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Indicator-based agri-environmental payments: A payment-by-result model for public goods with a Swedish application

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ABSTRACT

Biodiversity, cultural heritage, and scenery are major public goods produced in the agricultural landscape. Theoretically, Indicator-based Agri-Environmental Payments have the properties of providing socially efficient production. A system of seven composite state indicators, expressing the public goods of the respective fields or field elements, was developed and tested to assess if the model worked in practical policy implementation. The evaluation indicated a more efficient resource allocation, better dynamic incentives and lower transaction costs, compared to the current Swedish payment programs. A disadvantage is that such value-differentiated payments do not comply with tailoring and with present WTO- or CAP-regulations of cost-based payments.

Introduction

The policy problem and the objective of the study

Three conditions have to be considered if aiming to develop socially efficient policy measures for the environmental services connected to agricultural landscapes. A basic condition is the non-rival and non-excludable characters of these environmental goods, which normally causes a market supply below social optimum (Samuelson, 1954; Randall, 1972). Secondly, these environmental goods are positive externalities produced by agriculture, which limits the feasibility of policy restrictions since unprofitable land use and management cannot be enforced. Thirdly, the agricultural landscapes are quite heterogeneous in many dimensions, implying that the values of the environmental public goods vary widely between fields, pasturelands and field element objects. The present agri-environmental payments (AEPs) to pastureland and field elements according to EU Council Regulations 1698/2005 and 1974/2006 is an appropriate policy response, but only to the first two conditions stated above. Their management-based payments, cost-based designs and more or less uniform payment tariffs do not consider the differences in environmental values, which make them inefficient.

This paper presents an assessment whether value-differentiated AEPs are better or not than the present Swedish management based and unit-price AEPs. The approach of this explorative study is to test if it is possible to develop feasible public good indicators and agri-environmental payments that are directly linked to estimates of such indicators. The assessments of the Indicator-Based Agri-environmental Payments (IAEPs) are carried out by Multi-Criteria Analysis with respect to efficiency, fairness and implementation feasibility criteria. A coherent set of indicators is accordingly developed to reflect the respective environmental public goods of the individual field, pastureland and field element objects; see Hasund (2005b, 2011) for a presentation of the methodology and the results. The idea is that the more public goods, the higher the indicator estimate, and the higher the AEP. This involves "paying for the product" instead of rewarding management measures.

The agricultural landscape and the environmental problem

The agricultural landscapes of Sweden have changed drastically with the modernization of food production over the last decades. New technology and mixture of input factors have reduced the maintained area and its environmental quality. This process is likely to continue. It has large impacts on the environmental public goods of the landscape, here classified into biodiversity, cultural heritage, and other socio-cultural landscape amenities (scenery etc.).

For example, in quantitative terms, the area of traditional meadows has declined drastically (SBA, 2005, 2009). Traditional meadows and many of the semi-natural pastures are the most species rich terrestrial habitats in Scandinavia (Svensson, 1988).

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At least 50% of the former field elements, such as stonewalls or ponds, have been removed in Sweden since 1947 (Ihse, 1995). Environmental quality has decreased in substantial parts of the remaining agricultural land, partly caused by the use of fertilizers and pesticides, partly by decreased management of field elements, permanent forest edges and pastureland (Ihse and Blom, 2000; SBA, 2002; Jonasson and Kumm, 2006; SBA, 2006). Similar patterns of agricultural landscape deterioration have taken place in most industrialized countries (EEA, 1995; OECD, 1999b).

The present Swedish system of agri-environmental payments

The production of environmental public goods by Swedish agriculture is affected by a complex set of policy measures, including the tax system, general agricultural policy measures, infrastructure, and animal welfare regulations. Although many of them are important, they are generally inefficient measures of supporting the positive externalities of agriculture. Targeted measures are recommended or requested by several actors, e.g. OECD (2001, 2007a), mainly advocated in terms of goal attainment or efficiency. The more important directed regulations are in The Swedish Environmental Code (SFS 1998:808), concerning Nature Reserves (7 kap. 4, 5§§), Biotope Protection (7 kap. 11§), and Environmental Concern in Agriculture (12 kap. 8, 9§§). These are aimed at restricting environmentally harmful activities, but cannot support positive maintenance. By limiting this study to comparing the present Swedish AEPs with an IAEP-system, the starting-point of its comparative assessments was that efficiency and fairness properties may differ also between directed AEPs.

