Agri-environmental indicators in relation to rural development policy in Flanders, Belgium

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Executive summary

The Flemish countryside is characterised by a good quality of life for all actors in a strongly urbanised environment with a multifunctional use of space. The Flemish rural development policy aims at improving the competitiveness of agriculture and improving the environment and the countryside by supporting land management. The quality of life in rural areas is encouraged by diversification of economic activities. The agricultural sector in Flanders is very intensive with greenhouse horticulture and intensive cattle farming. Different indicators are used for monitoring the rural development policy.

This paper focuses on agri-environmental indicators, especially High Nature Value Farming (HNVF) and agri-environmental impact indicators. An analysis of High Nature Value Farming systems in Flanders was conducted. Three different types of High nature farming system indicators were defined and analysed using geographical information.

Impact indicators are very challenging because of site specific circumstances, time lag and difficult cause-effect relations.

An effect indicator for evaluating the effect of agri-environmental measures is being established. Farmland bird populations have been declining in Flanders for the last 10 years and different agri-environmental measures are used for halting this decline. Secondly an effect indicator for agri-environmental investments is presented. Investment policy in agriculture has moved from production enhancing investments towards investments in water reusage, energy production and ammonia emission reduction. For this indicator an administrative database is used.
1. The rural area and agriculture in the Flemish region

General overview

The Flemish region is one of the three regions of Belgium, north of the Walloon region and the Brussels Capital Region\(^1\). Flanders is situated at the heart of Europe, with boundaries with the Netherlands, France and the other two Belgian regions. The Flemish region is part of the metropolitan regions of North West Europe. The surface of the Flemish region covers nearly half of the Belgian territory (13.522 km\(^2\) out of a total of 30.528 km\(^2\)). The Flemish population noticeably outnumbers its Walloon counterpart and the population density in Flanders is more than double the Walloon’s region population density (in 2005 respectively 446/km\(^2\) and 201/km\(^2\)). As such, Flanders has one of the highest population density levels in Europe. The area with the highest population density is mainly situated in the central part of Flanders enclosed by the cities of Antwerp, Ghent and Brussels.

Agricultural characteristics

In Flanders, as in many other parts of Europe, the rural area is characterised by the farmed landscape. In Flanders, there are hardly any undeveloped areas left. The agricultural sector occupies more than half of the Flemish surface area. As Figure 1 shows, more than half of the Flemish farms are located in areas which are not denoted as rural. Many farms are found in the transitional area, the Metropolitan Brussels area, the structure supporting cities and the regional urban fringe.

Figure 1: Location of farms in Flanders (Universiteit Gent & IDEA Consult, 2007).

As in other regions of North Western Europe, agricultural activity in Flanders has changed considerably, with the main trends determining its development in the second half of the twentieth century: intensification, specialisation and concentration. As can be seen in Figure 2, the total number of agri- and horticulture businesses in Flanders has declined steadily reaching a figure of 29.446 in 2009, while the mean surface area of Flemish farms has gradually increased to an average of 21 hectare per farm.

\(^1\) The three Belgian regions are situated on the NUTS 1 level (NUTS = Nomenclature of territorial units for statistics).
In 2008, agriculture occupied a total area of 623,698 ha. This area presents a slightly falling trend. Of the total area of agricultural land, the fodder crops account for the largest share (59.8%), which underscores the importance of livestock farming in Flanders. Approximately half of Flemish farms keep cattle. Arable farming is good for 31.7% of the total available area, two thirds of which is intended for cereal cultivation. Almost 8% of the available area is horticultural land, a good half of which is intended for vegetable cultivation.

