CASE STUDIES ON THE INTEGRATION OF ENVIRONMENTAL CONCERNS AND THE NUTRIENT MANAGEMENT

STUDII DE CAZ CU PRIVIRE LA INTEGRAREA ASPECTELOR LEGATE DE MEDIU ŞI MANAGEMENTUL NUTRIȚIEI

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Abstract: *Where the causes of environmental change associated with agriculture are understood, usually they can be traced to changes in farm management and land use. These include the use of new or larger quantities of inputs, changes in the farming practices employed, variations in the numbers, distribution and methods of rearing livestock, and alterations in cropping patterns and landscape features. These direct causes of environmental change may include the cessation of previous farm management practices as well as the adoption of new ones. Some can be isolated individually, as in the case of direct impacts arising from the use of a single pesticide. Others are viewed more conveniently as changes in farming systems or new management approaches. The replacement of mixed crop and livestock systems with specialist arable or livestock farms and the displacement of low input dryland agriculture with more intensive irrigated production are examples of changes in farming systems.*

Rezumat: *În cazul în care consecinţele schimbărilor de mediu în ceea ce priveşte agricultura, sunt înţelese, acestea pot fi transpuse în schimbări la nivelul managementului fermelor şi a folosirii pământului. Acestea includ folosirea unor noi sau a unei cantităţi mai mari de materii prime, schimbarea modalităţilor de cultivare a pământului, variaţii în ceea ce priveşte numărul, distribuţia şi metodele de creştere a animalelor precum şi modificări în tiparele recoltelor şi a trăsăturilor mediului înconjurător. Aceste cauze directe ale schimbării mediului pot include încetarea practicilor anterioare de management al fermei precum şi adoptarea altora noi. Unele pot fi identificate în mod individual, cum este cazul impactului direct survenit din folosirea unui singur tip de pesticide. Altele pot fi privite mai mult ca şi schimbări ale sistemelor de cultivare a pământului sau ca şi noi abordări ale managementului fermei. Înlocuirea culturilor mixte şi a sistemelor de creştere a animalelor cu fermele specializate pe cultivarea pământului sau pe creşterea animalelor precum şi înlocuirea cultivării reduse a pământului uscat cu o procedură mai intensă de irigare, sunt doar câteva exemple de schimbare la nivelul sistemelor de cultivare a pământului.*

Key words: *fertilizer, organic, term, levels, directive, framework, pollution*
Cuvinte cheie: *fertilizator, organic, termen, nivele, Directivă, cadru, poluare*

INTRODUCTION

The IRENA operation (Indicator Reporting on the Integration of Environmental Concerns into Agriculture Policy) is a joint exercise between several Commission Directorates-General (DG Agriculture and Rural Development, DG Environment, DG Eurostat and DG Joint Research Centre) and the European Environment Agency (EEA). Its main purpose was to develop agri-environmental indicators for monitoring the integration of environmental concerns into agriculture policy in the European Union (EU-15). IRENA follows the two Commission communications mentioned above.

The IRENA process foresees the following project outputs:

• 35 agri-environmental indicators supported by data sets at NUTS 2/3 level (where data is available) and classified according the DPSIR model (Driving force - Pressure - State -

Impact - Response);

• an indicator report ("Agriculture and environment in EU-27 — the IRENA indicator report") providing an integrated environmental analysis of EU-27 agriculture based on those 35 agri-environmental indicators as well as an assessment of the progress made in their development and interpretation;

• an indicator-based assessment report on the integration of environmental concerns into agriculture policy (this report). These reports and internal working documents also include proposals for improving the data and methods for further work on agri-environmental indicators.

This report builds therefore on the 42 indicators finally produced and the analysis presented in the indicator report in order to identify the essential agri-environmental issues (through the indicators related to "driving forces", "pressure", "state" and "impact"), and to analyze the targeting of policy responses (through the 'response' indicators related to the "public policy" dimension).

MATERIALS AND METHOD

1. ANALYSIS OF IRENA INDICATORS IN RELATION TO RISK OF NUTRIENT POLLUTION

The IRENA indicators provide data in relation to both driving forces and pressures that can influence the risk of water pollution by nitrates. Indicators No. 8 (Fertilizer consumption), No. 13 (Cropping/livestock patterns), No.14 (Management practices) and No. 15 (Intensification/extensification) are driving force indicators providing data on farming practices and patterns that can result in increased or decreased risk of nutrient leaching. IRENA No. 18 shows that at EU-27 level, the gross nitrogen balance in 2006 was calculated to be 55 kg/ha, which is 16 % lower than the balance estimate in 1990 of 65 kg/ha. In 2006 the gross nitrogen balance ranged from 37 kg/ha (Italy) to 226 kg/ha (the Netherlands).

