Chapter 3

Evidence-based agri-environmental policies: The Swedish experience

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This chapter discusses the evaluation of agri-environmental measures within Axis 2 of the CAP's Rural Development Programme, focusing on methodological aspects. The evidence analysed is based on experiences from the recent mid-term evaluation of the Swedish Rural Development Programme, which is dominated (70%) by Axis 2 measures. The authors identify major weaknesses in the present evaluation procedure and suggest appropriate remedies. The weaknesses include, inter alia, vague concepts, insufficient availability of suitable methodology and lack of empirical data. A number of strong recommendations for improvement are formulated, which would jointly improve the objectivity and scientific rigour of the methodology as currently applied.

Agri-environmental schemes for the protection of the environment are common in many OECD countries. In the European Union, such schemes come under Axis 2 of the Rural Development Programme (RDP) (EU, 2005). Axis 2 accounts for 44% of the EU's RDP spending. Due to co-financing requirements, additional funds are allocated to those measures from member states' (MS) budgets. Altogether, about EUR 96.3 billion[2] will be spent for the period 2007-2013 on agri-environmental policies in the European Union. Hence, it is highly relevant to ask what those policies are actually delivering. The need to show value-for-money for European citizens is further accentuated by the present economic crisis and taking into account the many competing demands on the EU budget.

There is an extensive scientific debate about the efficiency of agri-environmental schemes as well as about the relative merits of the alternative designs of such schemes (see, for instance, the discussion in Primdahl *et al.*, 2010). As part of the RDP programmes, Axis 2 measures are subject to an institutionalised evaluation procedure based on a set of common evaluation questions and indicators (see Council Regulation (EC) No 1698/2005). Accordingly, these evaluations should have the potential to contribute to this debate and to inform formulation of efficient environmental policies. Additional usefulness of this evaluation procedure could come from the broad coverage of countries and regions, which follows from the fact that all MS are obliged to carry out the task. This should help to correct the geographical bias found in the existing scientific literature on the subject. For instance, a widely quoted review article by Kleijn and Sutherland (2003) is mainly (76%) based on studies from just two countries (the United Kingdom and the Netherlands).

It is therefore very pertinent to ask whether the present evaluation procedures are up to the task and, if not, what needs to be revised. Kleijn and Sutherland (*op cit*), commenting on the obligatory EU evaluations, state that "most of the evaluation studies simply examine uptake patterns of different schemes in the programme." According to Primdahl *et al.* (2010), who analysed the methods applied in a selected sample of evaluations of agri-environmental schemes, "common sense methodology" was the most commonly used (51%) followed by qualitative assessments (34%). Moreover, the results of these evaluations appear not to be referred to very much in the relevant scientific literature, which raises doubts as to their quality. Rather than providing an appraisal of past evaluations, our discussion below focuses on the common evaluation procedure as such, as it is presently designed, and examines prospects and preconditions for this procedure to generate science-based analysis. The chapter builds on experiences from the evaluation of the Swedish RDP where Axis 2 accounts for 70%.

The outline of the chapter is as follows. Section 3.1 describes Axis 2 of the RDP. In section 3.2, the European Union's Common Monitoring and Evaluation Framework is presented. Section 3.3 reports the evaluation of the Swedish RDP: questions, methodology, data and conclusions and recommendation. Section 3.4 summarises the results of the evaluation. Section 3.5 assesses major weaknesses of the evaluation procedure, Section 3.6 outlines suggested improvements. Overall conclusions are given in Section 3.7.

3.1 The agri-environmental measures and the CAP

The European Union's agri-environmental schemes are a part of the RDP, also known as the second Pillar of the CAP. The first Pillar consists of market instruments (tariffs, export subsidies and domestic market interventions), which aim at supporting the prices of agricultural commodities and stabilising markets, and the direct farm payment system (the Single Payment Scheme, SPS). The CAP has been constantly changing and the present design is the product of this evolution, which has involved a weakening of the role of price supports and the introduction of direct farm payments decoupled from production. These payments constitute the single most important instrument of the CAP and account for almost three quarters of the CAP budget. To qualify for SPS entitlements, farmers are required to keep agricultural land in "Good Environmental and Agricultural Condition" (GAEC) and respect relevant Statutory Management Requirements. These requirements are together referred to as cross-compliance conditions (Council Regulation EC No. 1782/2003). Because environmental requirements are attached to the SPS, those payments operate to some extent as a rudimentary environmental support and interact with environmental supports in Pillar 2.[3]

Pillar 2 is much smaller than Pillar 1 (about 25% of Pillar 1)[4] in terms of spending but has been gaining in importance over time. In contrast to Pillar 1, Pillar 2 requires co-financing from national budgets, at the rate of about 50%, but poorer MS pay less. Pillar 2 is devoted to promoting rural development and consists of four axes. The MS can freely choose from a menu of eligible measures. However, there is a lower limit for the share of each Axis in each MS's total RDP budget. For Axis 2, the lower limit is 25% of RDP spending.

Table 3.1. Budgetary allocation per axis for the Swedish programme for 2007–2013, million euro (before the 2010 revision) and corresponding shares in the European Union

Axis	Swedish budget mn euro	Percentage of Swedish budget	Percentage of budget in EU
Axis 1 – to improve the competitiveness of the agriculture and forestry sector	555	14	34
Axis 2 – to improve the environment and the countryside	2 702	69	44
Axis 3 – to improve the quality of life in rural areas and encourage the diversification of economic activities	326	8	13
Axis 4: LEADER	264	7	6
Technical assistance	70	2	3
Total	**3 917**	**100**	**100**

Source: Financial plan, 2007, The Swedish Department of Agriculture, 2010.

Table 3.1 shows the distribution of payments in Sweden and the corresponding shares in the European Union. Clearly, the Swedish allocation differs significantly from that of the rest of the European Union, with Swedish spending focusing much more on environmental support and considerably less on farm competitiveness.