Structural characteristics of agriculture (Flanders, 2000-2008, ha)

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total area agricultural land</td>
<td>636,876</td>
<td>629,684</td>
<td>625,207</td>
<td>623,786</td>
<td>623,698</td>
</tr>
<tr>
<td>Meadows, pastures and fodder crops</td>
<td>383,600</td>
<td>369,881</td>
<td>364,618</td>
<td>362,745</td>
<td>373,161</td>
</tr>
<tr>
<td>Arable farming</td>
<td>197,511</td>
<td>202,700</td>
<td>202,858</td>
<td>204,798</td>
<td>197,867</td>
</tr>
<tr>
<td>Horticulture</td>
<td>47,901</td>
<td>49,072</td>
<td>50,255</td>
<td>49,599</td>
<td>49,154</td>
</tr>
<tr>
<td>Other uses</td>
<td>7,864</td>
<td>8,031</td>
<td>7,475</td>
<td>6,644</td>
<td>3,516</td>
</tr>
</tbody>
</table>

Source: Platteau J., Van Bogaert T. 2010

The Final Production Value of Flemish agriculture and horticulture is nearly EUR 5 billion and presented a slight increasing trend between 2000 and 2008. The value of arable farming products was EUR 424 million in 2008. Cereals, potatoes and sugar beets are the main products. Vegetables make up 41% of the production value of horticulture. Of this, 46.5% came from open-air production in 2008, with leek, chicory and cauliflower being the three main crops. Sheltered vegetable cultivation accounted for the remaining 53.5%. In this subsector, tomatoes, mushrooms and lettuce are the three main products. Fruit cultivation (apples and pears) is good for 27% of horticultural production value. Although ornamental plant cultivation only accounts for 12% of horticultural area, ornamental plant cultivation is responsible for 32% of the total value of horticultural production. The pig sector contributes by far the most to the production value of livestock. Dairy products are the second most important product in the livestock sector. Beef completes the top three livestock products.
Table 2: Evolution of final production value of Flemish agriculture and horticulture, million EUR

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007*</th>
<th>2008*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final production value</td>
<td>4,689</td>
<td>4,811</td>
<td>4,527</td>
<td>4,600</td>
<td>4,481</td>
<td>4,493</td>
<td>4,682</td>
<td>4,968</td>
<td>4,976</td>
</tr>
<tr>
<td>Arable farming</td>
<td>386</td>
<td>473</td>
<td>418</td>
<td>467</td>
<td>434</td>
<td>413</td>
<td>432</td>
<td>504</td>
<td>424</td>
</tr>
<tr>
<td>Horticulture</td>
<td>1,389</td>
<td>1,359</td>
<td>1,389</td>
<td>1,506</td>
<td>1,341</td>
<td>1,449</td>
<td>1,532</td>
<td>1,588</td>
<td>1,597</td>
</tr>
<tr>
<td>Livestock</td>
<td>2,913</td>
<td>2,979</td>
<td>2,720</td>
<td>2,627</td>
<td>2,706</td>
<td>2,632</td>
<td>2,718</td>
<td>2,875</td>
<td>2,955</td>
</tr>
</tbody>
</table>

*: provisional figures
Source: Platteau J., Van Bogaert T. 2010

Agri-environmental situation

The acidifying and eutrophying emissions by agriculture fell by 28% and 67% in the period 2000-2007. The driving forces behind this drop are the manure policy implemented and the conjuncture. This expressed itself in a shrinking number of livestock. The manure policy led to a decreasing use of chemical fertiliser, the application of low-emission techniques, a lower level of nutrient content in animal feeds and an increase in manure processing. The shrinking number of livestock explains the reduction in the greenhouse gas (-13%) and fine particle (-10%) emissions. The erosion sensitivity of the land use kept increasing by 4% between 2000 and 2007, due to the cultivation of more erosion sensitive crops such as maize and potatoes (Van Steertegem, 2009).

Also biodiversity is declining in Flanders. Flemish agriculture is amongst the most productive in Europe, but it scores badly in terms of farmland biodiversity (Dumortier et al., 2008). Farmland birds in Flanders declined markedly during the last decade (e.g. skylark, barn swallow) due to intensification and scale consolidation of agriculture. Farmland birds declined to a greater degree in Flanders than in the surrounding countries. Sprawling urbanisation and intensifying agriculture exacerbate the negative impact of habitat fragmentation.

