IMPROVING MEASURES FOR TARGETING AGRI-ENVIRONMENTAL PAYMENTS: THE CASE OF HIGH NATURE VALUE FARMING

JEL classification: Q18, Q56, Q57.

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Abstract. *The debate on optimization of policies and instruments for European agriculture has lasted for several decades and there is still no consensus about it. Although there is unanimity on the targets these policies should achieve, there is an on-going discussion about policy tools for the practical implementation of the CAP as regards agri-environmental payments. The aim of this paper is to contribute to this discussion by looking at the approaches developed to evaluate environmental and economic efficiency simultaneously, as well as to examine possibilities for more targeted agricultural support by implementation of economic-environmental efficiency analysis. In this regard it is especially interesting to consider the case of support for sustainable land use practices such as in HNV (high nature value) farming and the opportunities for implementing such analyses in areas of HNV agriculture: we consider in particular disadvantaged mountain areas in the Romanian Carpathians and the bordering areas in the Ukrainian Carpathians.*

Keywords: *CAP measures, agri-environmental payments, economic-environmental efficiency, HNV farming.*

1. Introduction

The debate on optimization of policies and instruments for the European Agriculture Policy (CAP) with regard to environmental aspects has lasted for several decades and there is still no consensus of opinion on it. There is certainly unanimity on the targets these policies should achieve such as: (1) they should be formulated in order to obtain economic efficiency together with the simultaneous achievement of environmental goals and (2) they should recognize regionally specific aspects and subsidiarity. However, since the early 1990s, when agri-environmental issues were first reflected in the CAP, there has been an on-going discussion on policy tools for the practical implementation of CAP targets and on those instruments which should particularly serve as a basis for agri-environmental payments. The range of opinions on suitable policies is quite wide. Generally it seems that the currently existing system of agri-environmental payments and the cross-compliance mechanism is justified and positively evaluated only because there are no alternatives (Cooper *et al.*, 2009; FAO, 2010).

However many researchers have criticized the implementation of the CAP system for inef-

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ficiency and inconsistencies noticeable between policy measures and objectives (Arovuori, 2008; Mann, 2005). Some specifically argue that there is an obvious contradiction in the current CAP policy: on the one hand, there are agri-environmental payment schemes offering support to sustainable land use practices; on the other hand, there are market and income support payments which give incentives to intensify agricultural production (Pacini *et al.*, 2004). In any case there is a constant search for a suitable policy scheme which could replace the existing system of payments and which would consider a more targeted distribution of payments.

It is especially interesting to consider the case of support for sustainable land-use practices such as in HNV (high nature value) farming which is recognized in some parts as the CAP and as a set of farming practices which are successful in providing positive externalities and environmental services. Those member states, which acknowledge and support the HNV farming concept and maintain HNV agriculture, sustain it mainly through Rural Development Programmes (RDPs) (Beaufoy, 2007).

The aim of this paper is to contribute to the above-mentioned discussion on EU agricultural policy schemes by looking at the approaches developed to consider ecological and economic efficiency simultaneously and to examine the question of the possibilities of measuring economic performance in agriculture by considering environmental efficiency. To do that, we give a review of the existing literature on economic-environmental efficiency and on incorporation of environmental externalities into analysis of production efficiency. Moreover, in the paper, we reflect on opportunities of implementing such analyses in areas of HNV agriculture: we consider, in particular, disadvantaged mountain areas in the Romanian Carpathians as target areas. Bordering areas in the Ukrainian Carpathians were also taken as a region for comparison because they have generally similar conditions but the efficiency analysis can be conducted with the exclusion of the influence of the EU agri-environmental payments (which have already been introduced in Romania). This article brings into the discussion the question of addressing efficient provision of nature if there are possibilities for more targeted agricultural support in the case of HNV farming.

The paper is structured as follows: after the introduction, the theoretical background on policy intervention, specifically in agriculture, is presented, and subsequently the main policy instruments, their mixes, and their possible problems are considered. The third part deals with the CAP itself. First, its development, and, after that, the current state and possible future amendments are described with special consideration of agri-environmental schemes; finally, the most debated problems and inconsistencies of the CAP are mentioned. In the fourth part we give an overview on the options for solving some of the problems mentioned: some approaches for evaluation of farms' performances which are mentioned in the literature are considered, and then an alternative approach for performance analysis is discussed which considers economic and environmental parameters simultaneously within efficiency analysis; this part shows how the methodology was developed and used in various studies and deals with the positive sides as well as the limitations of the approach presented. The fifth part considers the special case of HNV farming support and reflects on implications of the efficiency evaluation approach described for the special HNV farming areas at the research sites in the Romanian and the Ukrainian Carpathians. The conclusion sums up the discussion presented in the paper on the possible solutions to more targeted support within the CAP.

2. Agri-environmental policy: theoretical background

The aim of this part is to give an overview of the theoretical foundation for agri-environmental policies and discuss the most important justifications for policy interventions in agriculture within a market economy. Two dimensions will be mentioned: the environmental and the economic perspectives. The same dimensions will be considered subsequently in other parts to analyse the methods of performance evaluation or the policy mechanisms. The subsection concerning the political perspective deals with main components of policy design: the objectives of the agri-environmental policies as well as policy instruments and their mixes.