Axis 2 aims at improving the environment and countryside by means of support to land management. The most important measures are agri-environmental payments. These include payments to encourage extensification of farming, low-intensity pasture systems, organic farming, preservation of landscape and historical features, and conservation of high-value habitats and their associated biodiversity. The payments are intended to compensate farmers for the additional costs, or income foregone, from adopting such practices and are usually paid on a per hectare basis. Below, these measures are presented in more detail.

Axis 2 in Sweden

Since measures in Axis 2 aim at protecting the natural environment, it may be of interest to start with a short description of environmental problems related to Swedish agriculture. Agriculture accounts for only a tiny share of GDP and employment in Sweden: less than 0.5 and 2%, respectively. Sweden is a large country and conditions for agricultural production differ considerably between the northern and the southern parts. The intensity of agricultural production and, consequently, the type of environmental problems encountered vary according to geographical location. Land use in Sweden is dominated by forestry. Arable land accounts for only 11% of total land use (5% in northern Sweden). Loss of biodiversity, nutrient leaching and use of pesticides are considered to be the major environmental problems, while soil erosion does not represent a major threat. Loss of biodiversity is strongly linked to abandonment of marginal agricultural land in forest-dominated regions.

Axis 2 consists of five different measures. The sole justification in Sweden for payments with respect to natural handicaps (codes 211-212) is preservation of biodiversity by preventing marginal land from turning into forest, which already completely dominates the land use in the regions in question. Accordingly, this measure is considered an environmental support. The greatest share of the budget, however, goes to measures under codes 214-216, which account for almost 80% of the budget.

The architecture of Axis 2 in Sweden is immensely complicated, as is illustrated in Table 3.3 with measure 214 as an example. As can be seen, this measure consists of eight different payments.

Table 3.2. Budgetary allocation to measures within Axis 2 in Sweden

Measure	Total budget (m euro)	Percentage of budget
211-212 Natural handicap payments to farmers in mountain areas and to farmers in other areas with handicaps	562	21
214-216 Agri-environment payments and support f or non-productive investments	2 106	78
227 Support for non-productive investments – forestry	34	1
Total, Axis 2	**2 702**	**100**

Source: The Swedish Board of Agriculture.

Table 3.3 Payments within measure 214, Agri-environmental payments in Sweden

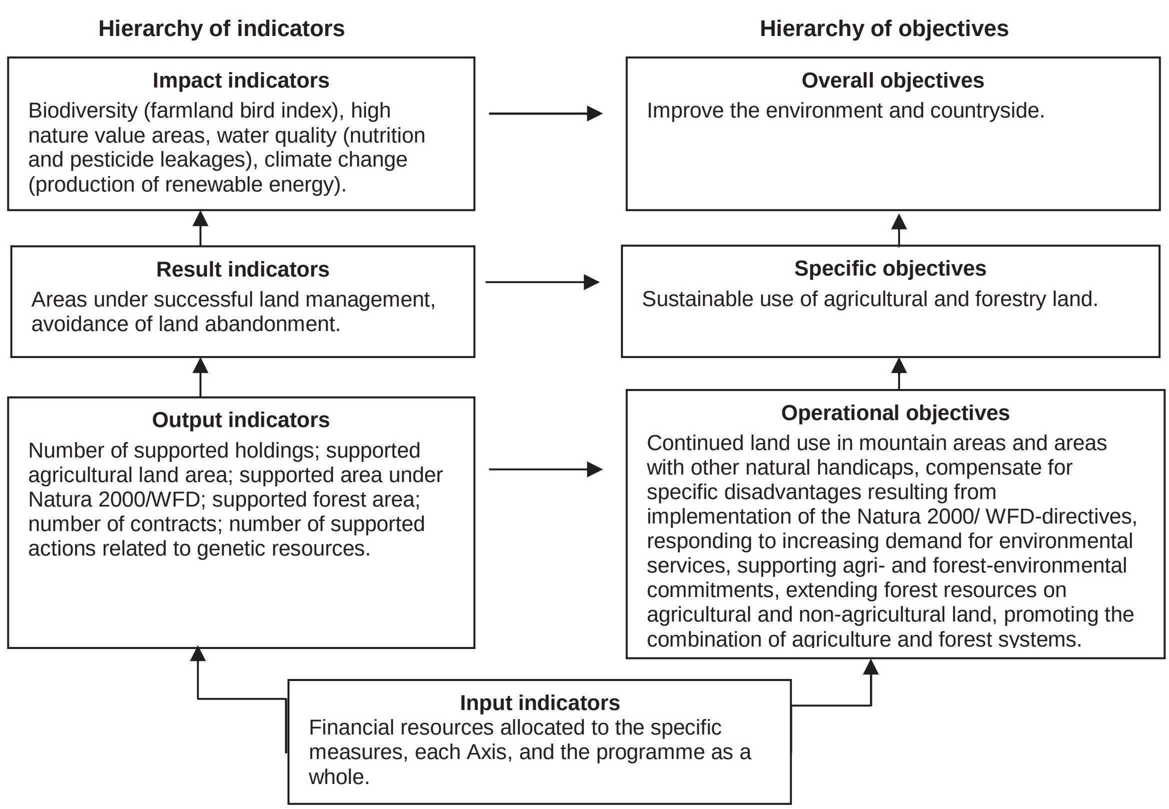
	Payments for…	Indicative budget share %
1.	…biodiversity and cultural heritage in semi-natural grazing lands, mown meadowland and wetlands	32.9
2.	…valuable natural and cultural environments in the agricultural landscape and reindeer herding areas	5.8
3.	…regional priorities	5.2
4.	...traditional cultivated plants and livestock breeds	0.4
5.	...reduced nutrient leaching from arable land	6.1
6.	...environment protection measures	1.7
7.	...organic forms of production	18.7
8.	…extensive ley management for a better environment and an open landscape	29.1

However, not even this breakdown does full justice to the details of the Swedish RDP. Several of the payments listed in Table 3.3 are divided into further categories and even sub-categories. Payments for biodiversity in semi-natural grazing lands are differentiated according to land use, land type and environmental quality level. Payments for valuable cultural elements in the agricultural landscape are differentiated between point elements (12 different categories) and line elements (nine different categories). Regional priorities, a payment administered at the county level, is subdivided in 22 categories, etc. It may be noted that the subdivision often concerns payments that are small in terms of their initial budget shares, resulting in very small amounts of money to be paid. Those tiny payments coexist with large schemes such as organic forms of production and extensive ley management. It is not uncommon that the same piece of land receives several payments with different objectives and conditions attached to them.