Rural development policy

As the Member States implement the European rural policy in their own region, Flanders adopted a specific Flemish strategy and program for rural development. In this policy emphasis was laid on the quality of life in a strongly urbanized area with a multifunctional use of the fragmented open space and an important role for the agri- and horticulture. All measures can be constrained into four central themes, namely economics, environment, quality of life and diversification of the rural economy and the furthering of the social cohesion through the LEADER approach. The total public funding for the program for rural development amounts to 667,575,000 Euros. Of this amount 66.37% is contributed by Flanders, and the remaining balance by the European Union.

Flemish rural development policy includes a mix of instruments for halting biodiversity decline. The Flemish program for rural development contains agri-environmental schemes for field margins, pools, hedges and wooded banks, etc. to meet those targets. The benefits of the program on reversing the biodiversity decline both at the level of the intervention but also more generally in the program area, are monitored by measuring farmland bird species population (Directorate General for Agriculture and Rural Development, 2006). Farmland
birds species population is an indicator of general biodiversity trends for which the best data exist in term of series and geographic distribution.

In 2008, there were 2,428 individual farmers in Flanders that had a management agreement relating to conservation (combating erosion, species protection, buffer zone management, small landscape elements, botanic management, nature management agreement). In comparison to 2007, this is an increase of more than 400 producers. The greatest increases were in the number of approved agreements for botanical management and maintaining small landscape elements.

2. High nature value farming systems: a basket of indicators

High Nature Value farmland comprises those areas in Europe where agriculture is the major (usually the dominant) land use and where agriculture supports or is associated with either a high species and habitat diversity, or the presence of species of European, and/or national, and/or regional conservation concern, or both” (Andersen, 2003). Within the Common Monitoring and Evaluation Framework of the Regional Development Policy a group of indicators is designed to measure whether the High Nature Value resource of a Member State is being preserved and maintained. Distinction is being made between three types of indicators:

- Baseline Indicator: High nature value Farmland and Forestry, measured as UAA of HNV Farmland, in hectares;
- Result Indicator: Area under successful management contributing to biodiversity and HNV Farming/Forestry, measured as the total area of HNV Farmland and Forestry under successful land management, in hectares;
- Impact Indicator: Maintenance of HNV Farming and Forestry, measured as changes in High Nature Value areas and defined in terms of quantitative and qualitative changes;

An analysis of High Nature Value Farming systems in Flanders was conducted. Three different types of High nature farming system indicators were defined and analysed using geographical information. As described in the guidelines (Beaufoy & Cooper, 2008) it doesn’t have to be one single indicator, but it can be a basket of indicators. Different baseline indicators were determined.

**HNVF type 1: farmland with a high proportion of semi-natural vegetation**

The first type HNVF is farmland with a high proportion of semi-natural vegetation. In Flanders, where agriculture is very intensive, few of the semi-natural vegetation is in agricultural use. Semi-natural vegetation houses important habitats of the Annex 1 of the Habitat Directive. Heath land and extensive grassland habitats of Annex I of the Habitat Directive in agricultural use can be considered as high nature value farmland-indicator since habitat conservation at a European level is required. In Flanders, 1,350 ha European habitat is in agricultural use. According to the biological valuation map the quality of these habitats is good. 96% are of good or very good biological quality. Every six years, the Institute for Nature and Forest Research monitors the
conservation status of habitats and species to the European Commission, so monitoring of the indicator is guaranteed. There are also some relics of semi-natural grasslands that are not protected as a European habitat but are protected by regional legislation, these are the so-called “regionally important grassland habitats”. The regionally important grassland habitats in agricultural use is the second HNVF-indicator. In Flanders there is 820 ha regionally important habitat in agricultural use. 96% of the regionally important habitats in agricultural use are of good until very good quality.

**HNVF type 2: land-use mosaic**

The second type of HNVF comprises agricultural land in a land-use mosaic. It consists of farmland features in more intensely farmed landscapes, extensive (in Flemish context) grasslands and historical pastures.

The first indicator of HNVF type 2 is the agricultural land associated with farmland features. To ensure the farmland features have a high habitat quality, sufficient density and adequate connectivity only certain traditional landscapes were considered. In Flanders, 27.575 ha of the landscape elements are associated with agricultural parcels.