2.1. Environmental perspective

A central aspect of agri-environmental policy is the recognition of the various impacts of agricultural practice on material flows of pollutants, nature biodiversity, landscapes, etc. Tillage practices, usage of chemical substances for fertilization, pest control, water consumption, etc. can significantly influence nature and its components. In particular, intensified agricultural production can lead to serious environmental problems such as soil erosion, degradation of water quality, reduction of wild life habitats, etc. (Bonnieux *et al.*, 2006). Production systems and practices differ in the impacts they have on the environment, which can be positive or negative (for example, the differences between the production approaches in organic and in conventional farming).

To justify policy intervention from the perspective of the environment, it has been important to realize that changes in farming practices towards nature-friendly techniques can have a strong positive influence and solve some serious environmental problems. Some forms of agricultural management can provide better environment; for instance, such characteristics as agricultural land use, the size and structure of the farm, agricultural infrastructure, etc. can influence, to a certain extent, types of positive or negative environmental change (Cooper *et al.*, 2009). This aspect has increased the importance of the role farm practices play in managing environmental impacts: farmers are not only food suppliers but also the "conservers of the landscape" and "protectors of natural resources" (Pacini *et al.*, 2004).

2.2. Economic perspective

The economic perspective of policy intervention, in this case, deals with two main terms: environmental externalities and public goods. The impacts of agricultural production on nature influence not only the producer but also other members of society, causing additional costs (in the case of negative external effects) or benefits (positive external effects). The concept of public goods implies that certain goods are characterized by non-rivalry and non-excludability (Schader, 2009) and these public goods can be provided by farming practices which are environmentally friendly only if governance is clear.

Both externalities and public good aspects are considered as market failures, since external effects create costs which are not compensated or benefits which are not paid and environmental public goods can be undersupplied since the provider has no incentives to provide it without compensation (Cooper *et al.*, 2009). This justifies policy intervention in the market mechanism and provides an important framework for agri-environmental policies the aim of which is usually to internalise the external effects.

2.3. Policy perspective

Agricultural policy is an example of multi-objective policy. Most of the aims of current agricultural policy can be accommodated into a sustainability concept (FAO, 2010) and the particular sustainability of farming also implies multiple objectives (Pacini, 2003). Although the term itself is quite ambiguous, we can argue that sustainability in agriculture includes two important components: socio-economic and bio-ecologic or environmental dimensions (De Koeijer *et al.*, 2002). The main policy objectives should cover these dimensions and include such aims as securing farmers' incomes, allowing increase in productivity, recognizing structural developments, market stabilization, reasonable consumer prices, availability of supplies and of course environmental concerns (Arovuori, 2008), which are, in their turn, comprised of further specified targets that will be discussed in part 3 of this paper.

There is a wide variety of policy instruments which can be used to achieve the above- mentioned objectives. The overview of these instruments is given in Table 1 (based on Schader, 2009).

Tab. 1 - Overview of the instruments in agri-environmental policy

Instrument	Short description
Standard regulation	Standard regulation bans the use of certain (detrimental) inputs and prescribes the use of precautionary measures
Environmental tax	Input-oriented taxes allow farmers to use the taxed input only in case it can still be profitable with the tax. There may be also output-oriented taxes (e.g. undesired output)
Tradable quotas	Contrary to the environmental tax which deals with price regulation, the quotas regulate the quantity of environmental certificates tradable on the special market
Environmental auctions	An effective solution on a smaller scale
Communicative policies	Communicative policies lead to higher uptake levels of the agri-environmental schemes on the production side and improved market transparency on the side of the consumer
Agri-environmental schemes and measures	AE schemes represent a voluntary instrument and are a mixture of regulatory instruments with economic incentives; compensate farmers for yield and income loss and higher production costs due to implementation of environmentally-friendly practices
Cross-compliance	Cross-compliance rules represent an obligatory approach. Non-compliance to certain environmental standards makes farmers ineligible to receive other types of payments, for instance direct payments
Community-based schemes	The idea behind this instrument is to fund local initiatives aimed at pursuing policy goals at regional or local level

Source: based on Schader, 2009

Beside these instruments a certain number of other tools are connected directly to the economic dimension, which implies the use of several instruments for one policy. This diversity of instruments causes major difficulties for policy design presenting the task of combining policy tools in the most favourable i.e. effective way, in order to create the needed incentives to farmers for the provision of environmental public goods. There are some rules for effective policy measures and policy design (OECD, 2007):

- Good understanding of the (environmental) problem which should be addressed;
- "Cost-benefit" criterion – the marginal cost of implementing the mix of instruments should be less than the marginal benefit;

- "Cost-effectiveness" criterion – the marginal cost of applying the mix of instruments should be as low as possible;
- "Environmental effectiveness" criterion – the marginal environmental benefit from implementation should be as high as possible;
- In particular the question of the optimal number of instruments in policy design is usually addressed from the perspective of the Tinbergen rule (Tinbergen, 1966), which implies that each instrument within one policy should address one specific policy objective, i.e. the number of tools used should be equal to the number of policy aims.

Following these rules, we can sum up other important aspects which are crucial for effective agri-environmental policy:

- Thorough analysis of the problem is necessary, the focus of the policy is on efficiency;
- Sufficient information on socio-economic and environmental parameters is needed;
- It is essential to develop economic evaluation techniques to measure the effectiveness of policy measures, to estimate the costs or benefits of certain farming types and to evaluate the performance rates of certain farms with regard to the provision of environmental public goods. The latter has implications for more accurate targeting of agri-environmental policy measures which plays an important role and will be partially addressed in the following sections of this paper.