3.2 The Common Monitoring and Evaluation Framework (CMEF)

The evaluation of these measures in each MS is required to be conducted by evaluators that are independent of the authorities responsible for the design and monitoring of the programme. The work is guided by the CMEF (European Commission, 2006), which includes a set of common evaluation questions that are to be answered with information provided by a set of common indicators. To be useful for the evaluation, the indicators should follow naturally from the intervention logic for the measures, i.e. the chain of causality hypothesised to run from the supported measures to the objectives. A schematic illustration of the intervention logic for Axis 2 is presented in Figure 3.1.

Figure 3.1. Intervention logic for Axis 2 measures



Thus, the implementation of the measures is assumed to result in the attainment of some operational objectives, deemed essential for attaining the specific objectives, which in turn are essential for the attainment of the overall objectives. As the causal links are hypothetical (in the Swedish RDP, while there is some reference to economic theory, references to biological or ecological theories as the rationale for the choice of measures are lacking), firm theoretical foundations for these hypotheses are needed. The economic rationale for Axis 2 is the provision of public goods. Those goods are, however, produced jointly with agricultural commodities. For instance, raising beef cattle may provide both a private good (meat) and a public good (biodiversity). Private and public goods are not produced in fixed proportions, however, and the environmental payments aim, by and large, to favour the latter, i.e. lower the intensity of agricultural production. Hence, the evaluator needs to establish both how farmers respond to the payments, which is not easy, and how changes in their behaviour affect the environment. For the latter, theories from other fields (biology, ecology, etc.) are needed and, as it turns out, they are not always conclusive. For instance, different species thrive in different types of habitats, (Kleijn *et a*l., 2006; Wretenberg *et al.*, 2006; Kleijn *et al*., 2009) implying that the overall effect may be difficult to assess. The complicated architecture of Axis 2 with one measure having several objectives, and vice versa, adds to the difficulties.

The common indicators

Separate indicators are attached to each level of the hierarchy of objectives. At the first level, there are the *input indicators*, which quantify the financial resources allocated to each intervention. At the next level are the *output indicators*, which quantify the number of beneficiaries (farms, farmers, projects, area, etc.) and the total volume of investment for each beneficiary. At the third level, the *result indicators* measure "immediate effects of the intervention and provide information on changes in, for example, the behaviour, capacity or performance of direct beneficiaries". It is clarified that information is to be collected from *supported* enterprises only (cf. European Commission, 2006). Thus, the result indicators provide information on changes in the target variables but not necessarily how much of this change that can be attributed to the intervention. At the fourth level are the *impact indicators*. These are intended to measure the effects attributable to the respective interventions. Considering measures that are relevant for Axis 2, they should measure changes in biodiversity, high nature value areas, nutrient balances, and production of renewable energy in supported enterprises (regions). It is noted that their quantification requires counterfactual analysis.

The common evaluation questions

The evaluation questions are divided into two main groups: measure-specific questions (around four per measure) and horizontal questions where the latter are related to the programme as a whole.[5] Both types of questions should be answered with the information provided by the *impact indicators* (cf. European Commission, 2006 – Guidance note B). Questions that are asked for the main measures applied in Sweden (211-212 and 214-216) are as follows:

Measure codes 211-212: Handicap payments

- To what extent have compensatory allowances contributed to ensuring continued agricultural land use in mountain areas?
- To what extent have compensatory allowances contributed to the maintenance of a viable rural community in mountain areas?
- To what extent has the scheme contributed to maintaining or promoting sustainable farming systems?
- To what extent has the scheme contributed to maintaining the countryside and improving the environment?

Measure codes 214-216: Agri-environmental payments

- To what extent have agri-environmental measures contributed to maintaining or promoting sustainable farming systems?

- To what extent have agri-environmental measures contributed to maintaining or improving habitats and biodiversity?
- To what extent have agri-environmental measures contributed to maintaining or improving water quality?
- To what extent have agri-environmental measures contributed to maintaining or improving soil quality?
- To what extent have agri-environmental measures contributed to mitigating climate change?
- To what extent have agri-environmental measures contributed to maintaining and improving landscapes and its features?
- To what extent have agri-environmental measures contributed to improving the environment? Distinguish between the contribution of agri-environmental measures implemented demanding site-specific measures, and less demanding measures which are widely applied.

It should be observed that the questions are very general and apply, in the case of measure 214, to the measure as a whole, which obviously complicates the evaluation process.

3.3 Evaluating agri-environmental schemes in Sweden: Data and methodology

The evaluation of the agri-environmental measures in Sweden proved to be a considerable challenge. The major difficulties were related to three issues: the design of the evaluation procedure (clarity of concepts and scope of questions, see the previous section), the availability of appropriate analytical methods, and the availability of data. All three are interconnected but here we focus on data and methodological issues.

The effort to evaluate the programme amounted to answering the questions listed above. In the case of measure 214, this was done at the level of the payments listed in Table 3.2, which is already a considerable simplification.