All national gross nitrogen balances in Member States show a decline in estimates of the gross nitrogen balance (kg/ha) between 1990 and 2007, apart from Ireland and Spain (22% and 47% increase, respectively). The following Member States showed organic fertilizer application rates greater than the threshold of 170 kg/ha specified by the nitrates directive in 2000: the Netherlands (206 kg/ha) and Belgium (204 kg/ha). The general decline in nitrogen balance surpluses is due to a small decrease in nitrogen input rates (– 1.0%) and a significant increase in nitrogen output rates (10%).

The availability of regional gross nitrogen balances would provide a much better insight into the actual likelihood of nutrient losses to water bodies, when combined with data on farm management practices as well as climatic and soil conditions. Such an indicator could not be developed in the timeframe of the IRENA project, mainly due to the lack of important data at regional level (manure, fertilizer application, yield coefficients) and even at national level (particularly the uptake of nitrogen through fodder and pastures). Among the response indicators, IRENA No. 1 (Area under agri-environment support), IRENA No. 2 (Regional levels of good farming practice) and IRENA No. 7 (Area under organic farming) are relevant.

IRENA No. 1 is important in as much as agri-environment schemes are specifically aimed at achieving positive environmental management. As it has been said in the context of biodiversity, there is considerable variation both between and within Member States in terms of annual expenditure per ha of UAA as well as coverage of agri-environment measures. Low levels of expenditure per ha of UAA and low coverage of schemes in some countries suggest that the potential of this policy instrument is not being fully realized. In itself, this indicator does not provide direct information about the environmental effectiveness of agri-environment schemes in relation to reducing the risk of nutrient pollution. It does show, however, that the

most important category of agri-environment scheme in terms of area covered was the one aimed at the reduction of inputs (including in most countries integrated farming) and the extensification of farming, including crop rotation.

In 2002, this category covered 11.4 million hectares and represented 40 % of the total agri-environment scheme area across the EU-15. Both types of measures lead to changes in farming practice that are likely to have significant benefits in terms of reducing the risk of water pollution by nutrients. However, no data is available to show the extent to which such schemes are being targeted at specific areas where the risk of nutrient contamination is greatest or applied more widely. IRENA No. 2 shows the extent to which Member States have defined good farming practices that should help prevent nutrient pollution compared to standards for other environmental issues.

All Member States have defined standards for fertilization, which is regulated at EU level (through the "nitrates" directive). This has the most wide-reaching effect in those Member States that have designated their whole territory as nitrate vulnerable zones (NVZs): the Netherlands, Luxembourg, Austria, Denmark, Germany, and Finland. Member States and regions have defined compulsory requirements in the framework of their nitrates actions plans for nitrate vulnerable zones. The United Kingdom, Sweden, the Walloon region of Belgium and Portugal have also defined fertilization standards for farms outside the NVZs (e.g. recommended fertilization rates, restrictions on timing for organic application, storage capacity), which are either recommendations or verifiable standards. Furthermore, France, Sweden and Denmark have addressed soil cover during autumn and winter in certain areas to avoid nitrate leaching.

2. ANALYSIS OF THE SPATIAL TARGETING OF POLICY INSTRUMENTS FOR NUTRIENT MANAGEMENT USING IRENA INDICATORS

At this stage of the development of the relevant IRENA indicators it is not possible to undertake any spatial analysis of the targeting of policy responses to the areas at greatest risk of water pollution by nutrients, e.g. the nitrate vulnerable zones designated under the nitrates directive. Further development of indicator No. 1 is required to provide data on specific agri-environment schemes that relate to nutrient leaching and their spatial targeting. Again it is not only spatial targeting, however, that determines the effectiveness of policy effort with regard to nutrient pollution, but also the appropriate mix, choice and implementation of policy instruments at national level. Two examples of agri-environment policy approaches that effectively target nutrient leaching are given below for Denmark and Sweden.

