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Impacts of agri-environmental policy on land use and nitrogen leaching in Finland

Heikki Lehtonen [a,*], *Katri Rankinen* [b]

[a] *Natural Resources Institute Finland (Luke), Economy and Society, Latokartanonkaari 9, FI-00790 Helsinki, Finland*
[b] *Finnish Environment Institute (SYKE), Natural Environment Centre/Ecosystem Processes, Mechelininkatu 34a, PO Box 140, FI-00260 Helsinki, Finland*

ARTICLE INFO

Article history:
Available online 5 March 2015

Keywords:
Agricultural production
Nutrient leaching
Agricultural economics
Hydrological modeling

ABSTRACT

Agri-environmental policies are challenging to be evaluated since they are often implemented in combination with other policies and regulations affecting agriculture. Also input and output markets affect agriculture. We provide impact assessment of agri-environmental scheme implemented in Finland 2007–2013 based on integrated economic and hydrological modelling and counterfactual scenarios. Development of crop specific fertilisation and land use changes, simulated using a multi-regional economic sector model, is included in a nutrient leaching model implemented in a typical agricultural region. Our results on agricultural production, land use, and nitrogen leaching show that the agri-environmental policy successfully mitigates nutrient leaching in intensive production regions but some mitigation potential is lost in less intensive regions.

1. Introduction

Agri-environmental policy schemes are often difficult to evaluate. According to the European Court of Auditors (2011), the objectives determined by the EU Member States are numerous and often not specific enough for assessing whether they have been achieved. Based on the number of shortcomings found in the implementation and assessment of the agri-environmental schemes, it is recommended that the European Commission and the EU Member States should better clarify, justify and report on agri-environment sub-measures, and the Commission should assess more rigorously the key elements in rural development programmes before approving them. There is a substantial need to improve the evaluations of agri-environmental schemes.

The Finnish agri-environmental support scheme (FAEP), as part of the Common Agricultural Policy (CAP) of the European Union, is considered to be a major package of policy instruments to encourage farmers to protect and enhance the environment on their farmland, through payments for the costs of provision of environmental services (European Commission, 2014). Different measures, with appropriate cost reimbursements, have been defined in the scheme, and they are aimed at maintaining and improving environmental quality while mitigating negative impacts. Participation in the FAEP and receiving FAEP payments for cultivated farmland is conditional on fulfilling the CAP pillar 1 cross-compliance conditions. Cross-compliance conditions of the CAP pillar 1 are relatively inexpensive for a farmer compared to FAEP conditions. CAP pillar 1 cross-compliance conditions require that land must be kept in good agricultural condition and

* *Corresponding author*. Tel.: +358 407347533.
E-mail addresses: heikki.lehtonen@luke.fi (H. Lehtonen), katri.rankinen@ymparisto.fi (K. Rankinen).
http://dx.doi.org/10.1016/j.envsci.2015.02.001
1462-9011/

cannot be idled. According to the CAP implementation in Finland, set-aside eligible for CAP direct payments must be kept as grasslands, to mitigate soil erosion (Finlex, 2006). However, set-aside has not been eligible for agri-environmental payments (but only CAP direct payments and LFA payments), except in a case of nature management fields (NMF) which have received agri-environmental payment of 170 €/ha.

Water protection has played a dominant role in the FAEP (Aakkula et al., 2012; MMM, 2007, 2014). Nowadays, the FAEP is also the main tool within EU Water Framework Directive (WFD) to control the nutrient load from agriculture. The main goal of the WFD is to achieve good ecological and chemical status for all inland and coastal surface waters by the year 2015 (WFD, 2000). In Finland at a national level (Nyroos et al., 2006) the key objective by 2015 is that nutrient loads entering water bodies from Finnish agriculture should be reduced by a third compared to their levels over the period 2001–2005. Recent ecological classification of surface waters have showed that rivers and coastal waters need attention in improving their state, but larger lakes were mainly in excellent or good state (YM, 2014). Studies have shown that the Baltic Sea may seasonally or spatially be N limited (Tamminen and Andersen, 2007).