The ambition was to use a counterfactual approach, as prescribed by the CMEF guidelines. This implies a comparison between a supported group of farms and a control group. If supports were distributed randomly, the control group could be a random selection of non-supported farms. When this is not the case, the control group should be as similar as possible to the intervention group in all other respects. For instance, the control group could be created by matching farms using the criterion that they should be equal in all observable variables hypothesised to influence the probability of being granted support (propensity score matching). Given longitudinal data on the development of the target variables for members of the intervention and the control group, panel data methods could then be used to control for the effects of unobserved confounders (provided that differences in unobserved confounders could be assumed to be constant, or to develop according to some linear trend over time; see Wooldridge, 2002, or Greene, 2003).

Occasionally, it was possible to apply this type of methodology for the evaluation of measures in other axes (investment support in Axis 1). In the case of Axis 2, however, it was difficult to apply econometric techniques for two reasons. *Firstly*, data on the development of the target variables are lacking in official registers. *Secondly*, in many cases the measures are extended to all farmers as broad schemes, implying that it is practically not possible to construct a control group.

Data

It is suggested (European Commission, 2006, Guidance note I) that data on the evolution of the target variables and farm characteristics hypothesised to influence this evolution could be obtained from the Farm Accounting Data Network (FADN), the EUROFARM and the EUROSTAT databases, complemented by national or regional registers and surveys. The problem with the FADN database is that it is biased towards larger farms and includes only about 1.6% of all EU farms (FADN home page).[6] Accordingly, it is unlikely that a sufficient number of farms can be identified to conduct the matching process for the construction of the control group. In addition, at least in Sweden, the FADN farms are a rotating panel. For these reasons, FADN is not very suitable for panel data analysis. Oenema *et al*. (2011) argue that FADN ”should preferably be avoided” as a data source for producing agri-environmental indicators (of which indictors related to RDP are a part) since it is entirely based on economic data and is less representative of the farm population as a whole.

As to the Eurofarm and Eurostat databases, they are constructed like the FADN from data in national registers in the respective MS. In the Swedish case, with two exceptions (the TUVA and NILS databases), national registers only contain information on different types of land uses at farm level. Accordingly, there is no information on the evolution over time of the variables actually targeted by the environmental measures in Axis 2 (biodiversity, high nature value areas, water quality, and climate change).

Moreover, though national registers may contain information not included in the FADN and Eurostat data collections, there is the problem that (at least in Sweden), because of privacy considerations, access is restricted. This implies that merging information from these registers with information on which enterprises that have been granted support from the RDP must be performed by Statistics Sweden. In our experience, this is very time-consuming and costly.

As to Axis 2 measures, the TUVA database contains data on different species of vascular plants, as well as cultural values (i.e. man-made features of the environment such as traditional barns, hedgerows, and stone walls) in meadows and pasture lands in Sweden obtained through a nationwide inventory in 2002-2004, while NILS contains data on different species of insects in some of the meadows and pasture lands included in TUVA. Unfortunately, since both data bases contain cross section data only, they are hardly sufficient for analysing the effects of the environmental measures. Now, because of the difficulties in measuring the ultimate target variables, “driving force indicators” based on a so-called the Driving Force-State-Response framework (OECD, 1999) might be used as substitutes. Driving forces are factors, such as land use trends, that cause environmental changes. It was, therefore, contemplated to utilise the longitudinal information on different kinds of agricultural land use contained in the other national registers to identify the effects of Axis 2 measures on these driving force indicators. However, closer inspection revealed that data on what types of land use that applied to a particular farm in a given year to a large extent had been generated from information contained in the farm’s application for support from the RDP. That is, the coverage of data on land use is not independent of the payments granted, which makes it hard to draw conclusions regarding the effects of payments on land use.

Surveys are only suitable for the generation of cross section data since asking respondents retrospective questions is likely to result in recall errors. One might, of course, consider repeating the survey (with the same respondents) on an annual basis. However, this is likely to lead to attrition (observations lost due to respondents refusing to participate after some time). Also, given the time-frame of the evaluation, repeated annual surveys would not be feasible for generating the data needed. Finally, the information elicited by means of surveys may be difficult to interpret since responses could be affected by strategic considerations. In addition, environmental effects may become visible only after a number of years, or be spread out over long distances (Oltmer *et al*., 2000). Accordingly, it is difficult if not impossible for the evaluators to rely on surveys to collect supplementary data from farmers and the evaluation has to rely on pre-existing sets of data.

Methodology

As already mentioned, it was difficult to identify control groups and apply econometric techniques to Axis 2 measures. The complexity of the programme, with many interacting, not fully observable, factors adds to the difficulties. Agri-environment schemes display strong inter-linkages among measures and objectives whereby a single measure may contribute to multiple objectives and a single environmental objective may be achieved by several measures (Finn *et al*., 2009). Accordingly, the same tract of land usually receives several different payments with different objectives attached, implying that different payments are interacting with each other. This means that it is often implausible to evaluate the programme measure by measure (or rather payment by payment as environmental measures often include several different payments) and then add the results. Moreover, those payments interact also with the supports in Pillar 1 because of the jointness in production and because of the cross compliance conditions attached to the SPS.

This can be illustrated with the natural handicap payments (NHP). Their major justification is to prevent marginal agricultural land from going out of production and the accompanying loss of biodiversity. NHP are extended to almost all (over 90%) farmers and agricultural land in the eligible regions. Extensive ley management payments and biodiversity payments for semi-natural grazing lands are to a large extent paid to agricultural land in the same regions. In addition, the cross compliance conditions attached to SPS payments have to be taken into account. In Sweden, SPS payments go both to arable land and to semi-natural grazing land. Under GAEC requirements, farmers receiving SPS are required to keep a minimal stocking density of grazing animals (to promote biodiversity). The profitability of meat production has to be considered as well in addition to the Nordic Aid scheme (price support to milk production), which is paid to most NHP areas (north of the 62nd parallel).

