THE FLEMISH MANURE POLICY AS A CASE OF ECONOMIC MANAGEMENT OF ECOLOGIC PROBLEMS

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INTRODUCTION

The manure policy is one of the most important environmental policies in the Flemish agricultural sector. The first version of the manure decree was introduced in 1991 as a result of the introduction of the European Nitrate directive (91/676/EEC). The goal is to protect ground- and surface water against nitrogen pollution out of agricultural sources. Since its introduction, the manure decree has changed several times with in 2007 the latest reform. Nutrients are now controlled at two different levels: the production and emission level. In this paper we only focuses on the emission side. Therefore we developed a model which allows us to simulate farmer behaviour and to make ex-post and ex-ante policy analysis.

NUTRIENT ALLOCATION RIGHTS

One of the mechanisms used in the manure policy, is to limit nitrogen and phosphorus use on farmland. Per hectare of land only a limited quantity of both nutrients can be used per year. In this paper we focus only on Nitrogen, however the same research can be repeated for phosphorus. The right to use nitrogen on an hectare is called a nutrient allocation right (NAR). Theoretically, NARs can be defined as an example of emission rights. Contrary to most other cases of emission rights, the right is locally fixed and the emission can be transported.

MANURE ALLOCATION MODEL

The introduction of these NARs has implicitly led to a market for NARs. Because of the scarcity of NARs, farmers are willing to pay for using it. The willingness to pay depends on the transportation costs to free NARs in the region of the farm. In regions with high concentration of animals, and thus a high production of nutrients, NAR's are more valuable than in regions with less animals. In highly concentrated regions, manure has to be transported further before finding a 'free' NAR. The value of a NAR in a region is the cost a farmer can save by disposing his manure on that NAR.
By putting the whole farm population (38.000 farms) in a multi-agent-simulation model, using the mathematical programming approach, the value of NARs can be simulated. An elaborated description of this model structure and its possibilities is given in Van der Straeten et al. (2009). Three allocation choices are taken up in the model (disposing on own land, transporting to other farms and processing/exporting). The model simulates the most cost efficient manure allocation.

REGIONAL MANURE PRESSURE

The value of a NAR is given by the dual value of the equation which limits the use of nitrogen. An example of the spatial pattern of this value is given in figure 1.

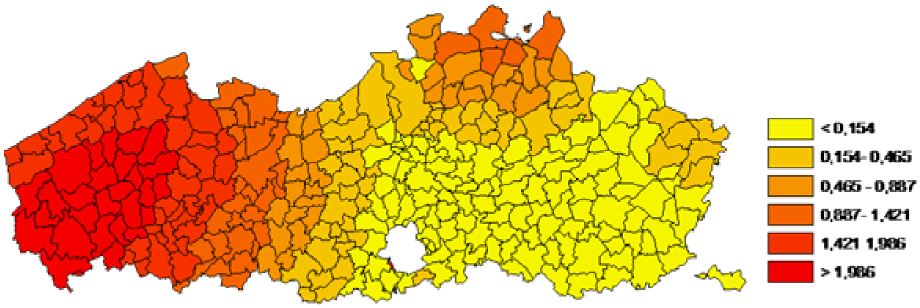

Figure 1. the value of NAR's in 2006 under MAP II (euro/kg N)

The value of a NAR is a good indication of the regional manure pressure because it shows the economical cost of producing one kilogram of nitrogen. In regions with a high value of NARs the farmer must pay more to allocate an extra kilogram of nitrogen than a farmer in a region with a low regional manure pressure. For farmers producing manure in a highly concentrated region, the manure policy has led to costs of up to 36€/sow/year. In contrast, for farmers with free NARs, the policy provides a new income opportunity by selling NARs. Because of its large economical consequences, the regional manure pressure strongly influences farmer behaviour.
The relation between the value of NARs and farm behaviour can be illustrated by two examples which also show the strong impact on the whole farm sector.

REGIONAL MANURE PRESSURE AND DEGREE OF UTILIZATION

Farmers are not obliged to use NARs and in reality they often choose to not or only partly use their NARs. Contrary, other farmers still overuse their NARs, and thus choose to pay the penalty. In our research we have found that this behaviour is not randomly but highly influenced by economic incentives. In Buysse et al. (2008) is shown that the flexibility of using NARs can be explained by the value of these NARs. In regions with a low value, NARs are more underused than in regions with a high value. In regions with the highest value, NARs are often overused. This over- and underuse behaviour is illustrated in figure 2.

