Changes in Farming Systems, Landscape, and Nature: Key Success Factors of Agri-Environmental Schemes (AES)

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Abstract

This paper deals with changes in farming systems and nature conservation. The main questions asked are:

- How are changes in farming systems influenced by agri-environmental schemes (AES)?
- What makes AES successful?
- Which criteria can be used to target schemes and to evaluate their effectiveness?

Focus is on grassland-based farming systems in mountainous areas; the present situation and the relevant trends in Germany; the immediate and longer term effects on nature conservation; the question why a detailed understanding of the ecological links between farming practices and wildlife value is necessary in order to formulate clear and effective policies.

The paper starts with a brief overview of trends in agricultural structures and production conditions in relevant regions of Germany. A major trend, the continuing concentration of crop and livestock production in areas with intensive farming and the decoupling of less favoured areas from mainstream production, is discussed. The corresponding changes in farming systems and their impact on biodiversity provide the background for a discussion of the experiences with AES. The question of assessing the 'success' of AES is discussed in terms of the expected changes and a comparison with the actual outcome. In the conclusions it is emphasized that AES cannot overcome mainstream economics, because by their very nature they should be site-specific and focused on particular problems and potentials. A significant deficit is seen in the lack of complementary programmes which support investments aimed at the promotion of structural and long-term changes. Examples are the improvement of more decentralized, regional and local marketing structures, and the the establishment of biotope networks in mixed farming areas.

1. Changes in farming systems and their impacts on biodiversity

1.1 Trends in agricultural structures and production systems

Agricultural change can be characterized by the continuing concentration of crop and livestock production in areas with intensive farming and the decoupling of less favoured areas from mainstream production. Mixed farming used to be the dominant type of farming in almost every German region until the early 1950s. With market conditions and policy as driving forces, improved technologies and extension, farmers turned their farms into specialised production systems. Today mixed and traditional low external input farming systems have, in terms of production, almost completely been replaced by more intensive systems and by large- scale farming.

As for grassland-based farming systems there has been a strong tendency towards the abandonment of semi-intensive mixed farming with dairy cows as well as of rough grazing systems with sheep. The general trend is that the meadows which are remaining in production are intensively managed. Grassland used as pastures has decreased substantially. Simultaneously, dairy farming has moved from more hilly grassland areas - the traditional beef and milk producing areas - to more central mixed farming areas with more capital intensive indoor production systems.[1] Modern milk and beef production is characterized by relatively high inputs of silage maize (which has a much higher labour productivity than grazing systems) and concentrate feed. Where grassland still plays a role it will be highly intensive systems with 2-3 cuts per year mainly for silage, and over 200 kg nitrogen fertilizer per hectare. With the more restrictive milk market policies (milk quota, outgoers premium for dairy farmers) a slight increase in suckler cows can be observed particularly in the more mountainous grassland areas. Recently, this trend was supported by the BSE crisis and the corresponding consumer reactions and increased demand for high quality beef.

1.2 Impacts on biodiversity

Changes in farming systems are inevitably linked with impacts on biodiversity. Regionally, they led to the loss of richly structured and ecologically valuable landscapes and to an unprecedented reduction of species diversity manifesting itself visibly in the Red Lists of endangered plant and animal species. With the decline in traditional farming systems their very significant contribution to the enrichment of biodiversity was lost too.

In the Convention on Biological Diversity (Articles 6b, 7c, 10a and b, and 14) and the European Union's 5th Environment Action Programme agriculture has been identified as one of the key sectors impacting on the natural environment. ECNC (1997) describes the situation as follows:

Europe's biological and landscape diversity is one of our greatest riches. It is

[1] See for example Baldock et al. 1996, European Commission 1997, Knickel 1994, 1997, and SRU 1985.

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a heritage passed down to us over thousands of years and linked to other natural systems worldwide. We have a shared responsibility to pass this heritage on to future generations as a diverse and sustainable system. Europe's natural diversity is in decline, however, the decline is rapid and continuing. Across the continent, valuable and characteristic habitats are suffering serious damage; this has led to decline in the diversity, number and range of a wide variety of species, habitats and landscapes. Traditional man-made landscapes, as well as natural and semi-natural habitats of European importance such as coastal zones, marine areas, wetlands, forests, mountain areas and grasslands, are under threat; so are many wild plant and animal species. The most obvious issues are changes in land use, and reduction in area of natural and semi-natural habitats, with their resulting fragmentation.