Under those circumstances, disentangling the result (change in land use) and the impact (improvement of biodiversity) of *just* NHP from the influence of other measures and factors is extremely difficult and not feasible without using a modelling approach. Evaluation using simulation models is performed as follows: first, the model is solved and validated for a given base year; second, the policy scenario (i.e. the counterfactual) (in this case, *removal* of a given support or of the programme as a whole) is determined and, finally, a comparison between the results of the base run and those of the policy run is made.

There are, however, several difficulties involved in applying simulation models for evaluation purposes. *First*, there are often no off-the-shelf-models available. Existing models have to be adapted, but this is possible only to a very limited degree given time and resource constraints. *Second*, aggregate agricultural sector models do not lend themselves easily to a precise assessment of many, small heterogeneous schemes. *Third*, key parameters of many simulation models, such as elasticities, are often derived from heterogeneous external sources and their reliability is uncertain. They may, nonetheless, strongly influence the results and hence the outcome of the evaluation. In the case of environmental support, the elasticity of land supply with respect to net return per hectare is often of crucial importance as the support is primarily paid to land. *Finally*, agricultural sector models provide an estimate of the behavioural changes (*results*) the support is intended to induce and need to be supplemented with estimates of the environmental effects (*impacts*) caused by these behavioural changes. This is often accomplished by linking farm output or input to environmental indicators such as nutrient or energy balances, (Sinabell *et al*., 2010). Combined economic and environmental models, whether linked or fully integrated, are preferable but are difficult to achieve on a large (country) scale. Drechsler *et al*. (2007) discuss differences and similarities between ecological and economic modelling, arguing that integration of approaches is possible but not without problems. The major advantage of using economic-ecological models is that the environmental implications of behavioural changes may differ considerably according to location and it is much easier to take this into account in economic-ecological models than in pure economic models. Hence, it may be difficult to make an informed judgement if the location cannot be identified.[7]

These problems were to a large extent encountered in the evaluation work in Sweden where the agricultural sector models CAPRI and AgriPoliS were used to analyse the results of environmental support, and the impact on water quality was analysed using the models SOILNDB and ICECREAMDB. Spatial comparisons between areas receiving support and not receiving support were made using GIS.

CAPRI is a regionalised comparative static sector model of agriculture in the EU and in the rest of the world, the latter being modelled in a more rudimentary way.[8] CAPRI was used to assess the impact on land use, farm incomes, nutrient balances and greenhouse gas emissions at an aggregate level, i.e. the effects of all measures 214-216 and measure 211-212 *and* the joint effects of both measures – in other words, of the entire Axis 2 support. Hence, the assessment of the environmental benefits from keeping land (especially grazing land) in production was only done at the general level. Because CAPRI is not a spatial model, it was, of course, not possible to identify *which* land has been saved from afforestation. Detailed simulation results are presented in Annex 1 of Wissman *et al.* (2010).

In these simulations, the policy instruments NHP, payments for semi-natural grazing lands and payments for extensive ley management were individually modelled (as addition to SPS or area payments for the activity in question). All remaining environmental payments were conceptualised as an intensity-reducing payment available to farmers who choose the extensive technology option in the model. Data on input indicators for all individual payments at the NUTS3[9] level were aggregated to the CAPRI regions (NUTS2) and the modelled instruments. The elasticity of land supply with respect to net return per hectare was based on van Meijl *et al.* (2006) and regionalised for the CAPRI regions using the CLUE model (Verburg *et al.*, 2010). Transformation elasticities for switching between arable land and grazing land were based on Golub (2006). In the policy experiments, only the Swedish agri-environmental programme was removed, implicitly assuming that the agri-environmental support continues in other MS but not in Sweden, which may seem a questionable assumption. However, the alternative (elimination of all environmental payments in the whole of European Union) would amount to an evaluation of the entire environmental support in the European Union, a task beyond the capacity of the team.

AgriPoliS is an agent-based, spatial dynamic agricultural model available for two NUTS3 regions, one in northern and one in central Sweden, both covered by NHP. The model contains an environmental module linking changes in land use to changes in biodiversity (farmland birds). In addition, the impact of structural change on landscape diversity is modelled.[10] The following payments were modelled: NHP (differentiated after region and land use), extensive ley management and semi-natural grazing land payments (base level only). All other payments were ignored (i.e. calibrated into the baseline). Simulations were made by Brady (see Annex 2 to Wissman *et al.*, 2010). The model was used to assess effect on land use, farm incomes, structural change nutrient balances and biodiversity (farmland birds).

The CAPRI and AgriPoliS models are complementary. However, because of the differences in, inter alia, modelling approach and geographical coverage, the results were somewhat difficult to merge. The main adaptation to the shock of removing the support in the CAPRI simulations was the adjustment (decline) in land use, especially semi-natural grazing land. In the AgriPoliS simulations there was no effect on land use. Instead, structural change in the form of the merging of smaller farms into larger units accelerated.

The SOILNDB and ICECREAMDB models (see Mårtenson *et al.*, 2010) were used to calculate nutrient leakage (nitrogen and phosphorus respectively) from arable land in Sweden divided into 22 leakage regions. The models are purely biological and do not estimate behavioural changes. Instead, the implications for nutrient leakage of lower input use are traced out. Moreover, those implications can take time to materialise. Hence, the results should be interpreted as expected long-term effects.

GIS (Geographical Information System) data were used to compare supported and unsupported areas with respect to several environmental qualities, such as the number of vascular plants per square metre based on an inventory of environmental features available from the TUVA database. Note that these data are cross sectional and, therefore, do not allow the evaluator to control for unobserved confounders, implying that it may be questioned how much of the differences between supported and unsupported areas should be attributed to the support.

