricultural Area (UAA) in Brandenburg have very low or low vulnerabality to groundwater pollution (see Figure 2-4). It is not surprising that the percentage of AEM reflects this relation. The spatial analysis on a detailed level shows that only 27 % of the relevant AEM are implemented on vulnerable areas. Table 2-4 shows that the grassland AEM are less effective, especially under consideration of the spatial equivalence.

Figure 2-4: N-input reducing AEM of the AEP in Brandenburg in 2004
(own calculations based on data of Kersebaum et al. 2006 and IACS 2004, some UAA are not assessed)

Table 2-4: N-input reducing AUM in groundwater pollution areas in Brandenburg (2004)

2.3.2 Using simulated nitrate leaching figures

As we demonstrated in our impact analysis for Brandenburg, there is a high potential for improving AEM aimed at reduction of nitrate leaching. One way to improve such AEM could be a site specific premium depending on spatial vulnerability. We wanted to go one step beyond and developed a first example how to use simulated nitrate leaching figures for a result-oriented incentive. We used N leaching figures from the root zone. By doing so, we could integrate the aspects of the N-input reduction potential of different management systems and the site conditions in a flexible premium.

Simulated figures present an opportunity to implement result-oriented approaches for such issues, where a direct link to the desired environmental goals is not possible. Water quality represents such an issue. Because of non-point-source pollution and the time lag, incentives for the reduction of nitrate leaching can not be directly linked to the water quality.

There is another advantage to the use of simulated figures. With the use of measured environmental indicators, there is always the risk for farmers that indicators are not only dependent on the current agricultural use but also on historical use or even on other users or impact factors (e.g. Lowe et al. 1999, Baldock et al. 2002). Compared with the application of measured environmental indicators within the incentive design, there is no risk to the farmers when using simulated figures. The incentives depend only on the variable integrated in the model. Naturally, this is an advantage on one hand, and a disadvantage on the other. The flexibility of farmers and the potential for innovation and the dynamic efficiency is not so great compared with the situation were measured indicators are used.

In our case study the process-oriented model HERMES (Kersebaum, 1995) was used for the simulation of N-dynamics. The model requires only a limited number of usually available input data and has been validated on different scales under similar climatic and land-use conditions. The model consists of sub-modules for water balance, N-transport and transformations, crop development, and growth including N-uptake (Kersebaum and Beblik 2001). The simulation was carried out for four different management systems: i) extensive grassland management (including grassland management of organic farming), ii) conventional grassland management, iii) organic farming on arable land, and iv) conventional farming on arable land. For arable systems, seven rotations attributed to classes for the soil index (Kersebaum et al. 2003) were defined for conventional and organic farming systems separately. This results in ten different soil-attributed crop rotations for each farming system. The crop-management systems for organic farming and the extensive grassland management system for organic and conventional farming were defined according to the specifications of the agri-environmental measures. Intersections of thematic maps for soils, groundwater level, land use, and land parcels result in a map with about 420,000 polygons. To reduce simulation time, the data were aggregated into classes, and the number of different class combinations resulted in 9,600 cases which were simulated with the model. (for more detail, see Kersebaum et al. 2006). To identify the spatial distribution of arable and grassland, data of the Integrated Administrative and Control System (IACS) were used at the spatial administrative level of ‘flur’ (land parcel approx. 190 ha). Based on simulated N leaching from the root zone of the four farm management systems we calculated the possible reduction for three scenarios at the polygon level:

1.) Conversion of conventional arable land into extensive grassland, 2.) Changing conventional arable land into organic arable land (following the current AEM),

3.) Changing conventional grassland into organic grassland or extensively used grassland (following the current AEM).

Next, we aggregated the results for each ‘flur’. Finally, we present the reduction potential for three different management adaptations spatial explicitly for the whole relevant area of Brandenburg (Figure 2-5). The average N reduction for all of Brandenburg for the first scenario was 44 kg N ha^{-1}, for the second scenario 20.1 kg N ha^{-1} and for the last only 5.8 kg N ha^{-1}.