A second indicator for HNVF type 2 is the area of grassland of farms with extensive (< 2 LSU per ha for Flanders) livestock raising. This indicator is determined by the agricultural census and is set on 18.455 ha.

The third indicator for HNVF type 2 is the area historical pastures of very good biological quality which are not regionally important grassland habitats. These grasslands are situated between the semi-natural grasslands and the intensive grasslands. The biologically valuable grasslands (8.250 ha) originated from degradation of semi-natural grasslands. Only on 362 ha (4%) of those grasslands, agri-environmental measures were implemented.

**HNVF type 3: farmland that is a habitat for specific species**

A third type of HNVF is farmland that is a habitat for species of European, and/or national, and/or regional conservation concern, or both, or a habitat in which a high proportion of European or world populations of species occur. The following species are considered:

- farmland birds of European Conservation Concern (Beaufoy & Cooper, 2008):
  - Eurasian skylark *Alauda arvensis*, corn bunting *Miliaria calandra*, yellowhammer *Emberiza citronella*, yellow Wagtail *Motacilla flava*, Eurasian curlew *Numenius arquata*, common redshank *Tringa tetanus*, garganey *Anas querquedula*, corncrake...
• other threatened species according to the Flemish Red List: meadow pipit *Anthus pratensis*, European hamster *Cricetus cricetus*
• species for which Flanders has a significant share of the European populations: greater white-fronted goose *Anser albifrons*, pink-footed goose *Anser brachyrhynchus*

A first indicator is farmland in which recently critical and very critical grassland birds were identified. Based upon a scientific map of populations of grassland birds, 43,400 ha are identified as HNVF type 3. On 26,350 ha it is possible to apply agri-environmental measures. Anno 2008, the coverage of agri-environmental schemes was only 3%.

A second indicator is farmland where there is at least 70% chance of a full field bird community. The value of the indicator is 21,386 ha and is based on a scientific map of populations of field birds. Within 4,849 ha agri-environmental measures can be taken by farmers.

A third indicator is the breeding and patch areas of international importance in agricultural use. The Flemish Polder areas are of international importance as a patch area for the White-fronted Goose and the Pink-footed Goose. In total, 23,426 ha farmland is a patch area of international importance and 20,070 ha is a breeding area of international importance.
A fourth indicator is the conservation area for European hamster in agricultural use. 5,540 ha is in agricultural use. Within 2,615 ha agri-environmental measures can be taken by farmers. In practice, 6 ha (0.2%) are under agri-environmental measure.

Analysis

This analysis proposes a baseline indicator for HNVF in Flanders based on detailed regional data sets and clear science-based criteria. In the exploratory analysis only existing scientific maps and policy maps were used. The maps were made using clear and scientific methods and their usefulness in the context of this exercise is not disputed. A basket of indicators was developed using existing designated areas, no new areas were designated.

If possible an overlap with agri-environmental schemes was done. This coverage is a type of result indicator. The creation of further result and impact indicators requires further investigation. To monitor the quality of HNVF and the impact of rural development programs (RDP), a monitoring network should be developed.

The indicators outlined in this study are necessary but not sufficient to evaluate the RDP. In order to do this, one should:
- monitor the baseline indicators and further investigate the quality of the indicators;
- develop good result and impact indicators. This requires more research;
- elaborate case studies to assess the robustness (sensitivity and accuracy) of the proposed indicators. The case studies can also serve as a testing ground for the monitoring of the indicators;
- investigate the effectiveness of the agri-environmental measures. The effectiveness should be monitored in managed and unmanaged plots so that a causal link can be established.

3. An impact indicator for agri-environmental measure for farmland birds

Farmland birds species population is an indicator of general biodiversity trends for which the best data exist in term of series and geographic distribution. The development and the interpretation of an impact indicator for farmland birds on the scale of Flanders, is being worked out by the Institute for Nature and Forest Research.