Inevitably, in spite of all the hard work, the result of the evaluation is more of an overview than an in-depth assessment. The programme is very complicated and should in principle be evaluated at an appropriate level of complexity. The very justification of specialised small schemes is the fact that they are supposed to deliver unique benefits. OECD (2010) also argues that "many of the environmental effects are site-specific, reflecting heterogeneous agricultural and environmental conditions, and thus some impacts cannot be extrapolated." Since an evaluation of the programme in all its detail was not possible given the time and resource limitations, the validity of the conclusions is limited.

3.4 Results of the evaluation

Because this chapter focuses on methodological issues, only a short summary of the results will be provided highlighting recommendations about methodology. The major results can be summarised as follows.

Given that other agri-environmental payments continue to be paid out, the natural handicap payments NHP (measure codes 211-212) have limited consequences for land use and income in the regions concerned. By slowing down the rate of structural change in agriculture, the payments to farmers in mountain areas and in other areas with handicaps are contributing to higher employment in agriculture. However, this may be at the expense of future competitiveness. This lower rate of structural change is probably having a positive effect on the preservation of man-made landscape features, but biodiversity does not appear to have been markedly affected.

Agri-environmental payments were evaluated, as pointed out above, at the level of the categories identified in Table 3.3. The payments for "biodiversity and cultural heritage in semi-natural grazing lands, mown meadowland and wetlands" have contributed to more pastures and grazing animals remaining in production. The payments for upkeep of wetlands and the special measures for pastures and meadows are contributing to the continuing upkeep of land with high biological value. Areas receiving payments compared with areas outside the scheme appear to have a more favourable environmental status, but the differences are small and not always in favour of the areas receiving payments. The payments for organic forms of production are contributing to decreasing the use of pesticides, which can help in promoting biodiversity in certain cases. The effects of the payments for "valuable natural and cultural environments in the agricultural landscape and reindeer herding areas" on biodiversity are unclear, although it is probable that they contribute to the upkeep of a greater number of elements. In summary, this indicates that the payments have contributed to the conservation of biodiversity.

The payments for "extensive ley management for a better environment and an open landscape" may potentially have negative effects, particularly in combination with the payments for biodiversity and cultural heritage in semi-natural grazing lands, mown meadowland and wetlands and the natural handicap payments to farmers in mountain areas and to farmers in other areas with handicaps. The payment for extensive ley management (cultivated grassland) admittedly keeps the countryside open, but also contributes to homogenisation in the form of increasing the share of cultivated grassland in a landscape already dominated by cultivated grasslands.

A number of different schemes, especially payments for reduced nutrient leaching, contribute to decreasing nutrient leaching from arable land and pesticide use. The schemes that are most effective, measured per hectare, concern wetlands in the case of nutrient leaching and buffer zones in the case of decreasing phosphorus emissions. The payment decreasing the use of pesticides most is that for organic forms of production.

No agri-environmental payments directly target the mitigation of climate change. The impact of agricultural production on climate change is a very complicated matter and there are many gaps in knowledge about emission processes. Based on results from the CAPRI model, it can be concluded that if all payments in Axis 2 were eliminated, emissions would decrease somewhat because the payments contribute to more agricultural land being used and more grazing animals being kept. Elimination of all measures in Axis 2 (implying an assessment of the overall impact of the environmental programme) would furthermore result in a decrease of agricultural land by 8%, mainly owing to a strong decrease (about half) in pastures (semi-natural grazing land).

Comparison between broad, less demanding schemes and site-specific payments was only possible in a limited number of cases, where computer simulations could be used. Targeted payments were found to be more efficient. For instance, the computer simulations carried out regarding the effect of organic production and the measurements performed in the field show that this payment had little or no effect on decreasing plant nutrient losses from agricultural land.

3.5 Major weaknesses of the procedure

The single most important weakness relates to the fact that the questions, as they are phrased at present, seem "too big" or too complicated to be answered within the time and resource framework of the evaluation. The evaluation is about establishing to what extent positive environmental effects can be *attributed* to the support programme, which in turn amounts to answering two questions: how payments have affected the behaviour of farmers and how this has influenced the environment. As pointed out before, reliable, science-based answers to both questions are often difficult to obtain. Unless suitable methodology and appropriate data are available, reliable answers cannot be produced. In other words, there is a considerable danger that the evaluation is not producing much new information beyond what is already known through monitoring and previous scientific research.

There is a shortage of data for analyses of environmental effects.[11] As pointed out before, FADN is of limited value in this context. The major reason is that it seems not to have kept up with changing societal preferences and, in particular, with changes in the CAP. The concept of FADN was launched in 1965 for the purpose of monitoring the impact of the CAP on farm income. At that time the (emerging) CAP was driven by annual price reviews while the predecessor of Pillar 2 played a marginal role. At present, there is no direct link between adjustments to Pillar 1 (SPS and market regulations) and the evolution of the income of farms of different types. At the same time, the RDPs are regularly revised. The process of mid-term evaluation is, for instance, supposed to produce recommendations for policy alterations.

As pointed out before, because of the difficulties in measuring actual environmental effects, driving force indicators based on the Driving Force-State-Response framework were used as substitutes for assessing the effects of the measures in Axis 2. However, while the use of driving force indicators may lend credibility to the intervention logic, the problem that a given driving force may affect different objectives in opposing directions (and to varying degrees in different MS) still remains. Moreover, what counts at the end of the day are the actual improvements in the environment and there is not enough focus on providing evidence, such as field data, that this actually the case.