3. The CAP as a mix of instruments for agri-environmental policy

3.1. Development, current implementation and future of the CAP

The history of the CAP (European Common Agricultural Policy) starts in 1957 and it has been constantly subject to new developments. Based on the Treaty of Rome, it introduced various market measures with the main objectives of increasing agricultural productivity and providing income support to European farmers (Cooper *et al.*, 2009). Although certain measures of agri-environmental policy were already implemented in some European countries in the 1980s, the first introduction of environmental concerns into the CAP framework took place in the mid-1990s when McSharry reforms were started (FAO, 2010). The EU Regulation 2082/92 covered such impacts as water quality, soil quality, biodiversity, and landscapes (European Commission, 1998). The relevant measures were classified into 3 groups: environmentally-beneficial in productive farming (including input reduction, organic farming, extensification of livestock, etc.); tools for non-productive land management (including maintenance of the countryside and landscape features, set-aside, etc.); and socio-economic measures (including training and education) (European Commission, 1998).

Next, changes within the CAP were introduced within the period of the Agenda 2000 – the policy developments for the 2000-2006 period – and with the 2003 reform. Within this period such measures as cross-compliance and decoupling of direct payments from production were introduced. This was implemented through the Single Payment Scheme (SPS) which is paid per hectare of land and does not depend on agricultural output. Cross-compliance implies that SPS is paid as long as the land is kept in Good Agricultural and Environmental Condition (GAEC) (FAO, 2010; Brady, 2011). There have been many explanations for the choice of policy (Bartolini *et al.*, 2012); a popular explanation is the theory of compromise and doing things at the minimum as well as having a focus on financial flows rather than on real concern for the environment.

The same strategy was followed in the CAP framework for the 2007-2013 period, which was formed around two pillars, with Pillar 1 representing traditional commodity orientation including decoupled direct payments as well as cross-compliance, and Pillar 2 containing rural development programmes (RDPs) (FAO, 2010). Three Axes of the Pillar 2 cover all dimensions of sustainability: Axis 1 deals with economic issues, Axis 2 focuses on environmental and land management issues with agri-environmental measures as a part of it and Axis 3 considers social and rural community issues (FAO, 2010).

Concerning an assessment of the policy, Cooper *et al.* (2009) put into the focus of their study 10 environmental public goods provided by agriculture which are under the influence of the CAP. These include agricultural landscapes, farmland biodiversity, water quality, water availability, soil functionality, climate stability with relation to carbon storage and measures to regulate green house gas emissions, air quality, resilience to flooding, resilience to fire. These authors also divide the current CAP measures into three groups (Cooper *et al.*, 2009): measures which are focused directly on the provision of environmental public goods (like agri-environmental schemes); measures with partial focus on the environmental issues (for example, support of LFA – less favoured areas); measures with no direct focus on environment but with potential to have a positive influence on nature (decoupled direct payments and cross-compliance). These interdependencies determine the complex structure of the CAP instrument mixes where each instrument may be used to reach several objectives.

All measures for the next CAP reform for the period of 2014–2020 are still under discussion. However it is already clear that there are some serious challenges for agricultural policy in Europe:

- The CAP reform is developing in the framework of Europe 2020 Strategy of “smart, sustainable and inclusive growth” which, among other issues, includes “the promotion of a more resource-efficient, greener and more competitive economy” (FAO, 2010). This implies that the CAP will keep a strong focus on the environmental aspects of agriculture. Moreover the current discussion about percentages of area to be devoted to ecological main structures by farmers, such as 7% of arable land for fallowing, crop rotations, etc., and the intensive discussion about what is eligible to be considered as a greening measure, show the will and need to proceed in the direction of getting better results out of a new CAP in terms of nature conservation;
- The problem of limited financial resources will pose additional challenges for all the actors and will require two important special measures within the policy design:
  - Improved justification of agricultural support as a definite benefit for society and
  - Improved cost-effectiveness of agri-environmental policies.

The latter issue belongs to the most debated problems of the agri-environmental aspects of the CAP and is discussed among other issues in the next subsections of this paper.

3.2. Problems and trade-offs of the CAP

As we have already mentioned, the effectiveness of the CAP can be questioned from the perspective of the Tinbergen Rule which implies that one policy instrument is needed for one policy objective to create an efficient policy. In the sub-section 3.1 we have mentioned the complexity of instrument mixes within the CAP which means that it fails to comply with the Tinbergen Rule (Arovouri, 2008). However this rule was formulated under certain assumptions which should be emphasized: there should be no conflicting goals or co-benefits of policies and there should be no transaction costs (Schader, 2009). This is hardly applicable to agri-environmental policy in general and to the CAP in particular due to the complex system of interdependencies of various tools. For example Schader (2009) shows that multi-objective policy should not be excluded on the basis of the Tinbergen Rule only. Rather, he shows, in his study of organic farming, that it is not the only criterion for the cost-effectiveness of a policy: the effectiveness of organic farming has to be regarded as a single instrument for several objectives. It was proved to be comparable to the option of combined agri-environmental measures (Schader, 2009).