In the study Europe's Environment: The Dobris Assessment (EEA 1995) indicates that the abandonment of traditional farming systems has been the major cause for the deterioration of landscapes and the natural environment on the Pan-European level. Traditional farming has given way to intensive agriculture, a process accelerated by subsidies. Most semi-natural, species rich grasslands and breeding areas for meadow birds were lost.

In terms of agricultural practices, management intensification as well as the complete abandonment of farming are both threats for biodiversity. The precise connections between the loss of biodiversity and agricultural change are seen above all in the extension of field units and loss of field margins, drainage, conversion of grassland to arable land in lowland areas, the intensification of animal husbandry, and high levels of fertilizer and pesticide use. A comprehensive review of the interdependencies between agriculture, environmental protection and the conservation of wildlife and landscape in Germany was provided in 1985 by the Council of Environmental Advisors to the Federal Government with a more recent edition in 1996 (SRU, 1985, 1996).

With respect to a reduction of conflicts and negative impacts it is still a predominant position that agricultural production should be concentrated on the best, most fertile land so that the marginal land can be preserved for wildlife and natural areas ('segregation model'). The alternative 'integration model' recognizes the vital role of agriculture for the management of landscapes and semi-natural habitats as well as for the maintenance of biological diversity. The aim then is to work towards reintegrating agriculture into ecosystems, for example by stimulating an environmentally friendly management of agricultural land, including organic farming methods. Cropping systems that are in harmony with the ecosystem and that allow to crop the land and to provide habitats for wildlife in the same hectare need to be developed and supported through agri-environmental policy (see section 4).

The maintenance of cultivated landscapes is a good example that shows that integration is a necessary precondition for the conservation of ecosystems and landscapes, traditionally linked to agricultural production.

Figure 1 gives a simplified picture of the agricultural system which is characterized by socio-economic, political, and ecological sub-systems which are closely interrelated.

2. Aims and effectiveness of agri-environmental schemes (AES)

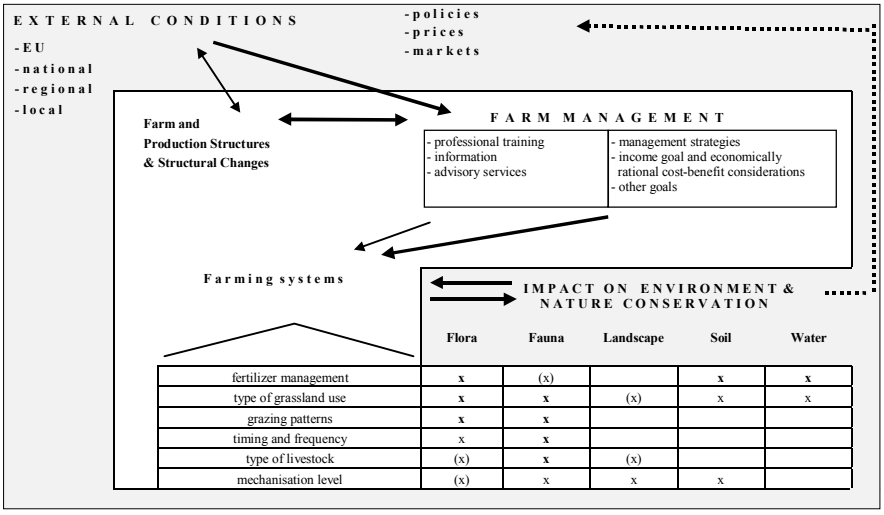
2.1 Aims

AES under Council Regulation (EEC) 2078/92 reflect the strategy to integrate environmental concerns in all Community policies. Article 1 of Reg. 2078/92 refers to three objectives: (1) contribution to a reduction of agricultural production, (2) protection of the environment and (3) income support of farmers ("contribute to providing an appropriate income for farmers"). The income objective can be linked to environmental goals in so far as it relates to an income sufficient for continuing farming and avoiding land abandonment, which is an important goal from an environmental point of view.

The Regulation acknowledges that farmers have an important function as stewards of the countryside. Its main aim is to encourage higher environmental standards of land use. The cost of the programmes is shared between the European Commission and the Member States.