Looking especially at the evaluation questions, it can be observed that the link between evaluation questions and the indicators is occasionally weak. For instance, most questions for measures 211-212 and the first question for measures 214-216 cannot be answered using the information provided by the impact indicators. Partly this is due to the scope of the questions. At the same time, there are indicators that are not related to any questions. Moreover, many of the ambiguities are caused by the use of vague concepts and overlapping questions. For instance, what is the difference between "maintaining a viable rural community" and "maintaining the countryside" or "promoting sustainable farming systems" and "improving the environment"? What does "promoting sustainable farming system" entail in addition to biodiversity, water quality, soil quality, landscape improvement and climate mitigation, to which separate questions are devoted? Concepts such as soil and water quality could also be more precisely defined. Without guidance it is likely that different evaluators interpret the concepts differently, implying that they might not investigate the same effects. This, in turn, could compromise the comparability of results. In other cases, the questions do not seem relevant for evaluation of the impacts on the objectives. For instance, why is it of interest to investigate to what extent agri-environment payments have contributed to viable rural communities in certain areas when the overall objectives are preservation and enhancement of biodiversity, high nature value areas, water quality or to counteract climate change? Again, without clear guidance, different evaluators may interpret the questions differently, which could compromise the comparability of results.

As the main rationale for policy evaluation is to contribute to the revision or improvement of the policy design in order to achieve higher efficiency, it is surprising that no questions are asked about efficiency or effectiveness, and that the common indicators are not designed to elicit such features. In the general instruction in Guidance note B, "Judging" section (European Commission, 2006), the evaluator is asked to assess the efficiency and effectiveness of the programme. However, it is not clear what is intended and whether those questions can be answered in a meaningful way using the information in the impact indicators.

The existence of a positive willingness-to-pay on the part of the user constitutes an intrinsic quality of a good, whether private or public. It could be argued that this requirement should also apply to those public goods whose provision Axis 2 payments are aiming to stimulate. However, none of the evaluation questions asks for evidence that taxpayers would be willing to pay for the agri-environmental programmes. It is implicitly assumed that willingness to pay, or at least some form of societal appreciation, exists. Research in Sweden (Hasund *et al*., 2010) shows that there is considerable difference between what kind of agri-environmental amenities consumers are willing to pay for and what amenities are supported by the payments. This implies that societal appreciation should not be taken for granted.

3.6 Suggested improvements

The evaluation of the Swedish RDP resulted in a number of recommendations with respect to the design of the programme as well as the monitoring and evaluation procedure. Here, we focus only on the latter.[12]

It seems reasonable that agri-environmental policies in the European Union should be assessed jointly. The provision of European environmental public goods is the strongest justification of having a common policy for agriculture in the Union (see, for instance, Declaration of agricultural economists, 2009). However, the argument is only valid as long the policies applied actually deliver environmental benefits and do so in an efficient way. A common evaluation process could contribute to achieving this and thus increase the credibility and legitimacy of the CAP. In addition, common evaluation and monitoring may offer several advantages, such as gaining additional experience and increasing the reliability of the results. As argued in the introduction to this chapter, common evaluations can also contribute to improved geographical coverage. To exploit those advantages, it must be possible to aggregate or at least compare the national results. Ideally, meta-studies should be conducted. The interest in meta-studies, especially in relation to environmental impacts, has been growing (see, for instance, Batary *et al*., 2010; Oltmer *et al*., 2000). It seems a reasonable ambition to synthesise results of the common evaluations in that way. Such a synthesis is not possible, however, if national experts are *in reality* answering different questions and using very different evaluation methods.

The common evaluation questions should be precise (i.e. not require, or be open to, interpretation by the evaluator) and rely on well-defined concepts. This may seem an obvious demand yet, as demonstrated above, many of the questions are vague and the concepts used are often unclear as well. Overlapping questions should be avoided since this creates confusion as to their proper interpretation. The link between evaluation questions and impact indicators must be strengthened. As demonstrated in the previous sections, there are indicators without questions and questions for which no indicators are produced. Also, some of the indicators seem to be of questionable relevance for the end objectives. This implies that concepts that are not readily interpretable should be defined, that evaluation questions should ask directly, and only, for the information contained in the impact indicators. In addition, the common impact indicators should be defined so that they quantify the effects intended by the measures. The evaluator is also of the opinion that there is an imbalance between the large number of output and result indicators and the few impact indicators within Axis 2. More (national) impact indicators need to be introduced. In particular, there is a need to develop more indicators of biodiversity. Pollinating insects were suggested as one possibility to be further investigated. Development of indicators for soil quality was suggested as well. The evaluator proposes that the work on developing new impact indicators be coordinated with increased collection of field data.

Common methodological standards should be prescribed and enforced. They should consist of well-established evaluation practices designed to provide relevant science-based evidence for the question at hand. If, in spite of reasonable and documented effort, a solid answer for some questions cannot be produced, the evaluators should be allowed to abstain from answering those questions. To some extent, ambitions to create a common methodology are already in place. Reliance on control groups is, for instance, encouraged in the CMEF as pointed out before. But this is still a recommendation not an obligation.

Enforcing common methodological standards has obvious advantages but may create some problems as well. On the other hand, as pointed out during the OECD Braunschweig workshop,[13] it could be argued that standardisation and harmonisation risk reducing the analysis to issues that are strictly measureable and quantifiable. Moreover, "unanswerable" questions may produce highly important answers. This is a valid critique but asking evaluators unclear questions and accepting vague answers is not a valid solution.

Instead, it could be advisable to distinguish between short-term evaluation questions and long-term *research issues* where evaluation is complicated by gaps in basic knowledge, and allocate them to separate activities. When scientists are in disagreement, it is not reasonable to expect evaluators to produce a reliable answer in a limited time. Development of advanced economic-ecological models (see below) and improvement of methodology for valuation of non-market benefits like biodiversity preservation could be seen as cases in point. More standardised procedures for "simple questions" could be designed alongside coordinated joint research programmes for long-term issues. Prescribing and enforcing a common methodology (see above) would be facilitated by such a division of responsibilities. Furthermore, "scientific" and "quantitative" should by no means be seen as synonymous.