Based on these findings, a result-oriented premium can be designed depending on the reduction of N in kg N ha^{-1}. However, more variety in the management adaptations (more than three) would increase the flexibility of farmers and increase the advantages of roAEM. In principle, the implementation could be relatively easy to realize. Of importance seems to be that the whole farm area is comprised. Starting point could be the definition of a reference figure for N leaching at the farm level based on simulated figures under conventional production and under consideration of the legal requirements. Depending on management adaptations farmers would be remunerated for the reduction of kg N ha^{-1} at the farm level. Using geo-referenced simulated N leaching figures, the calculations require little effort and transaction costs are proportional. Since 2005, the IACS has been linked to geographic information systems at the level of ‘agricultural parcels’ which support such a site-specific approach. These ‘agricultural parcels’ can be used to assess the site potential for N-leaching of relevant management adaptations at a very detailed level. In Brandenburg, for example, the advantage size of IACS land parcels is 19 ha. Even more important is that all supported areas within the CAP are administrated at this level.

Figure 2-5: Potential for the reduction of N-leaching from the root zone caused by three different AEM: a) Conversion of conventional arable land into extensive grassland, b) organic farming on arable land, c) extensive grassland management (including organic farming on grassland) in Brandenburg.

3. DISCUSSION AND CONCLUSION

In our paper we have given examples of how current AEM could be enhanced and designed more efficiently with regard to specific environmental objectives. We took the assessment of and discussion on horizontal ‘broad and shallow’ AEM as starting point to introduce examples of result-oriented incentives within the AEP.

a) b)

The main lack of effectiveness of horizontal AEM is caused by their main characteristic: no specific environmental objectives targeting on and seeking at a high participation. Analyzing the impact of such AEM for specific environmental objectives such as ‘biodiversity’ or ‘water quality’, results have showed that these AEM quite often less effective. The question has been how can AEM be designed in such a way that farmers get incentives not only to participate but also to produce something – the environmental goods? We argued that one of the interesting sources for improving AEM is to increase the flexibility for farmers accompanied with more responsibility for the desired environmental goals. We call incentives in our context targeting this issue ‘result-oriented’ and discussed the advantages of this approach with regard to AEM. In fact the main challenge is to operationalize environmental objectives useable for result-oriented incentives in practice. By giving tree example dealing with the issue of biodiversity and water quality we wanted to force the research on the development of that kind of incentive instruments.

In our first example, we adapted an existing approach (Oppermann and Gujer (ed.) 2003) to develop a roAEM for ordinary extensive used grassland outside of Natura 2000. We showed the development of a suitable indicator set to remunerate the ‘production’ of species-rich grassland outside of nature conservation areas. An adapted approach will be used within the regional AEP in Brandenburg during the next planning period (2007-2013). In Germany, this kind of roAEM will be implemented also in other federal states, e.g. Lower Saxony and Schleswig-Holstein. For Lower Saxony, Wittig et al. (2007) developed a similar indicator-based approach.

Contrary to Baldock et al. (2002) arguments concerning the implementation of ‘broad and shallow’ AEM, we recommend to replace the horizontal A1 (see figure 2-2) outside of nature conservation areas by a roAEM. In Brandenburg, the question within the horizontal grassland AEM was why should the society take over the risk of ineffectiveness in areas of no specific interest?

In our second example we look at Natura 2000 areas as the most important instrument in context of biodiversity policy in Europe. Some of the target habitat types are cultivated grassland habitats which need a specific extensive grassland management. Using the mandatory monitoring efforts, a roAEM could be designed and implemented quite easily using the characteristic indicator species of the habitat types. In the framework of the existing instruments in Brandenburg, we recommend an additionally incentive to design a result-oriented top-up premium.