2.2 Uptake and experiences

The following review of uptake of AES as well as the assessment of effects and experiences is based on a desktop analysis of a wide range of evaluation studies and a range of complementary information sources. The sources include evaluation reports at EU level, particularly the reports submitted to DG XI in 1998 (BALDOCK et al 1998) and the research report 'Implementation and effectiveness of agri-environmental schemes established under Regulation 2078/92' (SCHRAMEK et al. 1999) as well as national reports such as the evaluation of the 2078/92 programmes in Baden-Wuerttemberg, Bavaria and Hessen.



x = more important correlations; (x) = only limited direct connections; other: no direct interrelationsships.
Source: Own compilation

Figure 1: **External conditions, changes in grassland-based farming systems and impact on the environment**

Table 1: **Measures relating specifically to grassland-based farming systems**

No.	Type	Description
1.	Extensification of grassland (according to Reg. 2078/92, Art. 2.1b+c)	This group comprises (i) extensification schemes that aim at reducing nutrient inputs, erosion, livestock density (protection of abiotic resources); and (ii) schemes addressing the preservation of specific biotopes, habitats, animals or plant types in specific areas (protection of biotic resources).
2.	Reduction of livestock density	s.a.
3.	Conversion to or maintenance of organic farming (Art. 2.1a)	All measures that promote organic farming according to Reg. 2092/91. Additional conditions are: no conversion of grassland into arable farming land and restrictions regarding livestock keeping. The measure can be applied only to the whole farm.
4.	Protection of the environment, natural resources, and maintenance of the countryside (Art. 2.1d)	Measures aimed at the conservation and development of biotopes in high quality natural areas.
5.	Rearing of local breeds in danger of extinction (Art. 2.1d)	Special measures to preserve animals or specific breeds.
6.	Maintenance of abandoned areas	Measures to maintain abandoned fields; they are often part of a cultural landscape programme (*Kulturlandschaftsprogramm)*
7.	Maintenance of traditional farming systems / land use	Measures aimed at the maintenance of traditional and often region-specific agricultural farming systems and land use types.
8.	Basic support for environmentally sound land use	Bavaria and Saxony offer a so-called basic support meant as a basic payment for the maintenance of the cultural landscape (*Grundfoerderung*).

Source: Own compilation

Uptake of the measures is relatively high in Germany, particularly if compared with the situation in most other EU member states. In the period 1993-1996 an amount of 1.1m ECU was paid to farmers under 2078/92, of which 0.6m ECU came from the EU-Budget. The total agricultural area involved was just above 5 million hectares (BMELF, 1996). In 1997, approx. 37 per cent of total UAA was under 2078/92. Generally, however, there is a very substantial regional differentiation in uptake rates ranging from 1.3 per cent (Schleswig-Holstein) to 87 per cent of total UAA (Bavaria) (1996). Other Laender with high uptake rates are Saxony with 64 per cent, Baden-Wuerttemberg with 56 per cent and Saarland with 41 per cent.

From the total permanent grassland area of almost 6 million hectares (35% of UAA), 1.35 million hectares or 23 per cent were under 2078/92 in 1996. Premia for grassland are on average 140 ECU/ha with a maximum of almost 500 ECU/ha for very restrictive management agreements. An important factor affecting the scale and intensity of grassland use, and - related to that - the participation in grassland-related measures is the common market and price policy. With the reductions in cereal prices as part of the 1992 reform of the Common Agriculture Policy of the EU (CAP) (and the resulting price reductions for concentrates) as well as the premia paid for silage maize, the competitive position particularly of traditional grassland-based systems has worsened, an effect which is only partly compensated by the 2078/92 premia. As a result roughage is on most farms restricted to the essential minimum feeding requirements.

Table 1 presents the measures which relate specifically to grassland-based farming systems. The most important problems addressed with the measures are related to the intensification of grassland management, drainage, irrigation, ploughing, the use of fertilizers, and biocides and land abandonment.

The general trend for all AES in Germany is that the highest uptake can be found in regions that have higher proportions of lower productivity land (*Mittelgebirgsregionen;* upland and montainous regions) accompanied by livestock farming (mainly sheep and cattle farms). Uptake in intensively used regions with greater proportions of fertile arable land is relatively low. Particularly, measures which require significant adjustments and/or a significant level of investment find less acceptance. In regions with higher uptake production systems often had been extensive even before the introduction of the schemes.