Development of the impact indicator on biodiversity

The impact variable: farmland birds

Because of the aimed scale, it is obvious to link the impact indicator with the operational monitoring network "Common breeding birds in Flanders". This monitoring network was developed in 2007 to follow up the evolution and the spreading of 101 common breeding birds in Flanders. It consists of 1200 sample areas of 1 km², whereof 500 are under agricultural land use, distributed randomly in Flanders. The whole monitoring network is sampled triennial. With the collected data on the scale of Flanders, the evolution in time of the population size of individual species, the relative population size of species groups (grassland birds, arable birds, etc), occupancy (number of sample areas where a species is present) of species or species groups, and the species diversity (diversity indices) can be followed. Each of the variables can be potentially used as impact variable in the development of the impact indicator for the rural development policy.

The variable: rural policy

The Flemish program for rural development consists of many measures affecting the impact indicator on biodiversity in some way. Developing an impact indicator on program level requires that the overall impact on biodiversity of all measures from the program is taken into account. Therefore, a method must be developed that catches the volume or the input of all measures from the program in one geographic variable (area, farm, etc). A weighted sum where weighing is done according the expected impact of the measure on biodiversity, has been proposed. In practice, this variable could be the total weighted funding per unit area, the coverage of measures, etc.

Detailed geographic information about the location where a measure has been applied, is available for most measures from the program. However, some measures are difficult or cannot be situated spatially.

Subsequently, it can be verified if the set of 500 sample areas of the monitoring network “Common breeding birds in Flanders” forms a representative sample of the Flemish values for the variable ‘rural policy’. If not, the monitoring network has to be adapted. Possible solutions are statistical transformation of the variable ‘rural policy’ or enlarging the monitoring network with deliberated new sample areas.
The impact indicator: Effect of rural policy on farmland birds in agricultural area

A data set of 500 coupled values for ‘rural policy’ and ‘biodiversity’ can be generated triennial. Since the monitoring network “Common breeding birds in Flanders” started in 2007, these variables can be calculated for the first time for the period 2007-2010. This period coincides with the first three years of the program for rural development. The dataset of coupled values for ‘rural policy’ and ‘biodiversity’ forms a good base to develop impact indicators. Preferably, these indicators show the impact of the program with time.

Data of the period 2007-2010 obviously do not allow examining temporal trends. But a ‘biodiversity’-‘rural policy’ plot can be generated with the available data. This allows investigating patterns between the input of measures and biodiversity. However possible correlations do not imply causal relationships. It is possible that measures are especially applied in areas where more farmland birds are present and that it’s not due to the measures that more farmland birds are found. It is so that management agreements to protect farmland birds only can be applied in areas where vital populations of farmland birds occur.

However the presence and territory density of farmland birds in a sample area is a result of multiple factors. Beside the role of measures from the program for rural development, other factors such as the baseline situation, the cultivation choice, the land use and the fitness of a landscape may even matter more. Based on available geographical data, many of these factors can be quantified for each sample area. With multivariate and multiple regression techniques, the relative importance and mutual coupling of these factors can be investigated. This information is extremely useful to detect possible relations between the input of measures and the observed patterns of farmland birds.

Causality and validation of the impact indicator on biodiversity

In a second part, the causality and validation of the impact indicator is examined. In Flanders, no studies or monitoring networks are yet available that show the causality between for example management agreements and breeding distribution of farmland birds. Therefore, within the framework of this study, profound and systematic measurements to the presence of breeding territories in relation to the present measures of the program are carried out in a number of selected areas. These measurements include territory mapping and land use. Pairwise comparison of similar zones with and without measures of the program within these sample areas can advance the understanding of the action of the measures. This measurement scheme must also allow correcting for double counting, deadweight and displacement effects. These measurements can also act as pilots for a monitoring network on ecological effectiveness. This must allow us to follow up the net effect of management agreements for farmland birds.

Analysis
The datasets collected in the two approaches will give each in their way new information about the relationship between the input of measures and the response thereto of farmland bird species. The weakness of the first approach is the strength of the second, and vice versa. While combining them, it is expected to assess the impact of agri-environmental measures as good as possible within a limited time period.

Based on a integrated analysis of the two datasets, conclusions will be drawn about the measurable impact of the rural policy on farmland birds. Based on the insights gained, recommendations can be made to ameliorate the input and/or the design of measures in order to increase their positive effect on biodiversity. Here, ecological factors are focused on.