Since 1985, a number of national action plans have been implemented in Denmark to reduce nitrate leaching from agriculture. The main instruments to ensure the objectives of the Danish action plans are met are:

1) Mandatory fertilizer and crop rotation plans at farm level, with limits set on the nitrogen amounts that can be applied to different crops,

2) Statutory norms that set maximum values for the utilization of nitrogen in manure assumed to be plant available. These two instruments have been reinforced several times, for example with the 1991, 1998 and 2000 restrictions of the norms for the utilization of nitrogen in manure. In addition, a large effect has been achieved through improved feeding regimes, which has had a remarkable effect on the utilization of animal feedstuffs. Throughout the period, N-regulations were designed in close dialogue with researchers and farmers' associations, and were followed-up by information campaigns, extension services and education. Also, extensive strategic research programmes have been supported.

The ability to design the regulatory approach to nitrogen use in a manner whereby crop and animal production is affected as little as possible is a main achievement of this

bottom-up approach of continuous dialogue. To account for the development in nitrogen losses from the agricultural system, three national indicators are defined: Nitrogen (N) surplus, nitrogen efficiency and nitrate leaching. Environmental monitoring programmes have shown a decrease in nitrogen concentration in water leaving the root zone, in rivers and in coastal waters. In Danish coastal and open marine waters there has been a significant decrease in N concentrations. In the open waters N concentration is much lower, but a decrease can also be detected. The biological response to the changed N concentrations is less clear.

As a conclusion, the Danish approach to regulating nutrient losses from agriculture has proven successful, but with a delay concerning the environmental effect. It is based on research programmes and dialogue between authorities and the agricultural community. Until now regulations have been applied at a national scale. A more regional or local approach is believed to be necessary in the future.

Sweden has a wide range of agri-environment schemes including measures for nutrient leaching. It is one of the countries in Europe that has the largest share of area under agri-environment schemes (86 %). Cultivation of catch crops and delay of soil cultivation until spring are two measures to reduce nutrient leaching within the Swedish Environmental and Rural Development Plan. Their analysis shows that the agri-environmental support for spring tillage and catch crops complements the fertilizer tax and statutory requirements (e.g. rules on the handling of manure). In principle, taxes and fees have the advantage that they do not place administratively determined restrictions on farm activities. One advantage of agri-environmental support over fertilizer fees is, however, that it can be targeted to regions and crops where nitrogen leaching is a problem.

With regard to nutrient leaching, the effect of the agri-environment scheme is estimated to be 1 850 tonnes of leached N avoided, at a budgetary cost of 155 million SEK (17 million EUR). The efficiency of the measures expressed as budget cost per kg reduced nitrogen leaching (root zone leaching) is 80 SEK (9 EUR) per kg. Even though a systematic comparison with alternative measures has not been done, efficiency seems to be well on par with that of other agricultural measures and with the efficiency of measures in other sectors. For instance, the cost per kilogramme for reducing nitrogen by establishing wetlands on agricultural land was estimated to be 107–180 SEK (12–20 EUR) and 60 SEK (7 EUR) for improving purification plants.

One reason for the fairly high efficiency is that the agri-environment scheme is targeted at land where it has a significant effect and it mainly covers land where farmers costs are low. In addition, the annual cost to farmers may be lower than the budget cost, since the level of support corresponds to the cost for the farmer with the highest compliance cost. Hence, the use of budget cost leads to an overestimation of aggregated compliance cost. On the other hand, the calculations do not include administrative cost, but this is expected to be low when compared to total cost. However, continuous evaluation of the measures is necessary, since economic conditions may change, not least in connection with reforms of the CAP.

3. CAP INSTRUMENTS RELEVANT FOR IMPROVING NUTRIENT MANAGEMENT

The existing IRENA indicators provide some, albeit limited, data on relevant policy instruments as discussed above. Additional information has been gathered for the purposes of this report on other relevant policy instruments, such as cross compliance. But given the lack of comprehensive monitoring and evaluation studies of policy implementation in many Member States it is difficult to fully assess the extent to which policy integration in the field of water protection, including nutrient leaching, is being achieved. Difficulties arising from lack of data are discussed below.

The farming practices that agri-environment schemes most frequently encourage include a number that may reduce the risk of nutrient leaching. These are:

• reduction of inputs (mainly fertilizers and pesticides), including support for integrated production;

• extensification of existing management (e.g. reducing stocking rates);

• support for conversion to and continuation of organic farming.