A lot of criticism has been directed against the decoupling and cross-compliance policies. For instance, it was argued that decoupling would lead to a reduction of agricultural activities and production, especially in marginal rural areas (Brady, 2011). The SPS (Single Payment Scheme) is seriously criticized as an inappropriate measure for providing environmental stewardship for rural landscapes and as an inefficient environmental policy, at least as regards landscape values (Brady, 2011). The ability of the cross-compliance framework to avoid all the negative environmental consequences of decoupling is also questioned: the argument is that "commercial constraints will necessarily dominate" and environmental public goods will be undersupplied (Beard and Swinbank, 2001). Payments within this policy measure stay on the same level and are not connected to the levels of nature provision: if some farms show better environmental indicators than others, they still receive the area-based payment. Agri-environmental schemes and payments are yet to be developed to solve this problem. They face another challenge however: since the compensation level is not adapted to real performance of farms, this leads to overcompensation of some producers (Schader, 2009). Sensible methods for evaluation of farm performance are needed for more targeted and balanced agricultural support.

These contradictions which underlie the current CAP measures are a problem and a matter of conflict between environmental measures and other measures for support of agricultural production: although the agri-environmental issues are recognized and accommodated into the current policy, the main objective of the CAP is to increase agricultural productivity. Aims may contradict each other. The question is: if there is a certain farming system or a set of farming practices within a region which is able to reach both aims simultaneously in the most efficient way, how can we incorporate into policy the incentive to follow the best practice example?

The problem of performance evaluation of farms and ways to targeting of agri-environmental support will be addressed in the following parts.

4. Considering economic and environmental efficiency within the CAP

4.1. Evaluation approaches to support the CAP: an overview of the literature

As mentioned above, the agri-environmental policy itself and agri-environmental schemes in particular face a lot of challenges since it is very complicated to measure environmental effects in practice and to evaluate how effective the policy measures are. Many approaches are developed in the literature for solving the issue of evaluation. In this paper we consider a few evaluation approaches which do not cover all the scope of existing methods but give an idea of how this assessment can be performed. These methods contain the following common features:

- They are farm system approaches to evaluation (with the exception of the case presented by Schader (2009) where a sector-based approach was applied);
- They include modelling of economic and environmental effects;
- The main aim of these methods is to evaluate measures of agri-environmental policy.

For example, Schader (2009) used a cost-effectiveness approach for the evaluation of the Swiss agri-environmental policy, in particular of organic farming support. The approach used linear programming (LP) and modelled farm management and relations between farm internal activities as well as farmers' responses to changes in exogenous conditions in the form of direct payments or product prices; it also compared farm groups (organic and non-organic farms) within the sector and took into account policy uptake, environmental effects and public expenditure for agri-environmental policy, notably as determinants for cost-effectiveness (Schader, 2009). Although only three environmental effects were considered (fossil energy use, biodiversity and eutrophication with nitrogen and phosphorus), the analysis (with the use of this model) presented interesting results considering cost-effectiveness of organic farming support and showed differences between organic and conventional farms. It proved that generally organic farms perform better with respect to the environmental impact. Moreover it showed that organic farming support as a multi-objective policy provided individual environmental effects at a higher (but comparable cost) than specialised targeted agri-environmental measures.

In their approach Falconer and Hodge (2001) used the "production ecology methodology" to see how different measures of pesticide use control influence farm performance (Falconer and Hodge, 2001). The idea behind this approach is to analyse simultaneously production of agricultural outputs and environmental externalities. It resulted in connecting economic farm modelling with ecological models developed to evaluate environmental consequences of pesticide use. Economic performance models were developed for two farm groups: commercial crop production and "progressive" farming which included commercial as well as reduced input practices. The environmental model aggregated "hazard indicators for pesticides" which were identified for nine ecological and human-health dimensions scored according to labelled warnings (Falconer and Hodge, 2001). The two models were combined into a farm resource allocation model including both the economic components and indicators for environmental hazards. Finally a two-dimensional frontier analysis was used to see the differences between the outcomes of the various policy instruments applied. The approach also uses an LP model.

The model developed by Pacini *et al.* (2004) aimed at comparing the economic-environmental performance of organic and conventional farms under various policy scenarios, and at measuring the superiority of organic systems for various amenities. Versions of integrated ecological-economic LP models for organic and conventional farming systems were used to compare various aspects of their performance: technical, environmental and economic. In principle, the model used input-output matrices which were extended to include emissions and various indicators from ecological models such as nitrogen leaching, soil erosion, ground and surface water balances, herbaceous plant biodiversity, and others (Pacini *et al.*, 2004). The combination of these models allowed the evaluation of the production costs of environmental externalities provided by organic methods. The modelling framework is described as indicating efficient use of measures for the policy with multiple objectives because "it is based on actual environmental performances, it takes into account site-specific pedo-climatic factors; and it is holistically designed and considers trade-offs between potentially conflicting environmental goals" (Pacini *et al.*, 2004).

To sum up, it is necessary to mention that the approaches considered were developed to evaluate and compare the performance of various farming systems with respect to economic output and environmental impacts. However the main aim of these methods is to evaluate various agri-environmental policies. Another limitation is that most of them consider only a few environmental effects. Within the scope of this paper we are more interested in how to distinguish farmers according to their economic-environmental performance within a certain farming system. In order to make the agri-environmental support more targeted, we think that it is necessary to consider farm performance. Admittedly, the approaches described can be applied to this kind of assessment; however the next subsection will deal with a further method for evaluation which offers new perspectives for policy analysis and design.