In regions with higher uptake production systems often had been extensive even before the introduction of the schemes. The German Farmers Association emphasizes that farmers are active and supporting as long as the agreements are voluntary, and if premiums are sufficiently attractive. Farmers' reluctance concerning the adoption of measures which support the conversion to organic farming is partly explained by the relatively low financial incentives. Probably more important is the fact that marketing channels for organic produce are still too weak.

Some regulations underlying AES agreements appear unduly restrictive and a higher degree of flexibility could result in substantial benefits. The kind of restrictions partly explains poor take-up rates. A particular problem is that farmers' decision-making includes decisions on long-term land use such as drainage, irrigation, conversion of arable to grassland (or the opposite), abandonment, and afforestation as well as short-term management decisions about choice of crops, level and type of inputs, grazing, mowing etc (ANDERSON et al. 1999). Most measures, however, do not relate to considerations of long-term farm development.

Other agreements such as the support given to integrated farming are not sufficiently clear and restrictive in environmental terms. They merely provide an additional income to the farmers. When considering the results on uptake and performance effects, 2078-measures in intensively farmed areas are less effective in terms of participation rates and

area under contract. However, for this relatively small group of participating farmers improvement effects of 2078-measures upon the farm management have been obtained (ANDERSON et al. 1999).

Synergy effects between CAP compensation payments and Reg. 2078/92 can be observed in areas dominated by permanent grassland, particularly in Less Favoured Areas (LFAs). CAP compensation payments for beef, suckler cows, and sheep support the continuation of extensive farming in these areas, and thereby help maintain traditional farming landscapes with high biodiversity (GROIER & LOIBL 1999).

2.3 Effectiveness

Relevant criteria for evaluating the effectiveness of AES are: uptake rates; actual changes achieved (in farming patterns, in production systems / practices); stabilization of (often more traditional) high value systems; environmental effects and effects on nature protection (immediate and longer term); changes in attitudes; achievement of structural adjustments (in farm structure / farm development strategies); farm income effects (microlevel; absolute and relative); cost effectiveness of schemes (macrolevel: administration and control costs); and the public support for the scheme.

Both the maintainance of farm landscapes and farming systems which have proven their environmental value and the reduction of environmental problems can help to raise the environmental quality of the European agricultural environment. Some specific findings:

❶ A large proportion of Reg. (EEC) 2078/92 measures are adressed towards protecting and enhancing the cultural landscape. It reflects the fact that the economic support of marginal agricultural activities and compensation for natural handicaps have been a central concern in national agri-environmental policy agendas. 2078-measures represent an important income source in extensively farmed areas, and, subsequently, have a high impact on the survival of the farms in these areas. The main policy driving force in this case is the fact that the environment is threatened by abandonment and loss of cultivated or grazed land. The same strategy can be observed in respect of the implementation of Less Favoured Areas (LFAs) policy, as LFA-policy targets particular landscape-farming systems (such as extensive grazing on alpages) rather than economically marginal territories (BULLER 1999).[2]

❷ The limited effectiveness of measures related to integrated farming indicates that there is a particular need for clearly specified environmental objectives. Since at European level it is hardly possible to be more specific, it is necessary that Member States and regions define measures with specific environmental objectives in sufficient detail. A differ-entiation of the objectives of AES is in particular needed for different landscape and land use systems. This is often not the case (CARLSEN 1999).

❸ The support given for a conversion to organic farming has been very attractive for farmers. The farmers switching to organic production have seen their output per unit area decrease by around a quarter. On the other hand, the prices paid for organic produce are usually higher than for traditional produce. Although the demand for organic products has risen rapidly in recent years, their marketing still leaves a lot to be desired. The small amounts produced and the fact that organic produce is not always available makes it less attractive to retail traders, the food industry or wholesalers. In fact, a large percentage is sold directly to consumers.

❹ Experience shows that a significant proportion of farmers are willing to cooperate with local authorities in the framework of AES. Agreement holders generally regard the schemes as a secure source of additional income at a time of considerable pressure on producer prices. In most cases renewal of agreements is likely (>80 per cent of agreement holders). Hovever, at the same time relatively few non-agreement holders are likely to enter into AES in the foreseeable future. Payment levels are sometimes a less important issue in the decision to participate than the farmer's perception of the changes required or the uncertainty regarding possible income effects (which is often linked with a lack of suitable marketing channels for higher quality products). Payments alone do not seem to be sufficient to motivate these farmers to join the schemes. The studies available indicate that it is necessary to identify the more precise linkages between socio-economic systems and agro-ecosystems, i.e. stakeholder interests, constraints and opportunities, in order to set priorities and design measures accordingly.