With our third example we want to broaden the discussion about roAEM by using simulated environmental figures for this approach. One of the main problems of roAEM is the risk for farmers that the outcome depends not only on the farmers` efforts but also on outside influences such as weather conditions or even time lags in the causes-and-effects chain (e.g. Lowe et al., 1999, Baldock et al. 2002). An important issue in this context is water quality. In most cases the water quality does not only depend on the management of a single farmer and time lags are typical in this field. By using simulated nutrient leaching the issue of non-point pollution can be solved for our problem. We introduced in our paper an example of how simulated nitrate leaching figures can be used to design result-oriented incentives. The relevance of that kind of incentive is increasing due to the implementation of the Water Framework Directive during the next few years. Without going into more detail in this paper, our approach can be used as a starting point to think about the introduction of trading approach instances of AEM.

In our paper, we did not discuss the problem of how to calculate the premium for roAEM. At present payments for farmers are determined by reference to the compensation required to cover the loss of income entailed by complying with specific environmental restrictions and the management cost of actions required. The concept of result-oriented incentives fits much better to willingness-to-pay or even willingness-to-accept methods. However, there is a problem using these methods in the framework of the CAP, not the least caused by the WTO negotiation. Nevertheless, the premium for roAEM can be calculated using a reference management system which is identified as suitable.

There is no question that the result-oriented approach is only one option to enhance the effectiveness and efficiency of AEM. This kind of incentive is not suitable for all environmental issues. Additionally, the possibility of implementation depends on the specific AEP, the whole environmental and social objectives, and the institutional framework. Considering the question of acceptance, ‘broad and shallow’ AEM can be helpful for the agi-environmental policy. The combination of ‘broad and shallow’ AEM with a top-up result-oriented incentive can be an especially interesting alternative to get more practical experiences.

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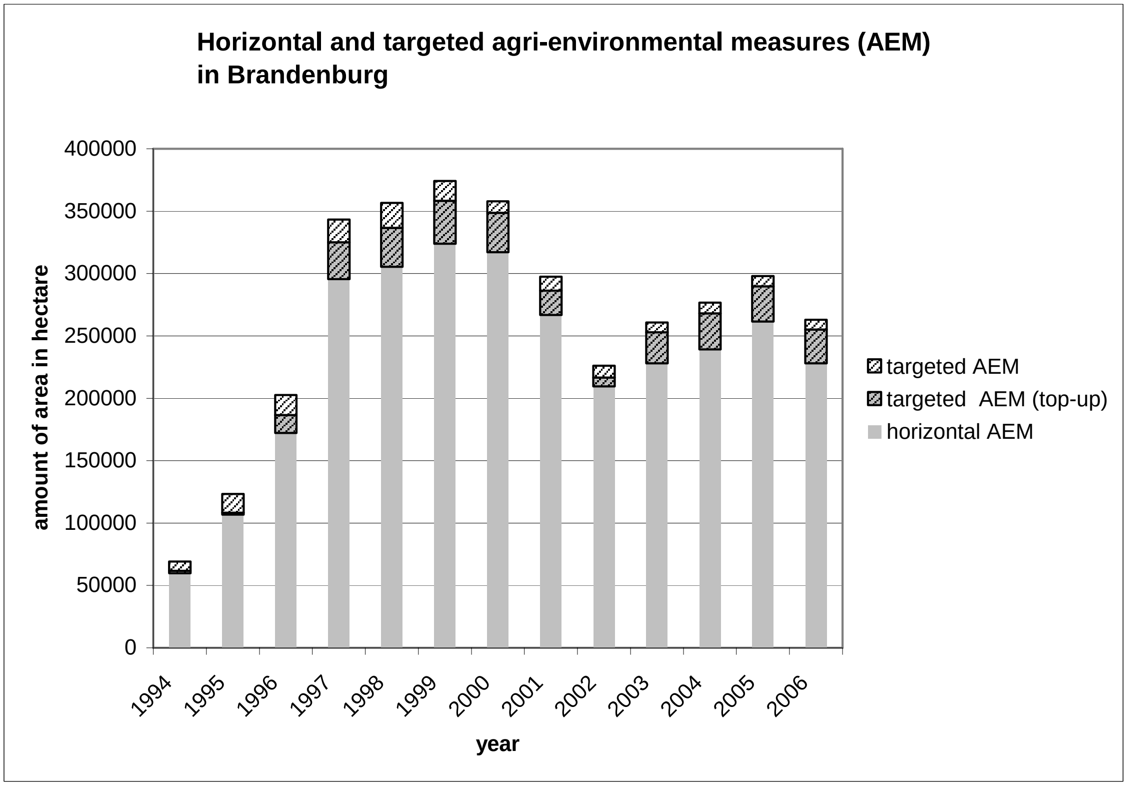
Schleswig-Holstein
Hamburg
Mecklenburg-
West Pomerania
Bremen
Lower Saxony
Berlin
Brandenburg
Saxony-Anhalt
North Rhine-Westphalia
Thuringia
Saxony
Hesse
Rhineland-
Palatinate
Saarland
Bavaria
Baden-Wurttemberg