Evaluation of impacts on the environment is especially cumbersome, as demonstrated in previous sections, due to difficulties in identifying control groups and the presence of many interacting factors. Such difficulties are often resolved by relying on modelling approaches. However, suitable off-the-shelf-models are not universally available. Even existing models have to be adapted, which is only possible to a very limited degree taking into account the time and resource limitations. Hence, this type of methodology needs to be developed in advance and in a co-ordinated way to ensure appropriate coverage (countries, regions, evaluation questions). Those circumstances need to be taken into account when designing monitoring and evaluation procedures.

Given the lack of empirical data, there should be efforts to develop a co-ordinated data generation process in MS. Especially with respect to the assessment of environmental impacts, the systematic collection of field data needs to be increased. Since environmental effects arise at a larger scale than the individual farm, data collected from farmers will not be sufficient for evaluating the effects of the agri-environmental supports. Boccaccio *et al.* (2009) argue that field monitoring of environmental impacts of spending is rare in the MS, and recommend that the assessment of the level of success should be based on the measurement of impact and not on the level of uptake. We agree with this recommendation.

Existing databases should, moreover, be better utilised and adjusted to serve evaluation purposes. The FADN system is at present designed to provide data on farm income development and it is biased towards bigger farms. The usefulness of this information for the evaluation of rural development policies is limited. Accordingly, it seems reasonable to redesign FADN for the needs of the RDP. Adjustment of the FADN for the purpose of evaluation of Axis 2 (and other rural development policies) should imply revision of both the selection of farms and the choice of variables.

The recommendations above relate mainly to the issues of how to design and answer the evaluation questions. An equally important issue is what kind of questions the evaluation should seek to answer. The major rationale for any policy evaluation is to inform potential policy revision. To be useful in that respect, the evaluation procedure should focus much more strongly on assessing efficiency. When possible, the evaluation questions should address the results of the measures undertaken in value terms (not be content with establishing whether or not they have succeeded in increasing output in physical terms) and provide cost-benefit ratios. When market values for the benefits are missing, cost effectiveness of measures aiming at achieving the same objectives should be assessed. In particular, comparisons of cost efficiency between measures aiming at similar objective should be provided in a comprehensive and systematic way. Cost-benefit analyses of the environmental support schemes are complicated by the difficulties of valuation of non-monetary benefits. Eliciting the willingness to pay from the population for goods such as biodiversity is a non-trivial matter (see, for instance, Rosen, 1974; Freeman, 1979; Bateman *et al.,* 2002). Indeed, including the development and adaptation of appropriate methodology for valuations of environmental non-market goods in joint the research programmes, as argued above, could be a good solution. Need for methodological improvement is, however, no reason, for completely abstaining from including societal valuations as part of the policy evaluation. Otherwise, there is no evidence that the policy is actually delivering a *public good.* It would be reasonable to provide some kind of "proof" that society values what is provided. Needless to say, such evidence or willingness-to-pay studies can hardly replace science-based assessments of whether policies are designed and operated optimally.

3.7 Conclusions

This chapter discusses the evaluation of agri-environmental measures within Axis 2 of the CAP's Rural Development Programme, focusing on methodological aspects. The evidence analysed is based on experiences from the recent mid-term evaluation of the Swedish Rural Development Programme, which is dominated by Axis 2 measures. We identify major weaknesses in the present evaluation procedure and suggest appropriate remedies. The weaknesses include vague concepts, a frequent mismatch between questions posed and indicators demanded, insufficient availability of suitable methodology and lack of empirical data.

We make a number of recommendations for improvement, which can be summarised under five headings as follows. First, the common evaluation questions that govern the process should be precise and not require, or be open to, interpretation by the evaluator. Second, the evaluation procedure should focus more strongly on efficiency and not be limited to establishing whether or not the measures have succeeded in increasing participation. Moreover, when possible the benefits should be assessed in monetary terms. Third, modelling approaches are often used to resolve the problem of missing control groups. Suitable off-the-shelf-models are, however, not universally available. Hence, this type of methodology needs to be developed in advance and in a coordinated way to ensure appropriate coverage (MS, regions, evaluation questions). Fourth, given the notorious lack of suitable empirical data on environmental variables of interest and at an appropriate measurement scale, there should be efforts to develop a coordinated data generation process across member states. Existing databases should, moreover, be better utilised and adjusted to become more useful for evaluation purposes. For example, the FADN could be redesigned with respect to selection of farms and the type of data collected in order to make a contribution to the evaluation of environmental and other rural development policies.

Notes

1. Swedish University of Agricultural Sciences.
2. Cf. *europa.eu/legislation-summaries/agriculture/general _framework/160032_en.htm*.
3. It should be noted that the monitoring and evaluation mentioned in the introduction, and the methodology critiqued in this chapter, refer specifically to Pillar 2 measures.
4. Cf. *europa.eu/legislation_summaries/agriculture/general_framework/160032_en.htm.*
5. If a MS were to apply all measures in the RDP menu, the evaluation would have to answer 171 questions (c.f. European Commission, 2006 – Guidance note B).
6. In the Swedish case, it includes 1 000 of a total of approximately 72 000 farm enterprises (Statistics Sweden, 2010).
7. See also OECD (2010) for a review.

8 For detailed information, see Britz and Witzke (2008).

9. NUTS = Nomenclature of Territorial Units for Statistics. This nomenclature establishes three levels of territorial division within the European Union, level 1 being the division into Member States. There are 271 (1303) regions at NUTS2 (NUTS3) level.

10. For a detailed description of the model, see Kellerman *et al*. (2008).

11. For a detailed discussion of the farm data needed for agri-environmental reporting and calculation of environmental indicators, see Oenema *et al.* (2011).

12. For other details see SLU (2010).

13. By Ian Hodge, University of Cambridge, United Kingdom, in his role as discussant.

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