❺ With regard to land use changes, such as converting arable to grassland, farmers often need a long-term perspective which is not the case for changing simple management practices. Thus land use changes in general are made as far as there is a perspective for several years whereas the intensity of farming more easily can be changed year by year. From the point-of-view of environmental sustainability, therefore, effects on land use are more effective compared to management effects (ANDERSON et al. 1999).

The available data on scheme uptake and effectiveness can be summed up as follows:

- uptake rates of 2078/92 measures are rather high in most German regions; however, measures which require more significant farm structural adjustments have very low rates of uptake;
- actual changes achieved in farming patterns are for some measures such as the conversion to organic farming very positive; however, the common market and price policy and other measures still have a more pronounced influence on production systems and farming practices;
- AEP are particularly important in terms of the stabilization of (usually more traditional) high value systems in many LFAs;
- positive effects on nature protection could be substantially improved if measures were more site-specific and result-oriented in terms of flora and fauna, key species, habitats, etc.;

[2] In Britain, the links between Less Favoured Areas (LFA) policy, upland grazing systems and environmentally sensitive areas (ESAs) is clear-cut. Similarly in France a large proportion of the original ESAs designated in the late 1980s and early 1990s are to be found in the mountain zones of the south east as is also the case for Germany. Indeed, in this latter country by far the highest proportions of farmers participating in agri-environmental schemes are found in the upland regions of the south (BULLER 1999).

- changes in attitudes among farmers are hard to assess but 2078/92 is clearly contributing to a better understanding of environmental values and to a better collaboration between farmers and conservationists;
- more emphasis should be given to promote structural adjustments on farms and to change farm development strategies; very important in this respect is the continuity of programmes and the improvement of the market potential for products from environmentally friendly farming;
- farm income effects are generally positive; for all measures there is at least a compensation of income losses, in some programme areas there is overcompensation and/or freerider effects;
- the cost effectiveness of AEP can be improved when the CAP as a whole becomes more consistent (through e.g. removal of premia for silage maize); some regulations are unnecessarily complicated and/or may better be implemented at a lower (local) level;
- public support for AEP is generally positive, particularly when compared with market and price policies and with other subsidies.

3. Improving the effectiveness of AES

The more recent development of the Common Agriculture Policy of the European Union (CAP) is characterized by a reduction of market and price support and an increase of resources devoted to AES. Another policy adjustment initiated with Agenda 2000 will link the aid for LFAs more closely with the principles of AES. Both changes are expressions of a trend towards a simpler, more understandable and more justifiable agricultural policy, and an increasing emphasis on the so-called European model for agriculture. Besides aiming at a competitive agriculture sector the main lines of this model are (European Commission 1997):

- production methods which are sound and environmentally friendly, able to supply quality products of the kind the public wants;
- diverse forms of agriculture, rich in tradition, which are not just output-oriented but seek to maintain the visual amenity of the countryside as well as vibrant and active rural communities, generating and maintaining employment.

3.1 AES cannot overcome mainstream economics

AES cannot overcome mainstream economics, because by their very nature they should be site-specific and focused on particular problems and potentials. The direction and dynamics of agricultural change, and, related to that, the inconsistencies in the overall CAP need to be taken into account when assessing the effectiveness of AES for at least two reasons:

- First, the development of excessively intensive farming practices and the specialisation of agricultural production (at regional and farm levels), has over a long time been driven by economic signals sent by national governments and the CAP. Undesirable practices and farm structures have to a considerable extent developed under the conditions of the CAP, and there still remain very substantial incentives to specialize and to intensify, thus counteracting AEP.
- Second, any concentration and intensification of production in some regions (with the resulting environmental problems) necessarily mean that other (usually more marginal) regions loose production functions and income opportunities (cf. KNICKEL & PRIEBE 1997, KNICKEL 1998). It follows that any stabilization of certain traditional farming systems without major changes in overall economic framework conditions (prices, costs, markets) and without major farm structural changes requires very significant permanent subsidies.