4.2. Opportunities for efficiency evaluation

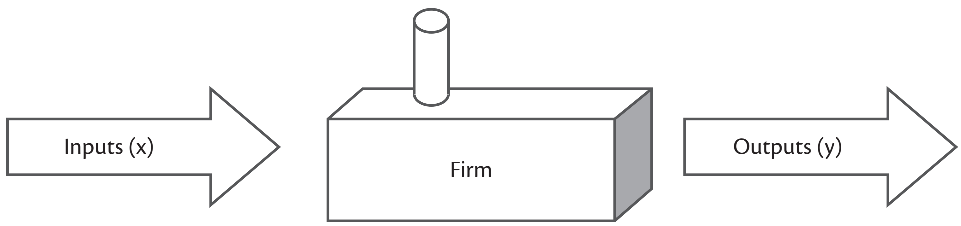
With regard to the trade-off between the two most significant objectives of the CAP which are often contradicting one another (i.e. the increase in productivity and the provision of environmental goods) it is important to take into consideration evaluation methods which would be able to provide an analysis combining both aims. Efficiency evaluation which would consider economic and environmental performance seems to be a suitable solution. This subsection gives an overview of the methodological developments in this area and discusses the possible implications for the CAP.

The measurement of production efficiency is usually based on physical and monetary inputs and outputs. The traditional setting of production economics (see Figure 1) implies that "a firm consumes inputs (e.g., labor capital, materials, energy) to produce economic outputs (i.e., goods and services)" (Kuosmanen and Kortelainen, 2004). Technical efficiency of this firm implies that its input-output combination lies on the boundary of the set of all possible inputs and outputs which represents technology (Kuosmanen and Kortelainen, 2004). A commonly used measure of efficiency is a ratio in the form of:

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}}$$

Although many other measures (such as, for instance, relative efficiency) are used (Cooper *et al.*, 2002, Bousofiane *et al.*, 1991), it lies at the core.

Fig. 1 - The traditional setting of production analysis



Source: Kuosmanen and Kortelainen, 2004.

It is important to point out that an incorporation of environmental externalities into efficiency analysis provides a more complete representation of production technology. At the same time the omission of environmental effects may create biases in evaluation of production techniques and underestimation of the environmentally friendly technologies (Sipiläinen *et al.*, 2008). The methodological challenge of this approach is the consideration of how these externalities can be incorporated into the efficiency model: as an input or as an output.

A number of research papers elaborate on consideration of environmental impacts of production in efficiency analysis. The majority of them deal with negative externalities. Some authors assume that negative environmental impacts are technically outputs and therefore argue that environmental externalities should be modelled as an undesirable output (Färe and Grosskopf, 2004). Another group of researchers sees it as a conventional input; they justify this, for instance, by the fact that undesirable environmental effects as well as inputs incur costs to the firm (Kuosmanen and Kortelainen, 2004; Lauwers and Van Huylenbroeck, 2003; Reinhard *et al.*, 1999, De Koeijer *et al.*, 2002). However there are also attempts to model positive externalities which are considered as non-marketed output or as desirable by-products (Sipiläinen *et al.*, 2008).

The notion of environmental efficiency provides many possibilities for economic evaluation of environmental impacts. However, modelling approaches differ. Usually environmental efficiency is defined either as "the ratio of minimum feasible to observed use of an environmentally detrimental input" (Reinhard *et al.*, 1999) or as the ratio of economic value added to environmental pressures (Kuosmanen and Kortelainen, 2004).

Methods of evaluation in case of environmental efficiency also vary. For instance, Reinhard *et al.* (1999) use an econometric approach to estimate the environmental efficiency of nitrogen surplus in agriculture. The same group of authors used the SFA approach (Stochastic Frontier Analysis) to assess the same parameter with consideration of multiple environmentally detrimental inputs (Reinhard *et al.*, 2000). But the method which we would like to consider in this paper and which is also often used for this type of analysis, is the DEA method (Data Envelopment Analysis).

DEA is an approach for comparing efficiency of various organizational units (farms) with multi-input and multi-output production options (Siplilälnen, 2008). Efficiency is calculated for a relatively homogenous set of decision making units (DMUs). DEA constructs the efficiency frontier (the most efficient combinations of inputs and outputs performed by some of the DMUs in the set) and calculates the distance to this frontier for the DMUs which are not situated at the frontier and therefore are less efficient (De Koeijer *et al.*, 2002). "DEA does not require the user to prescribe weights to be attached to each input and output... and it also does not require prescribing the functional forms" (Cooper *et al.*, 2002). So minimal prior assumptions are made and the approach lets the data "speak for themselves" (Kuosmanen and Kortelainen, 2004). This is especially beneficial for the case of environmental evaluation since subjective assessment of weights for the aggregate level of environmental impacts is quite a challenging procedure (Kuosmanen and Kortelainen, 2005). Moreover DEA uses LP models which are solved for every DMU.