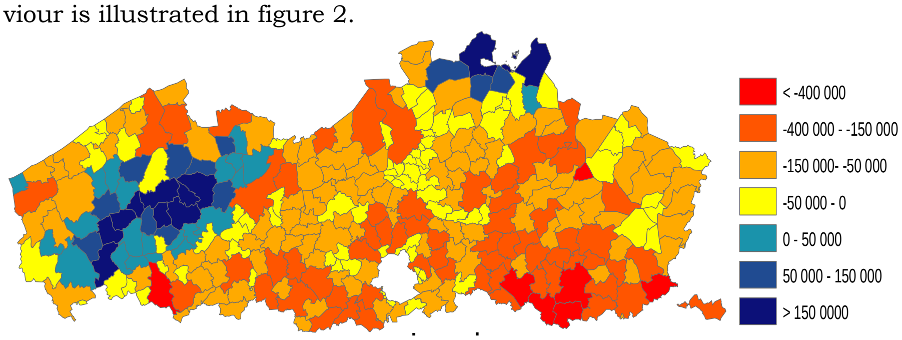

Figure 2. overuse of nitrogen per community in 2006 (kg N)

The positive correlation between the indicators in figure 1 and 2 are also econometrically quantified in Buysse et al. (2008). The value of NARs also determines the intention to use chemical nitrogen fertilizer. The manure policy has created freedom for farmers to choose between using more chemical fertilizer at the cost of loosing NARs. Van der Straeten et al. (2008) has shown that in regions with a high NAR value, the economic loss of using too much chemical nitrogen is too high. In regions with a low NAR value, the benefits of using chemical manure are worth more than the costs of loosing NARs.

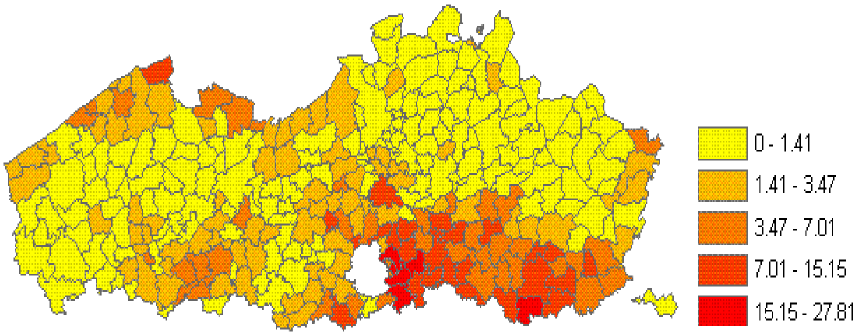

Figure 3. map comparing relative shares of NARs that are restricted by the use of inorganic fertilizers (in %)

The sensitivity of farmer' behaviour by the NAR-value has, on his turn, consequences for the ultimate goal of the policy. We see that some farmers still exceed their NARs while other farms preferring to use chemical fertilizer instead of allowing animal manure from other farms. Both aspects have an influence on the water quality as can be seen in figure 4 where the points with an exceeding of the norms is indicated by a red dot.

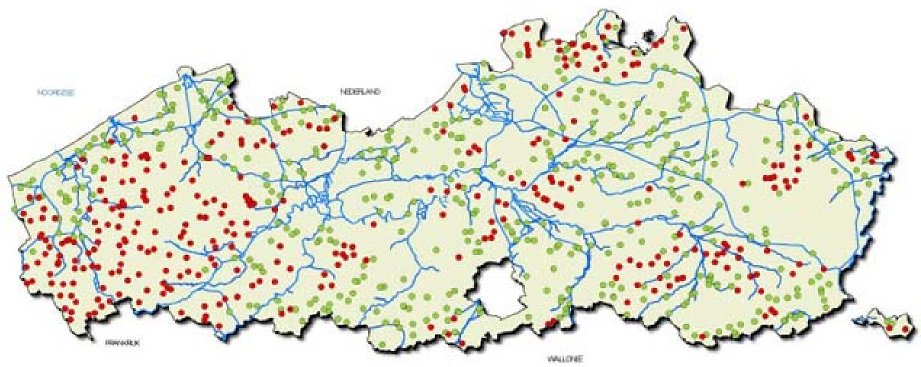

Figure 4. controlling points exceeding the norms in spring 2006 (VMM,2009) (red dots)

PROCESSING CAPACITY

Another feature of the model is to perform policy analysis or to provide private investment decision support. One example is to determine where extra processing capacity is most desirable. The lowest possible costs for the farmer (cost-efficient) and the highest benefit from the manure processor is reached by optimising the location of the processing systems and the type of manure that can be processed. Implementing capacity close to the farms demanding extra processing capacity lowers the transport distance to the processing system. The choice of type of manure is also very important because processing costs differ significantly among manure types.