3.2 AES should explicitely support integration and sustainable farming systems

Many of the proposed measures do not consider the agricultural system as a whole, instead only focus on a sub-system or a specific aspect of farming. The consequence of this may well be that the positive aspects for the environment, achieved by compliance with commitments under AES, are neutralized by activities carried out on the rest of the farm. ANDERSEN et al. (1999) recommend that while the environmental objectives might be focused on a subsystem within the farm they should also regulate the activities on the rest of the farm so as to prevent negative interactions with the target activities. KNICKEL and SCHRAMEK (1999) stress that the design of AES measures should consider the farming system as a functional unit. The term sustainable agriculture comprises a number of relevant whole-farm-concepts such as low-input agriculture, organic farming, regenerative agriculture, bio-dynamic farming, ecological agriculture, and the like. Linking payments directly to more lasting changes in farming systems and to environmental outcomes rather than to short term adjustments in management practices offers the best chance for an efficient policy. *Figure 2* illustrates different levels of integration of agricultural and environmental goals.

Site-specific farming refers to the degree of 'appropriateness' of a farming technique for a specific site and time, according to the ecological and socio-economic conditions of the location. The aim being to apply ecological concepts, socio-economic needs and principles to the design and management of sustainable agricultural systems that are built upon the knowledge and culture of the local people.

Agricultural landscapes are linked with certain types and intensities of land use thus making patterns of farming (farming systems) visible. Semi-natural systems are dependent for their integrity on the continuation of certain human activities. Dairy farms using rotational grazing are capable of producing as much milk per hectare as conventional farms, while providing improved habitat for grassland wildlife, such as meadowlarks. It is not a perfect solution in terms of conservation, because disturbance by grazing cattle can reduce nesting success. However, habitat quality is clearly better than the large maize fields of conventional dairy farms. The overall result thus is positive. Integration is an approach that allows agriculture to remain part of a functioning agro-ecosystem; even though such cropping systems are not as pro-

ductive as high-input systems based on silage maize and high levels of purchased feed concentrates. At the landscape level agricultural activity can be integrated with biodiversity protection and management by incorporating mosaics of agricultural landscape characterized by small fields, shelter-belts, stretches of meadows, small ponds in fields and marshes showing very high biological diversity.

Agriculture has changed and will never be the same as in the 'good old days'. The challenge is to progress towards sustainable farming systems with a sound use of approporiate agricultural technology and a careful, efficient use of natural resources. The aim must be to use the ecological knowledge that is available in order to link long-term economic viability with environmental quality.

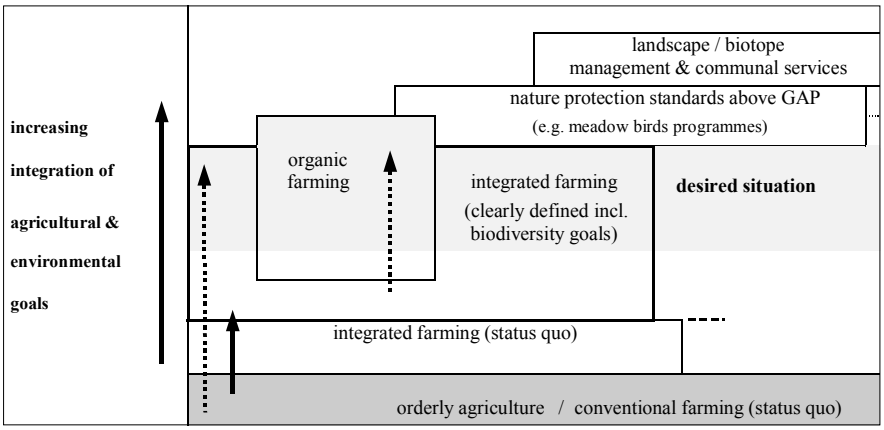


Figure 2: **Levels of integration of agricultural and environmental goals (Source: KNICKEL, 1999a, b)**

3.3 AES need to provide a regionally differentiated support framework

The promotion of large-scale agriculture based on uniform crop varieties and high input farming techniques has largely ignored heterogeneity, both environmental and socio-economic, that characterises farming systems. It is therefore important that the pronounced regional variation of agriculture and of types and intensities of land use is reflected in a rather broad and yet regionally differentiated agri-environmental policy framework. Regionally targeted measures are potentially more effective, as they are usually designed for more specific environmental objectives, and are better adapted to local conditions. An overall reduction in levels of mineral fertilizer application, in contrast, can more efficiently be promoted in a more cost effective way by economic instruments (such as a levy on mineral fertilizer).