In some countries or regions, soil erosion is also addressed through agri-environment schemes. However, lack of data on the spatial distribution and geographic targeting of these agri-environments measures and of their environmental impacts makes it difficult to assess if the current agri-environment policy response is effective in terms of reducing nutrient leaching. There is, in any case, a question as to whether agri-environment schemes (incentive measures) are the most appropriate policy tool to meet resource protection objectives or whether greater emphasis needs to be given to the "polluter pays principle" in supporting policy integration. Environmental legislation, such as the nitrates directive, or the use of economic instruments, a tax on fertilizers, are other relevant policy tools for achieving input reduction and reducing the risk of nutrient leaching. OECD papers review the use of different policy instruments highlighting some of the costs and benefits of different approaches such as regulations versus incentives and other economic instruments such as manure quotas. However, there is no fully efficient single instrument for addressing nutrient pollution problems. A mix of policy tools is likely to be the most effective in terms of addressing this - as well as other - agri-environmental problems.

4. ASSESSING INTEGRATION SUCCESS IN RELATION TO NUTRIENT MANAGEMENT

Data from the pressure, state and response IRENA indicators and information on policy implementation and targeting is insufficient at this stage to assess the effective integration of nutrient management concerns into the CAP. Various policy responses such as agri-environment measures, GFP and cross compliance all require farmers - to varying degrees and in different ways - to undertake practices that may reduce the risk of nutrient leaching. However, relatively little is known about the exact nature of these requirements, their spatial and geographic targeting, enforcement and the environmental outcomes. It is therefore currently impossible to judge the efficacy of these policy tools and to use this information as proxy measure for the success of policy integration in relation to nutrient leaching risk.

RESULTS AND DISCUSSION

a) Currently available data and methodological approaches do not allow an indicator-based analysis of the state and trends of agricultural landscapes throughout the EU-27.

b) A wide range of environmental legislation and policy documents has set objectives, and to a lesser extent targets, for environmental management in the agricultural sector. However, most of these are not concrete enough to allow an assessment of whether they are reached or not.

c) Environmental policy integration under the CAP can be achieved through measures in market policy and rural development policy. Significant progress has been made in both pillars of the CAP since 1990. However, the achievement of positive environmental effects depends on a successful and targeted implementation of relevant measures in Member States.

CONCLUSIONS

a) The IRENA indicator set provides a useful basis of information for environmental analysis. The availability of regional information for many IRENA indicators allows some

differentiation of environmental issues and environmental pressures across the EU-27. Thus association analysis can be carried out between indicators for assessing policy targeting. This shows some interesting results, e.g. in the area of biodiversity.

b) Nevertheless, pressure, state and policy response indicators are insufficiently underpinned by georeferenced data to carry out a detailed spatial targeting analysis. Currently available data are too coarse to provide fully satisfactory results.

c) Several key state/impact indicators are reliant on modeling approaches. Models can be very useful tools for environmental analysis as long as the required input data are of sufficient quality. Quality input data are, however, not available for all models employed for IRENA indicators. In this case, the relevant indicators need to be regarded as a first solution only.

d) Deficiencies in indicator data sets (in terms of data accuracy and/or insufficient geographic coverage) limit the possibilities for establishing a link between the driving force, pressure and state indicators. In addition, there is only a weak link or feedback mechanism from the response indicators back to the DPSI indicators. This hampers the evaluation of policy responses, which is further complicated by the complexity of agri-environmental and physical processes as well as the lack of data or knowledge to underpin (suspected) causal links.

LITERATURE

1. AMANN, M., BERTOK, I., COFALA, J, GYARFAS, F., HEYES, C., KLIMONT, Z., SCHOPP, W., and WINIWARTER, W.: „Baseline scenarios for the Clean Air for Europe (CAFÉ) programme", International Institute for Applied Systems Analysis, 2005, pag. 83-112;
2. EVANS, A. D., S. ARMSTRONG-BROWN AND P.V. GRICE: „The role of research and development in the evolution of a smart agri-environment scheme". Aspects of Applied Biology 67, 2006, pag. 253–264;
3. KLEIJN, D. AND SUTHERLAND, W.J.: „How effective are agri-environment schemes in conserving and promoting biodiversity?" Journal of Applied Ecology 40, 2003, pag 947–969;
4. PANIAGUA M. A.: „Agri-environment policy in Spain", The agenda of socio-political developments at the national, regional and local levels. Journal of Rural Studies 17, 2001, pag. 81–97;
5. RIPPEN, M.: „Die Durststrecke is überwunden", Ökologie & Landbau, 3/2004, pag. 12-19.