Aakkula et al. (2012) provide a general description of the agri-environmental supports scheme, its objectives, implementation and some changes realised in fertiliser use, nutrient balances and leaching from catchments 1985–2009. The Finnish agri-environmental scheme consists of basic measures, additional measures and special measures. Payments, aimed at cost re-imbursements for farmers based on generalised cost calculations, vary according to measures and regions assisted. The purpose of basic measures is a systematic monitoring of farming and its environmental protection, the upper limits of fertilisation of field crops, the reservation of wider headlands and an establishment of broader set-aside margins by water channels than is provided for in the water law, as well as care for biodiversity and the maintenance of landscapes. The basic measures are obligatory for all farmers who participate in the agri-environmental scheme. The basic measures include limits for nitrogen and phosphorous fertilisation, depending on crop, soil type and soil P status, as well as field parcel level bookkeeping of fertilisation and other management choices each year, chemical soil analyses based on soil samples from each field parcel every 5 years, compulsory filter strips of 0.6–3 m wide along watercourses, and various obligations related to crop protection and the use of pesticides. Since the basic measures imply significant costs to farmers, most of the FAEP payments have been paid for the compensation for the costs of the basic measures 2007–2013. On the top of the cost compensation payments, 20% transaction costs have been paid for farmers who make binding and detailed commitments to the FAEP.

In addition to basic measures, FAEP includes a number of more demanding additional measures concerning fertilisation, wintertime vegetation cover, application of manure during the growing season and extensive grassland production, among others. The compensation for basic and additional measures is paid for the entire arable land area of the farm that is eligible for agri-environmental payments, provided that both cross-compliance requirements of the pillar 1, i.e. CAP direct payments, and minimum requirements of the FAEP are complied with.

Special measures of the FAEP, in addition to the ones mentioned above, are measures with significant impacts on the quality of the agricultural environment. These measures may, for example, concern the establishment of a buffer zone, or artificial wetlands.

The study by Aakkula et al. (2012) is based on monitoring data collected during a follow-up study of the agri-environmental support scheme. The results show a gradually decreasing use of inorganic fertilisers, and significantly decreased nutrient balances of nitrogen and phosphorous, and the FAEP is concluded to play a major role in this development. Some reduction of nutrient leaching is reported which, however, is not considered to be sufficient with respect to the challenging targets of water quality improvement (Nyroos et al., 2006).

However, as pointed out by Aakkula et al. (2012), it is difficult, based on the monitoring study, to identify the actual causes of realised land use, fertilisation, nutrient balances and nutrient leaching changes. The monitoring data mainly shows the development in selected key variables, but not the actual impact of the agri-environmental support scheme. There are many drivers of agricultural development, such as market changes (agricultural input and output price changes) and agricultural policy reforms, while the agri-environmental support scheme is one among many. Some studies have attempted to evaluate the role of the agri-environmental support scheme in land use and nutrient leaching potential utilizing economic models and various alternatives to existing policies. According to Lehtonen et al. (2007), decreasing real prices of crop products such as cereals, not only the explicit fertilisation limits and other incentives for more extensive cultivation facilitated in the agri-environmental support scheme, have contributed to decreasing fertilisation development up to 2006. Since 90% of farmers have committed to the agri-environmental support scheme in Finland, a closer analysis is needed to evaluate the impacts on land use, fertilisation, and the possible nutrient leaching, which has been a major policy objective.

While there is a large body of literature on the environmental effects of agricultural policies (surveyed e.g. OECD, 2010), most of the studies focus on a few individual management options. Studies evaluating the overall effectiveness of agri-environmental schemes, consisting of many conditions and measures, on nutrient leaching are fewer. To our knowledge, there are no (or few, which we are not aware of) similar studies in the literature which explicitly connect the outputs of an economic sector level model to an ecological model well calibrated to the data of an agricultural region. We first evaluate the economically rational effects of agri-environmental schemes on agricultural production and land use on the regional scale, and then calculate implied changes in nutrient leaching, using an ecological model, where agricultural land is among other sources of nutrient loading (forests, other land use, point source loading). Such studies are needed to (1) show the contribution of agri-environmental schemes, while distinguishing them from the impacts of other policies and market developments on land use and nitrogen leaching, and (2) provide results and conclusions usable in designing better policies for nutrient leaching abatement. It is important for policy design to evaluate how agri-environmental