A particular advantage of AES is that they have the potential to be very region specific. The variations in Laender programmes in Germany reflects differences in agricultural, infrastructural, and regional structures, in experiences with earlier programmes and policies, the particular political and institutional situation, traditions, the particular environmental problems and the available financial means. Schemes and payment levels need to be differentiated to reflect the specific environmental objectives and the situation of farming in the particular area. Horizontal measures should focus on more general objectives such as education and training (ANDERSEN et al. 1999). Local agencies should be allowed the discretion and budget to design and implement at least smaller components of AES without higher level (ministerial) authorisation.

3.4 AES need to be part of integrated RD programmes

The new EU Regulation on Rural Development (Reg. 1257/1999) recasts all the rural development schemes within a single framework, providing Member States with an opportunity of defining the priorities themselves and making their own choices among the schemes contained in the Regulation. These choices are to be incorporated into an overall programming frame.

While AES should play a very important role in RD strategies other policy instruments can be positively linked with AES.[1] Environmentally friendly agriculture should be considered as one of the main pillars for sustainable rural development. The integration of these different policies is very important since the success of AES is often dependent on other investment, training or marketing related measures. The RD Regulation provides the chance to improve the integration of existing structural and regional policy instruments such as the LFA scheme, LEADER, and Objective 1 and Objective 2-programmes (formerly Objective 5b-programmes) with AES (GROIER & LOIBL 1999).

The aim must be to make policies for the conservation of biological and landscape diversity mutually supportive with structural and regional policies, especially in the field of rural economy and extensive agriculture, thus changing the mainstream of fund-assisted development to sustainable development. With the RD Regulation measures in support for farming in LFAs can be favourably linked with a remuneration for agri-environmental activities, and with support for investments in processing and marketing facilities. At the same time AES can contribute to a sustainable and diversified use of renewable resources and the development of rural businesses and recreational activities (rural / green tourism).

3.5 AES are more effective when linked with food quality and marketing initiatives

While 'conventional' or 'mainstream' agriculture gives primacy to the economics and profitability of farming within a national and global context, sustainable agriculture implies a concern with the economic, environmental, and community aspects of farming within a local and regional context. The establishment and improvement of more decentralized, regional and local marketing structures, is an important aspect of this.

An increasing number of farmers and farmers' organisations produce regional

[3] BALDOCK et al. (1996) stress that, in terms of agri-environmental policy concerns for maintaining agricultural activities and, as a result, rural community viability in marginal and handicapped regions have married well with the emerging European interest in 'High Nature Value' farming and 'High Natural Value areas'.

quality products in a way which benefits the environment, nature, and the landscape. Food quality systems should be used to continuously improve the quality of products and operations in cooperation with farmers. The retail trade must ensure that the quality of foodstuffs meets consumer expectations, and it must be able to respond to demand, ensure the safety of foodstuffs, act efficiently in accordance with sustainable development, and strive for greater transparency. Increasingly, AES are being seen not only as vehicles for environmental enhancement, but also as a potentially important factor in marketing. The purity and safety, and high quality of livestock products from mountainous grassland areas should in this context be seen as a unique chance.

3.6 AES need to include suitable training components

Effective implementation and adoption of AES is largely dependent upon demonstrating their value to farmers. Local meetings for land mangers to explain the schemes are an effective way of increasing interest and ultimately participation. The experience shows that it is particularly necessary to educate farmers with regard to environmental concerns and with regard to identifying and exploiting new marketing opportunities (ANDERSEN et al. 1999). In particular in view of achieving durable changes in agricultural production models, farmers need to be convinced of the agronomic as well as the environmental and territorial value of AES. Training should build upon local knowledge and experience. Indoor sessions on topics such as innovations in weed management and ecological principles of grazing should be complemented with farm visits. Too often presented as 'new', 'different' or 'alternative' approaches to agricultural management, agri-environmental techniques need to be rooted in current farmer knowledge and experience, and in local conditions. Simultaneously advisory services need to work within the context of local experience and local concerns. This is not always the case, particularly for schemes that have been 'constructed' nationally and are merely implemented locally (BULLER & BRIVES 1999).