The agri-environmental payments to Swedish farmers are regulated by CAP, EU Council Regulations 1698/2005 and 1974/2006, which are established in the Swedish Rural Development Plan (MA, 2007a,b). Within the program, the two most important directed schemes for landscape public goods are the AEPs to "Traditional meadows and pastureland" (Permanent Grassland, PG-scheme) and payments directed to Field Elements of arable land (FE-scheme).

The PG-scheme distributed 815 million SEK[1] to 294,900 ha in 2007 (Table 1) (SBA, 2008d). All permanent grasslands received 1100 SEK/ha/y, whereas qualifying pastures and traditional meadows receive 2500 SEK/ha/y and 3500 SEK/ha/y, respectively. An official of the county board determines if the grassland object is eligible for higher AEP, and then establishes a detailed, site-specific management plan linked to it. There are also specific payments to scythe mowing and pollarding. Besides providing financial support, the scheme involves a set of strict management requirements, such as clearing of all brushwood. Farmers who do not comply with the requirements on an object are subject to severe repayment claims (MA, 2007a,b).

The FE-scheme distributed 148 MSEK in 2007. Most types of linear elements are rewarded by 0.6 SEK/m, but some types receive 2.6 SEK/m/y (MA, 2007a,b: Table 1). There are no payments to wood edges. Each object of point elements such as ponds, field islets and redundant traditional field buildings may receive 180 SEK/y, whereas, others are paid 60 SEK/y (ibid.). No further differentiation of the payments exists. The payments are conditioned by management requirements. About 32% of the Swedish linear elements and 28% of the point elements are involved in the AEP schemes (calculated from SBA, 2006).

The AEPs are dependent upon a contracting procedure, where the farmers have to send in detailed applications (MA, 2007a,b). Many farmers employ consultants for the contracting procedure.

[1] Swedish Crown (1 SEK ≈ 0.1 Euro).

Outline

This paper continues with an introductory section providing a theoretical welfare foundation for how to design socially efficient policy measures for environmental public goods of the agricultural landscape. It is followed by a presentation of the proposed methodology that is broken down into four sub-sections. Section "The IAEP approach" explains the IAEPs approach based on the theoretical conclusions. Brief sections about the methodology for developing the indicators and about linking the payments to the indicators come after that. The methodology part ends with a section on the methodology for evaluating policy measures. The next part describes the results. Its first section presents the resulting set of developed indicators. One of the indicators is then presented to illustrate the set of indicators developed. The last section evaluates the IAEPs relative to the present Swedish system. The potential of an IAEP-system and its policy implications are discussed in a final, concluding section.

Welfare theoretical foundation

Agriculture produces not only private market commodities but also biodiversity, cultural heritage, and other socio-cultural qualities. Without continued agriculture, much of these environmental goods and services would disappear. Viewed from a welfare economic perspective, the basic policy problem is that these products are non-excludable and non-rival in consumption, included in the utility functions of many persons. This implies that private markets, based on property rights and contracts, normally cannot provide socially efficient land use, or production of these environmental qualities. These environmental services were previously by-products of food production by technical complementary, but joint output decreased drastically over the last decades through changing technology and changing relative prices.

Non-excludability means that nobody could be excluded from consuming the good, whether having the legal right to it or not, and whether paying for it or not. Non-excludability provides free-riding incentives, which leads to socially sub-optimal production of goods with this character (Randall, 1972). This character applies to many environmental qualities of landscape objects, not the least to non-use values of biodiversity and cultural heritage or use values in terms of scenery and local identity.

Non-rivalry implies that a person's consumption of a good does not reduce other persons' utility from, or possibility to, consume it. Consequently, the market will produce less than the optimal amount of biodiversity, pastureland, or other non-rival goods, as the price mechanisms underestimate their social value (Randall, 1972; Samuelson, 1954). The market transaction costs for supplying the landscape goods demanded are in most cases prohibitively high, even for co-operative solutions (see e.g. Vatn et al., 2002).

In this context, it should be emphasized that the Swedish agricultural landscape is not a single good but tens of thousands of heterogeneous arable fields, pastures, and field elements. Biotope conditions, geographical location, management history, hydrology, surrounding landscape, frequency of visitors, and size vary widely across the objects. Many values may also be involved in varying degrees between the objects, where biological, cultural heritage, and socio-cultural values are just broad categories (see OECD, 1999b). As well as implying high transaction costs (see Section 'Transaction costs' below), another consequence is that the marginal costs and the marginal social benefits of producing the landscape public goods vary widely from site to site.

Socially efficient land use implies that each arable field and pasture, where the total social benefits are larger than its social costs, is maintained with the most efficient technology. An optimal amount