Figure 2-1



AEM in 2004 (without modulation measures)

A6	Maintenance of extensive grassland and heath land through grazing
A7	Maintenance of traditional orchards
B6	Permanent set-aside of arable land
A3	Late and restricted mowing
A4	Small-scale grassland management
A5	Maintenance of grassland management in ‚Spreewald'
A1	Extensive grassland management
A2	Extensive management and maintenance of wetlands (floodplains)
B1	Integrated farming (vegetables and fruits)
B3AL	Organic farming arable land
B3GL	Organic farming grassland
B4	Erosion reducing/ soil-conserving measures
B5	Conversion of arable land into grassland
D	*Maintenance and conservation of ponds*

Figure 2-2

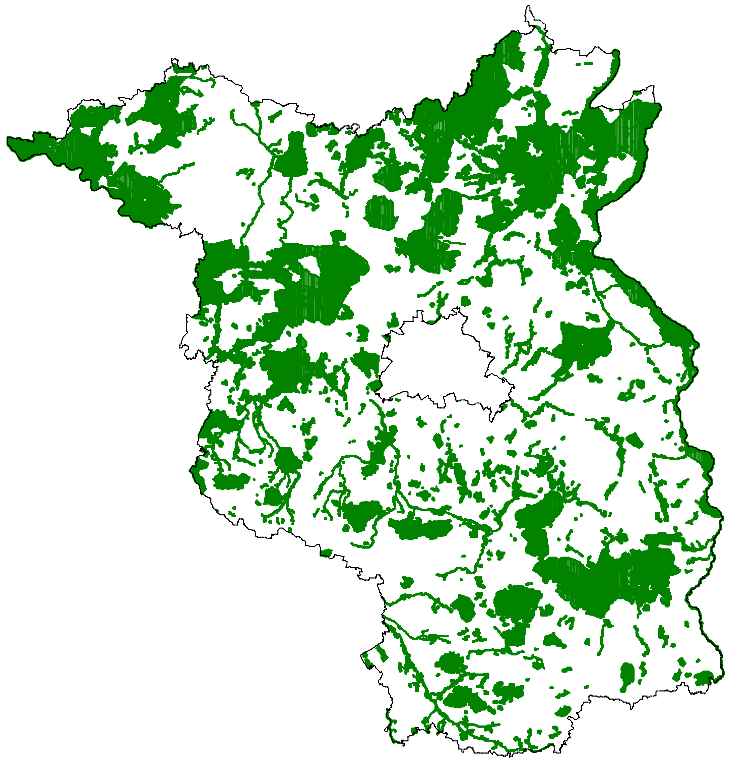


Figure 2-3

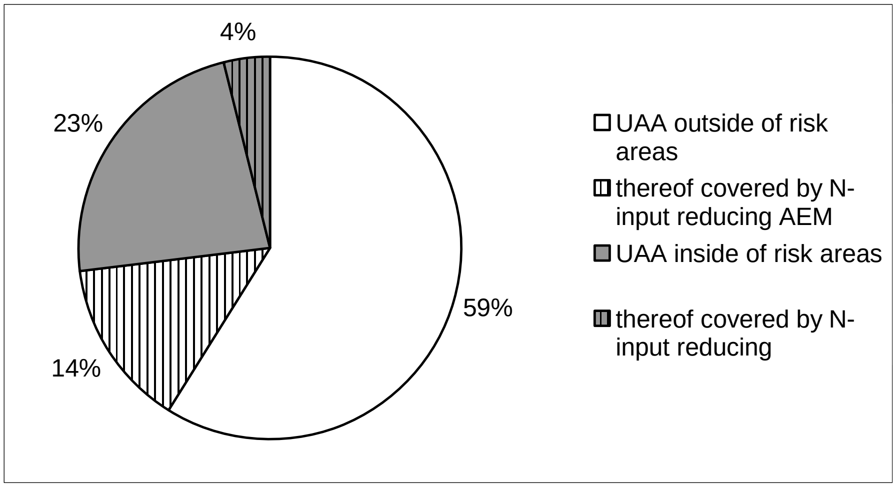

4%
23%
59%
14%
UAA outside of risk areas
thereof covered by N-input reducing AEM
UAA inside of risk areas
thereof covered by N-input reducing

Figure 2-4

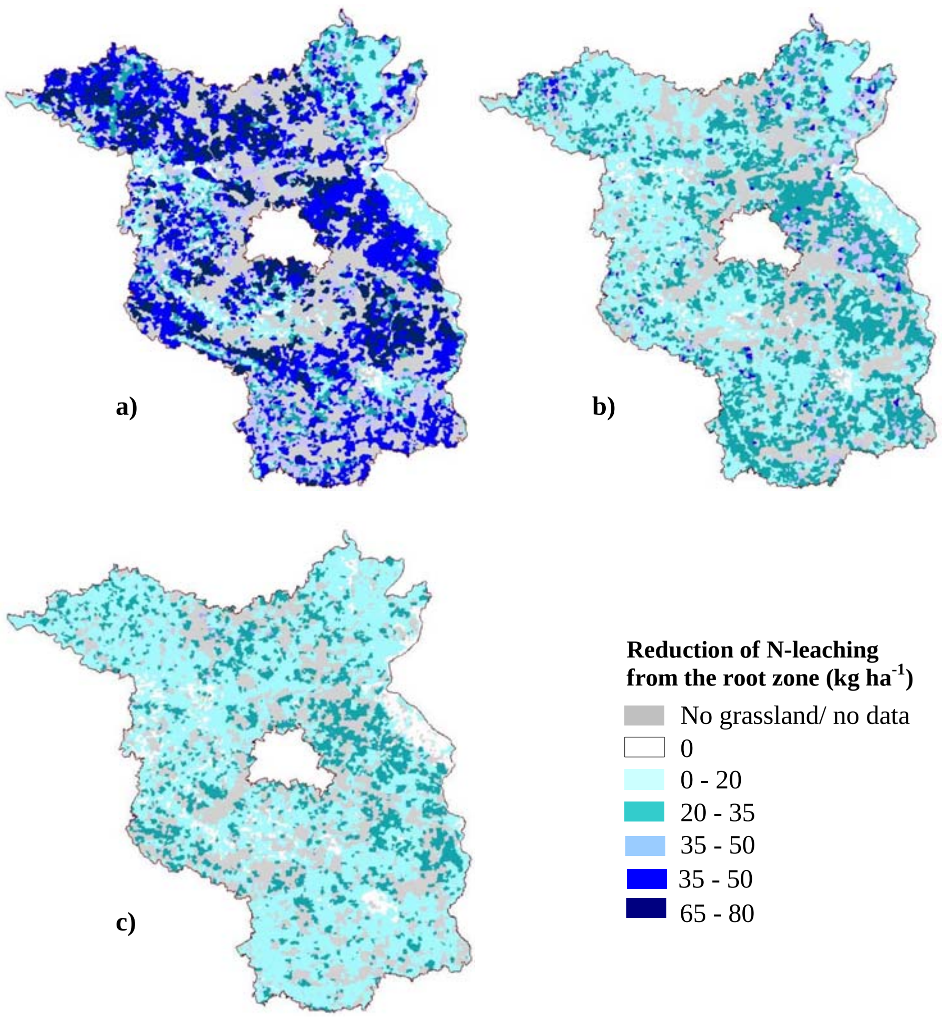

a)
b)
c)
Reduction of N-leaching
from the root zone (kg ha-1)
No grassland/ no data
0
0 - 20
20 - 35
35 - 50
35 - 50
65 - 80