Making durable changes to farm management practices is often a multi-year process, as management decisions operate generally in the context of one-year cycles. Hence training should be ongoing and reinforcing, rather than an occasional seminar in a distinct educational centre. Those charged with the establishment and the implementation of AES need to take a more proactive role in creating suitable networks for the exchange and sharing of experiences in AES management and participation. BULLER & BRIVES (1999) stress that the establishment of a sustainable equilibrium between agricultural production, environmental protection and rural employment will in the long-term depend upon the recognition of mutual interests, the strengthening of local territorial identity, and the operationalisation of those policy-making and information frameworks that support them. They recommend to establish a communi-cation platform between farmers, conservationists, and other actors interested in the develoment of the particular region.

3.7 AES should be accompanied by a strong monitoring and evaluation system

Procedures that enable rapid feed-backs and learning processes are needed. Adequate monitoring and evaluation regarding environmental effects, and its feedback into programme and project steering is vital for the continuous improvement of schemes (KNICKEL & SCHRAMEK 1999, WILSON 1999). Monitoring can be very effective if the monitoring system is integrated into the general administration and control system outlined in Regulation (EEC) No 3508/92.

The control and monitoring of implementation, and the assessment of the environmental and economic effects of AES is crucial not only in respect of ensuring a continuous improvement of AES but also in order to back its credibility to the public and in the international context.

4. Criteria for targeting and evaluating AES in terms of biodiversity

In the final section an overview of criteria for targeting and evaluating AES in terms of biodiversity is given. Biodiversity is stressed for two main reasons: First, until now there is far too little emphasis on biotic resources and nature conservation concerns in the existing schemes. Second, a detailed understanding of the ecological links between farming practices and wildlife value is necessary in order to formulate clear and effective measures (KNICKEL 1999c).

The following overview of indicators related to biodiversity is derived from a study carried out at present and focusing on the situation in Germany. In this study it is tried to review and systematically compile the large and rapidly expanding body of literature on the connections between farming systems and their effects on biodiversity (KNICKEL 1999a). Central questions are: What do ecologists actually know about the minimum requirements of flora and fauna in agricultural landscapes? How are minimum requirements defined as related to agricultural land use patterns and practices? The study will have two major results: First, a data bank with detailed information on the connections between biodiversity and agriculture (studies, data, cross-references); second, an overall concept for including biodiversity objectives in the definition of codes of GAP.

A review of the large number of studies available points to the following criteria for targeting and evaluating AES in terms of biodiversity:

- farm: farm type; farming system (conventional, integrated, organic); livestock density (LU/ha); nitrogen (N) balance (kg / ha UAA);
- arable farming (land): levels of fertiliser use; N balance - arable land; use of pesticides / integrated pest control; cropping diversity (defined by the number of crops per rotation); average field parcel size (large fields indicate a more monotonous landscape with little intermediate elements like hedgerows, stonewalls and trees; visual feature and conditions for wildlife to survive are poorer than in a well structured landscape); percentage extensive / intensive crops; significance of crops that have a high average N surplus (oilseed rape, pulses);

- grassland: levels of fertiliser use; N balance - grassland; average field parcel size; percentage grassland with drainage; grazing regime (intensity, timing); grass cutting (frequency, timing);
- traditional farming systems: per cent of total UAA / AA; key management practices;
- area covered by high-value natural and semi-natural areas (defined as biotopes partly maintained by agriculture): per cent of total area / UAA /AA; smaller landscape structures; biotope types (red list); percentage nature management area; status of key habitats types; fragmentation of natural habitats (related to the interconnection between biotopes and straigthening the edges of biotopes as well as the visual feature of landscapes); stepping stones, single trees (number/ ha), etc.;
- linear landscape structures: per cent of total UAA (AA); field margins and buffer strips; density of linear structures (m / ha UAA); maximum distance of hedges (for birds, etc.);
- direct indicators of species diversity in a certain area: appearance of 'red list' or key species (species which react sensitive by changes of natural conditions) (per cent of total number of species; nnumber/ha); 'red list' biotopes (per cent total area/UAA/AA); population change of 'red list' / key / indicator species.

Source: KNICKEL (1999a,b)

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