The results of model simulations of the optimal manure processing locations given the current policy are shown in figure 5. The figure shows actually the municipal manure surplus and thus the processing demand. In total 26.40 million kg N must be processed in Flanders.

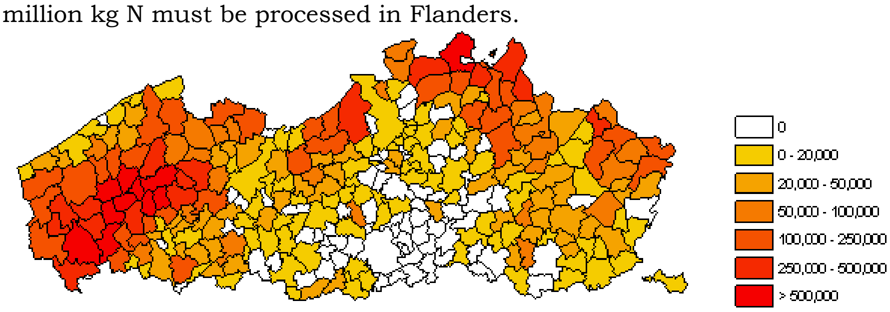

Figure 5. Simulated municipal demand for manure processing in 2006 (kg N)

However, the true situation differs from the optimal situation. A part of the demand for manure processing, illustrated in Figure 6, has already been realised by previous investments, not necessarily following the optimal allocation pattern. Currently, the operational processing capacity is almost 16.4 million kg N in Flanders.

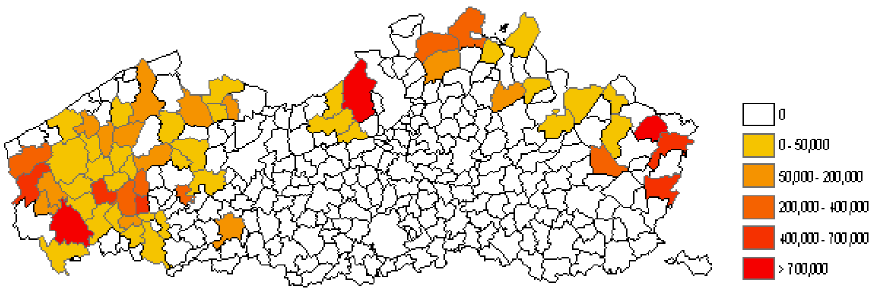

Figure 6. the actual municipal processing capacity in 2006 (kg N)

Given the current situation, the new optimal location pattern must be updated. Therefore, the current capacity is brought into the model and a new simulation procedure is performed. The result of the second simulation in figure 7 shows that currently the best investment in terms of cost minimisation is the development of a pig manure processing plant in the centre of West-Flanders.

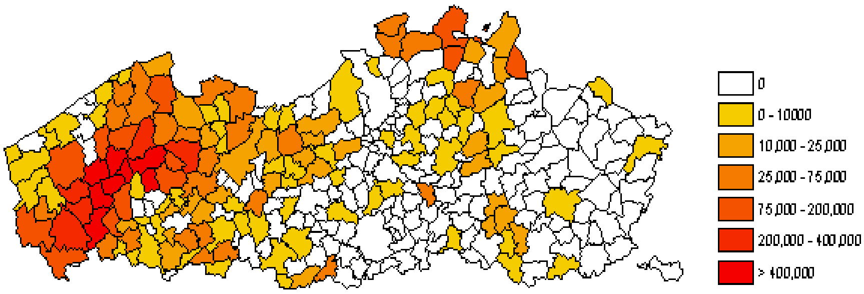

Figure 7. The simulated extra manure processing capacity per municipality in 2006 (kg N)

CONCLUSIONS

The manure policy has created a market for manure and nutrient allocation rights (NARs). The NARs have become a new intangible asset estimated at 56 million euro for Flanders, which is about 1.1 % of the gross agricultural output. The high value of the NARs has proved to have a large impact on the management on Flemish farms.

The high value of NARs also ask for a good functioning market of NARs. However, the lack of good information and the regional differences have created a complex market. Our research has developed tools to provide more information about the market to private and public decision makers that can result in an optimal distribution of the NARs.

The tools illustrate the spatial variation in the NAR market and can optimize investment in processing capacity.

Positive and negative lessons can be learned from the Flemish manure policy for future implementations of policies to manage bad outputs in an economic efficient way. One of the positive lessons is that even with the lack of a good institutional framework markets for emission rights may arise. One the negative lessons is that the lack of the institutional framework results in losses in time and an inefficient market. Another negative element is that the emission rights targets are more violated with increasing values of the emission rights given a constant penalty. The spatial variation of the value of the emission right combined with the spatial constant penalty leads therefore to a spatial difference of environmental policy success.

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