DEA has also been used for agricultural policy evaluations. For example, De Koeijer *et al.* (2002) applied DEA to estimate technical and environmental efficiency of Dutch sugar beet growers. The environmental efficiency in this analysis is based on the environmental impacts of polluting inputs (pesticides and nitrogen application). Reinhard *et al.* (2000) considered the use of multiple environmentally detrimental inputs (excess nitrogen and excess phosphate use and total energy use) within the DEA approach to evaluate the environmental efficiency of Dutch dairy farms. In contrast to the approaches mentioned Sipiläinen *et al.* (2008) used the DEA method for efficiency evaluation with positive externalities: they compared the performance of organic and conventional farms modelling the existence of two outputs – conventional output (crop yield) and environmental by-product (agricultural biodiversity). The latter research shows that the method can be used to evaluate the performance of a holistic farming system such as in this case, organic farming.

Considering these attempts to evaluate performance at farm level, we can argue that DEA is a suitable method for measuring the efficiency of farm performance considering environmental impacts. On the one hand it allows consideration of multiple environmental effects (Reinhard *et al.*, 2000) and on the other, it also provides an opportunity of modelling positive as well as negative externalities (in the form of outputs and inputs respectively). In addition, DEA results can be used practically in many other ways, for instance, to ascertain how the DMUs can become more efficient, to form peer groups, to identify efficient operating practices and strategies, to allocate resources, etc. (Bousofiane *et al.*, 1991). The aim is now to use DEA for evaluation of farm performance.

Despite all the positive features, it is obvious that the approach also has some limitations. DEA is based on certain assumptions such as availability of resources, convexity and absence of statistical errors in the data set. In fact "the extensive data requirement" is usually mentioned as the main limitation of this method (Kuosmanen and Kortelainen, 2005). Since the efficiency frontier is built simultaneously and no prior assumptions are made, the data should be accurate and reliable. It is also important to point out that data availability, especially for analysis with consideration of environmental impacts of policy (payments), is a major problem for all evaluation methods including those described in subsection 4.1. At the same time the information requirement is very important for policy design: "The omission of information on many environmental aspects may lead to misjudgements in the objective policy-making process and conflicts between different government programmes or regulations" (Pacini, 2003). Another problem within DEA, which should be mentioned, is connected to the simultaneous evaluation of multiple positive and negative environmental impacts. First, a clear framework should be elaborated which accommodates the environmental effects and groups them into two categories according to their positive or negative impact. It should also be decided how these impacts are defined – as inputs or as outputs. Secondly, the interdependencies between the environmental effects should also be considered (Kuosmanen and Kortelainen, 2005).

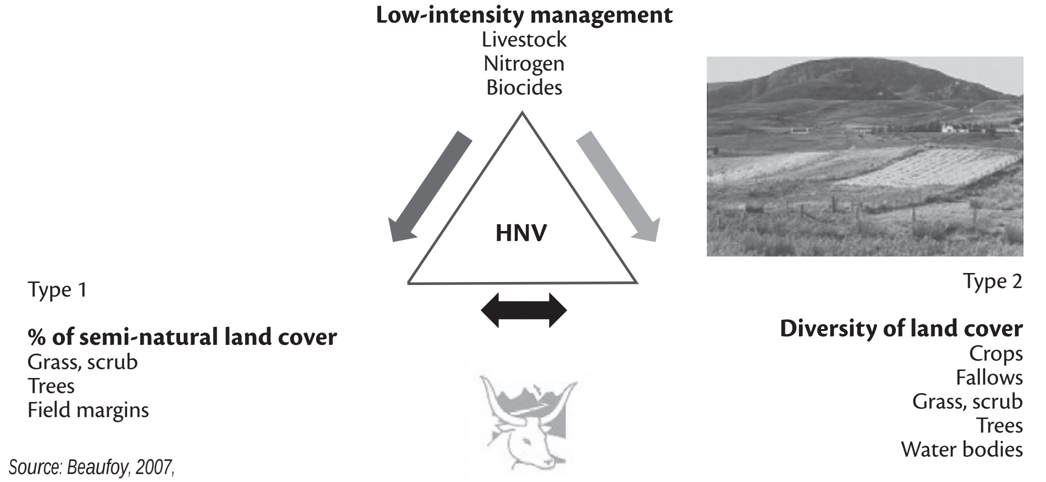
The next part of this paper considers the special case of HNV (High Nature Value) farming and the possible implications of the efficiency evaluation approach described for HNV areas.

5. Efficiency evaluation in the case of HNV farming

5.1. HNV farming within the CAP

The concept of HNV (High Nature Value) farming is rather new (Beaufoy *et al.*, 1994; Beaufoy, 2007, Andersen *et al.*, 2003), though it covers well-established conceptual approaches in farming system and landscape analysis (such as extensive farming, farming with nature provision). The concept was developed for different landscapes, within which nature is still found intact and ecological values are ranked high (Fig. 2). HNV farming applies to situations in which nature co-exists and coincides with farming activities as well as in situations where farming is supportive of greater biodiversity in semi-natural landscapes. The purpose of this concept is to compare and contrast extensive farming systems to farming systems that do not care for nature or even degrade nature. The aim is to link the three components, ecology, farming, and public policies, in such a way that they get "equal" recognition in management concepts. Since most of the payments within the CAP framework were intended for Europe's most productive and competitive farmers, HNV farming is an attempt to identify and define alternative types of farming that also need public support but, on the other hand, deliver increasingly scarce ecosystem services at both local and EU levels. The central objective is to shift public support in favour of low intensity farming across extensive areas of landscape (Beaufoy, 2007).