4. An impact indicator for environmental investments

An impact indicator for agri-environmental investments is presented. Investment policy in agriculture has moved from production enhancing investments towards investments in water reusage, energy production and ammonia emission reduction. For this indicator an administrative database is used.

The total axis 1 budget in Flanders is 65% of the total RDP budget, this is the highest proportional budget of all RDP’s. In this respect it is important that the evaluation of the axis 1 is also directed to environmental impacts. This is definitely true for the Flemish realization of the axis 1 measures and partially of the axis 3 measures. In axis 1 the most important measure in Flanders is the ‘modernisation of farms’ (measure 121) and in axis 3 it is ‘diversification of farms’ (measure 311). Both measures are operated by the Flemish Agricultural Investment Fund. The Agricultural Investment Fund operates as an open system that offers capital subsidies and interest subsidies to all farmers that fulfill the minimum requirements.

Since 2000 exists a gradual system for subsidies: the more environmental friendly the investments are, the more subsidies are granted. The actual maximum level for environmental subsidies is 30% of the investment cost. There are 44 types of investments that can be considered as investments with a positive environmental impact. Calculation based on data of the year 2008 indicated that 44% of the captured VLIF subsidies are foreseen for these 44 types of investments. This is equal to the whole budget spent in 2008 for axis 2 (25 million euro). Some examples of the 44 types of environment friendly investments are: stables with systems of ammonia reduction, systems for purification, treatment and re-usage of water, incinerations plants for the use of bio-energy, photovoltaic cells, energy saving investments in greenhouse farming like energy screens, cogeneration, heat pump, etc.

**Development of investment specific environmental indicators**

Environmental impact studies of new techniques of the Flemish Institute for Technology Research (VITO) were used as a starting point for the development of the indicators. The investments specific indicators that were developed are situated on the output indicator level. There are qualitative and quantitative output indicators. Examples of qualitative
indicators are the type of water purification system that is installed and the type of manure injection system that is subsidized. Examples of quantitative indicators are cubic metre purified water per year and peak power of the installed photovoltaic cells. Out of the quantitative investment specific output indicators it is possible to calculate within varying levels of accuracy some impact indicators. There is only one of the four environmental impact indicators of the EC that can be linked with the type of investment specific output indicators: kilo tons of oil equivalents (ktoe) of renewable energy produced. There are however some more impact indicators that can be calculated out of the output indicators (in EU terminology they can be named program specific impact indicators):

- Contribution to combating climate change: kilo tons CO₂ reduction
- Contribution to combating the acidification of the environment: kilotons of ammonia reduction
- Contribution to combating the desiccation: volume of water reuseage
- Etc.

As an example of the calculation of the impact indicators out of the output indicators the reduction in ammonia emission of the low ammonia emission stables is given. In the ex-post evaluation of the RDP 2000-2006 only a rough estimation of the contribution to ammonia reduction of the investment support could be calculated: 420 tons of ammonia reduction as direct result of the subsidized low ammonia emission stables compared to classical stables. This calculation could only be based on the number of subsidized stables, the type of animals in the stables, an average number of animals in the stables per animal category, the average production of ammonia per type of animal in classical stables and an average reduction percentage of the ammonia reduction techniques of 50% compared to classical stables. In the new administrative database for each subsidized ammonia reduction stable two extra output indicators are defined that significantly increase the accuracy of future calculations: the number of animal places in the stable and the type of technique of ammonia reduction system that is installed. For the more precise calculation of ammonia reduction per low ammonia emission stable research results will be used that measured the kg of ammonia production per animal place per type of ammonia reduction technique per animal category.

**Analysis**

The administrative database (output indicators) for each type of investments is operational since October 2009. The indicators are included in the computer system for administrative handling of the investment support. Retroactively also the output indicators of the investments since 2007 were introduced in the system. In 2010 the external mid term evaluator of the Flemish RDP will process the data of the environmental output indicators for investment support and will report on the environmental impact of the investment support by the end of 2010.

**REFERENCES**