Figure 2-5

Table 2-1: Tentative checklist of indicator species for result-oriented grassland AEM in Brandenburg outside of Natura 2000 areas (Matzdorf et al. 2007, slightly changed)

	species	moisture value**	Frequency (absolute) in our database (n=1547)				
			149 moderately dry	856 mesic	518 damp	24 wet	total %
1	Ranunculus acris, R. auricomus	6, x	10	298	186		31,9
2	Carex sp. (tall)*	8-9		120	337	11	30,3
3	Lychnis flos-cuculi	7	1	168	224		25,4
4	Trifolium pratense	x	30	218	51		19,3
5	Cirsium oleraceum	7		112	147		16,7
6	Galium album, G. uliginosum	5, 8	32	116	110		16,7
7	Lathyrus pratensis, L. palustris	6, 8	6	102	137	1	15,9
8	Lotus corniculatus, L. uliginosus	4, 8	13	101	129		15,7
9	Carex sp. (small)*	8-9	7	66	80	2	10,0
10	Lythrum salicaria	8		34	109	4	9,5
11	Achillea ptarmica	8	1	67	69	1	8,9
12	Stellaria palustris, S. graminea	9, 4	1	50	69	2	7,9
13	Campanula patula, C. rotundifolia	5, x	23	86	10		7,7
14	Daucus carota	4	33	71	11		7,4
15	Cardamine pratensis	6		28	67	1	6,2
16	Centaurea jacea, C. scabiosa	5, 3, x	22	62	10		6,1
17	Leucanthemum vulgare	4	6	65	16		5,6
18	Armeria maritima ssp. elongata	3	51	32			5,4
19	Anthoxanthum odoratum*	x	11	42	25		5,0
20	Cnidium dubium	8		33	41		4,8
21	Lysimachia nummularia	6		22	48		4,5
22	Pimpinella saxifraga, P. major	3, 5	15	27	21		4,1
23	Hieracium pilosella	4	32	10	1		2,8
24	Knautia arvensis	4	20	13	1		2,2
25	Inula britannica	7	1	16	17		2,2
26	Silene vulgaris	4	14	16	1		2,0
27	Potentilla erecta	x		10	16	1	1,7
28	Tragopogon pratensis, T. dubius	4	10	13	1		1,6
29	Luzula campestris*	4	2	12	4		1,2
30	Saxifraga granulata	4		7			0,5

* Grasses and grass-like plants

** after Ellenberg et al. 1991 gives information on major dissemination with regard to water supply

Table 2-2: Quality criteria corresponding with two thresholds of indicator species

number of indicator species	site group	number of species	number of species indicating extensive use	number of endangered species
3	mesic to moderately dry	29,4	4,3	0,7
4		32	5,5	1
3	damp	25,6	5,8	1
4		29,8	7,5	1,5

own calculation, data source HUB 2003, field sample n=391

Table 2-3: agriculture-depending grassland habitat types of the Habit Directive in Brandenburg

Grassland habitat types	Area in Natura 2000 (ha)
Molinia meadows (# 6410)	889
Alluvial meadows of river valleys of the Cnidion dubii (# 6440)	1,201
Lowland hay meadows (# 6510)	3,728
total	**5,818**

Data source: LUA 2004

Table 2-4: N-input reducing AUM in groundwater pollution areas in Brandenburg (2004)

	Area in %								
N-risk	**A1**	**B3AL**	**B3GL**	**A2**	**B1**	**B4**	**B5**	**B6**	**total**
very low	80	47	75	88	60	53	51	82	64
low	9	13	9	2	12	14	17	0	11
medium	7	19	10	7	17	13	20	14	13
high	3	21	6	3	11	18	11	0	11
very high	0	1	0	0	0	2	0	0	1

own calculations based on data of Kersebaum et al. 2006 and IACS 2004