Fig. 2 - Characteristics of HNV farming



Source: Beaufoy, 2007,

As we can see, the concept of HNV farming is based, first of all, on the idea of low-intensity farming and more importantly on the concept of a holistic system of extensive land use practices which includes the notion of connectivity between farming and nature. Therefore HNV agriculture provides the public good of biodiversity conservation as well as other environmental amenities and facilitates an improvement in the ecosystem, possibly at lower cost than single measures. In contrast to other farming systems, in this case the main policy task is not to encourage the farmers to produce in a more environmentally friendly manner since the basic assumption of HNV is that nature provision is already a part of this agricultural system. This type of farming is based on traditional knowledge and local culture. However there are other important challenges for such policy: intensification or abandonment should be necessarily addressed and agri-environmental schemes should be adopted. Since these farming systems dominate in marginal and remote (usually mountainous) areas (Baldock *et al.*, 1996), abandonment, which is related to inability to adapt land management to social and economic pressures (MacDonald *et al.*, 2000), is a significant threat. The main impacts of this trend on the environment are usually connected directly to biodiversity losses, changes in the landscape mosaic and soil depletion (MacDonald *et al.*, 2000). An assumption is that HNV farming, as a holistic sustainable agricultural system, can provide a solution for these challenges; therefore all kinds of support measures can be regarded as environmental measures.

Currently HNV farming is supported through Pillar 2 of the CAP and RDPs (Beaufoy, 2007). The main measures within the CAP which have an impact on this type of farming are for instance: i) natural handicap payments or aid to farmers in less favourable areas (measures 211 and 212), ii) Natura 2000 programme for special conservation zones (measure 213), iii) agri-environmental schemes (measure 214), and iv) partially also payments for conservation and upgrading of the rural heritage (measure 323) (Cooper *et al.*, 2009).

Summing up, we should emphasize that HNV farming can be regarded as a holistic system which comprises extensive farming practices favourable to the environment. In contrast to organic agriculture, which can also be distinguished through its special approach to production techniques, this system is, moreover, incorporated into the way of life of local people and strongly connected to the local culture and traditional knowledge. However, we argue that even within the homogenous group of HNV farms there can be differences in performance and in environmental provision which it is important to identify and analyse. Therefore, as has been shown in the subsection 4.2, DEA is a suitable approach for exploring these issues for several reasons: 1) it is suitable for evaluating the efficiency of multi-input multi-output production; 2) DEA has already been used for evaluation of holistic farming systems such as organic farming (Sipiläinen *et al.*, 2008); 3) this method can consider negative as well as positive environmental impacts in the efficiency evaluation; 4) it allows incorporation of several environmental impacts simultaneously (Reinhard *et al.*, 2000).

5.2. The case of sustainable farming in the Romanian and the Ukrainian Carpathians

The Romanian and Ukrainian parts of the Carpathians are still characterised to a large extent by traditional farming and still exhibit a high level of biodiversity (hot spots of biodiversity in Europe) with landscapes still partly intact. They can, therefore, be considered as HNV farming areas. Often, however, they have undergone and still undergo pronounced land-use changes that negatively affect the resilience of sound ecosystems and the provision of ecosystem services and public goods (Nuppenau *et al.*, 2011). It is remarkable that even after periods of intensive land use during the communist era (and the times of state farms which dominated in both the Ukrainian and the Romanian parts of the Carpathians) the areas under study managed to maintain a system where a rather high degree of connectivity between local farming activities and biodiversity exists. This might be the consequence of the mixture of natural, social and economic conditions as well as a strong cultural identity which is present in both regions.

Those areas in the Romanian and Ukrainian Carpathians, which we consider in this paper, possess various features in common, as well as differences (Solovyeva *et al.*, 2011). The regions are famous for their unique hot-spots of biodiversity and marvellous heterogeneous landscapes. Although the regions under comparison are far away from each other, their natural and climatic conditions are quite comparable and have a strong influence on the way of life as well as on the regional development paths chosen. The areas belong to the group of disadvantaged areas and natural conditions limit possible farming practices to a certain range of agricultural activities which are almost the same for both regions (i.e. livestock breeding, limited use of arable land, hay making etc.). Beside other features such as low income, which are also common for both countries, a strong cultural identity prevails in these mountainous areas: both in the Romanian and in the Ukrainian Carpathians people identify themselves with the local culture, traditions (including traditional ways of farming), and history. The study area in Romania is associated with the Hungarian minority of Székely and Csángós and the research sites in Ukraine are linked to Hutsuls – one of the three ethnic groups typical of the Ukrainian highlands. So far this cultural identification may be regarded as a very important integrating force for these regions which could not be weakened even by the collectivization period.

The main differences between the regions under study are new events like availability of EU CAP instruments (payments) for Romania, flight from the land, and different pathways for land distribution (Solovyeva *et al.*, 2011). Since Romania entered the EU, farmers received agricultural support based on the CAP (similar to farmers in other member states). As a survey carried out in two villages in the Romanian Carpathians showed, every farmer in this region of the Romanian Carpathians is eligible for at least one type of payment (Biro *et al.*, 2011). The overview of the measures applied, together with the policy uptake, is presented in Table 2. 'Land based' subsidy is the Single Area Payment Scheme (SAPS), 'After animals' subsidy is the payment farmers receive per animal; the agri-environment subsidy is available for High Nature Value Grasslands and has two packages: 1) basic HNV grasslands and in addition 2) the traditional farming package (manual scything of fields) (Biro *et al.*, 2011).

Tab. 2 - Absorption of subsidies

Type of subsidy	Delne (n=24)	Hidegség (n=36)
Land based	66.7% (16)	97.2% (35)
After animals	37.5% (9)	77.8% (28)
Agri-environment	12.5% (3)	16.7% (6)

Nota: figure in brackets = number of households taking up the subsidy or grant
Source: Biro et al., 2011.

Although the results show that land based and animal based subsidies are relatively well absorbed, these types of measures are not quite suitable for HNV farming systems in the Carpathian areas. Whereas farms in Romanian regions (as well as in Ukraine if this kind of payment were available) obviously meet the cross-compliance criteria, the amount of support for this measure cannot be compared with that for other types of farming systems. Since the farm land size is very small in both countries and animal numbers are also small and keep on decreasing (Solovyeva *et al.*, 2011), payments are minimal. Although most farms which took part in the survey in Romania are eligible for agri-environmental payments, the policy intake of this category of measure was quite low (Biro *et al.*, 2011). The explanation might be that the respondents are not familiar with the available schemes; they don't understand the reason for receiving these payments and simply accept the recommendation of officers from Local Councils.

Beside these difficulties in applying agri-environmental schemes, another point should be mentioned: if we assume that there is a certain variation in farming intensity and in agricultural practices (even within this homogenous group of low-intensity farmers) their environmental performance might also vary (Kleijn *et al.*, 2009) which leads to the problem of overcompensation already mentioned (see subsection 3.2 of this paper and Schader, 2009, p. 23). It is worth mentioning, moreover, that the results of the same survey carried out in the Ukrainian Carpathians showed that the situations in both countries are very similar (except for CAP support) and similar land management patterns were observed (Solovyeva *et al.*, 2011). This proves that, even without policy support, farmers in the conditions of the Carpathian Mountains follow the management patterns which have existed there for centuries and which are based on cultural traditions. Normally this phenomenon would create an argument against payments since they can cause deadweight effect (Schader, 2009) and may also lead to overcompensation. However, as we have mentioned above, the measures within HNV farming systems should be directed more towards the prevention of abandonment and creation of conditions which would assure the preservation of these farming practices. Therefore any kind of support directed to income improvement may be regarded as a suitable solution.

Taking into consideration the peculiarities of HNV farming in general, and in particular with respect to the regions in the Romanian and Ukrainian Carpathians, the application of the environmental and economic efficiency evaluation method can contribute to agri-environment policy in several ways:

- It enables evaluation of farmers' performance which might be used for the justification of policy decisions, and the design of the suitable support measures;

- It can contribute to the targeting of the policy support: in the case of HNV farming this method would allow identification of the less efficient farmers with respect to economic and environmental performance;
- Depending on the outcomes of the efficiency analysis (and efficiency in this case is identified as economic and environmental efficiency) the groups of farmers which need support can be identified. For instance, if the payments are distributed to the most efficient farmers, this policy would give farmers an incentive to keep the management patterns which are conducive to nature provision, on the one hand, and to optimize their economic performance, on the other (for instance, to develop mid-size technology locally which would not have a negative impact on the environment).

Despite the positive features of the DEA efficiency evaluation method which were described in subsection 4.2 of this paper, all the negative sides of this approach should be carefully considered. We would like to mention two of the most important challenges with respect to this kind of evaluation:

- Many environmental characteristics are connected to site-specific natural conditions of the area; therefore it is very important to exclude the influence of this kind of site characteristic from the evaluation. This is necessary in order to ensure that the difference in environmental efficiency between the farms is conditioned by different agricultural practices and not by the natural characteristics which cannot be influenced by farmers. This is a big challenge for all types of environmental evaluation but there have been many attempts to consider it in the evaluation methodology (for example, see Pacini *et al.*, 2004);
- This method, as well as other evaluation approaches, has stringent requirements in terms of data availability: the data should be especially accurate and reliable. This challenge gives much scope in the search for improvement and optimization with respect to the availability of information: the development of various indicators could be a solution.

6. Concluding remarks

This paper contributes to the debate on optimization of policies and instruments for European agriculture, which has continued for several decades, by suggesting an efficiency evaluation approach to policy based on the heterogeneity of farms. Rules crucial for effective agri-environmental policy have been described and the degree of the CAP's compliance to these rules discussed. Some important limitations of the CAP with respect to agri-environmental policy have been mentioned. These limitations, as well as changes under discussion in the European policy for the 2014-2020 period, such as a shift of financial resources from Pillar 1 to Pillar 2 and a general reduction of the overall CAP budget (FAO, 2010) pose many challenges to developments in the field of policy design. These aspects also force policy-makers and researchers to look for sustainable farming systems where the connectivity between farming practices and nature is already in-built. At the same time, the search for suitable methods for evaluating farm performance, which would allow the differentiation between the efficiency of environmental and of economic performance, is taking place. The paper then discusses options for further modes of evaluating policy by efficiency analysis. The literature overview focuses on the DEA-efficiency evaluation and describes this method as a suitable approach for policy evaluation; its main positive features as well as drawbacks are emphasized. Although its implementation would definitely contribute to policy design, especially in areas with HNV agriculture, it creates various additional challenges which require further development of the approach and techniques for assessment of environmental and economic performance.

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