Spatial Analysis of Rural Development Measures
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Netherlands case study: Noord-Holland

Calibration and estimation of model
- Noord-Holland-

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Contents

1. Introduction

This document contains a description of the Rural Development Programme in the province of Noord-Holland and an analysis of selected measures within the RDP. This analysis is primarily aimed at identifying the factors influencing participation of farmers in the programme, but an attempt is also made to evaluate the impact of certain measures.

It must be stated at the outset that the analysis has achieved less than what had been hoped for. A major objective of the SPARD project is to explore to what extent it is feasible to evaluate RDPs systematically and quantitatively. In that respect, we believe the experience gained in this case study is worthwhile and will help to make the Common Monitoring and Evaluation Framework (CMEF) more effective. Therefore, this report describes not only the results, but also the attempts we made, even if these did not achieve the results desired.

Some background information on the province is provided first, so as to sketch the context within which the programme must be understood (Chapter 2). Besides a few general points on the province, this chapter describes the different landscapes and the agricultural sector; it also describes the situation with regard to multifunctional activities and organic farming.

The following chapter describes the RDP itself, the way it has been given shape in this particular case and the budget earmarked for it. Also, the measures selected for the analysis are described. For each of them, we describe the data necessary for its analysis in SPARD.

Chapter 4 then analyzes what factors have contributed to the uptake of the three measures selected in the SPARD project: modernization of farms (121), agri-environmental schemes (214) and diversification of the farm economy (311). Chapter 5 contains our attempts to assess the impact of measure 214 and of two other measures which we chose because measures 121 and 311 are quite small in this province and therefore are unlikely to have a measurable effect. The alternative measure for Axis 1 is measure 125 (agricultural infrastructure), and for Axis 3 measure 313 (promotion of tourism). These two measures are the largest in their respective axes in terms of budget, but they are public activities rather than subsidies to farmers and therefore it makes no sense to analyze them in terms of uptake. As usual, conclusions are drawn in the final chapter.

2. Background information on the case-study area

2.1. General

The Netherlands is divided into twelve provinces, of which Noord-Holland is one. A province is governed by an executive board (Gedeputeerde Staten), which is elected by the provincial council (Provinciale Staten, elected directly) – except for the governor (Queen's Commissioner) who is appointed by the government. Originally the provinces were sovereign (in those days the Netherlands resembled what the European Union is today), but since Napoleonic times the state is quite centralized and provinces have only limited authority. Their main tasks are spatial planning and environmental management, but they also have some role to play in infrastructure and supervision of the administrative level below them: the municipalities. Their income is mostly from national revenue, although they have some income sources of their own.

Noord-Holland originated from the medieval county of Holland, which was by far the largest and wealthiest province in the former Dutch republic. In the 19th century, when the republic had been replaced by the centralized kingdom of the Netherlands, it was considered necessary to break up this dominant province into a northern and a southern one. Noord-Holland includes Amsterdam, whereas Zuid-Holland includes The Hague and Rotterdam; these three are the largest cities in the Netherlands. Zuid-Holland is now the largest province in terms of population, with Noord-Holland in second place.

Figure 1. Location of Noord-Holland in the Netherlands

The province covers an area of 287,000 hectares and has a population of 2.7 million. Counting the land area alone, this gives it a population density of over 1,000 inhabitants per km^2, among the highest in the EU (excluding regions that cover urban areas only). The population, moreover, is growing at a rate of about 0.8% per year – almost double the average for the Netherlands. It is a relatively rich province, with a GDP per capita about 14% above the national average. This is mainly due to the economic strength of Amsterdam, however: production per capita in the rest of the province is less high[1].

Notwithstanding this high population density, not all of the province is highly urbanized. The southern third is part of the metropolitan area known as the Randstad Holland (to which also The Hague and Rotterdam belong). As one moves north, however, the province becomes more and more rural in character. This becomes evident from the distribution of towns and larger villages in the province, as shown in Figure 2.

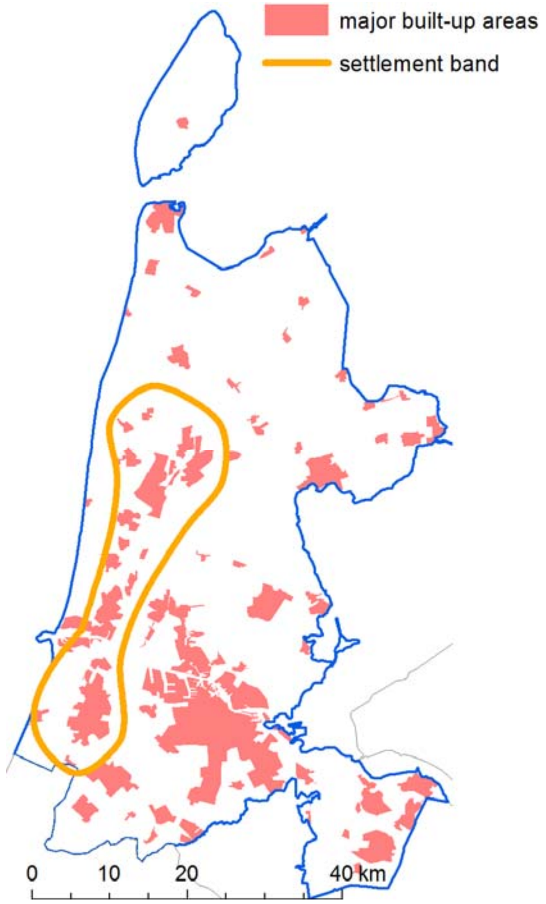

Figure 2. Settlement patterns in Noord-Holland

[1] Amsterdam is not really richer in *income* per capita: it only produces more – much of which is done by workers who reside elsewhere.

2.2. Landscapes and land use

Apart from a stretch of sand dunes along the coast, the topography is virtually flat. Yet, the province has a considerable variety of landscapes (Figure 3):

- a coastal strip of dunes, with progressively denser vegetation towards the interior, culminating in forest.
- Ancient dunes in a narrow band just inland from the present dunes. The dunes themselves have been flattened, but the area remains slightly raised above the surrounding land, and its soils consist of a fertile mixture of sand and organic material. This zone was the first one to be settled, and this can be recognized in from the band of settlements behind the coast, running from north to south. On the land remaining, flower bulbs have become the special product.
- Marine clay, deposited where the sea entered Holland through openings in the dune barrier. This area is specialized in market gardening (mostly vegetables, but also flower bulbs), although there is dairying as well.
- A large area of peat bogs, which developed behind the coastal dunes. During the Middle Ages, these bogs were drained and became used first for arable farming and later for dairy pasture. As a consequence, the land subsided and parts of it became flooded.
- Some of the flooded areas remain as lakes today. Others, however, were reclaimed from the 17th century onwards. The former peat cover having been destroyed during flooding, the soil there consists of the underlying marine clay. The settlement pattern and land use depend on the period in which reclamation took place, and is very different between the oldest reclamations and the most recent ones, in the 20th century. It is suitable for arable farming, but in the older reclamations there is also dairying and some fruit cultivation.
- Underlying all these landscapes is a thick layer of wind-blown sand from the last ice age. This layer slopes towards the north and west, where is is covered by the landscapes mentioned heretofore. In the southeast of the province, however, it surfaces. This is an area with forest and moor as well as some small-scale farming. A large part of the land, however, has been settled over the last century, when the forested landscapes became popular.
- Minor landscapes include a small river valley just west of the sandy area described above; and two patches dating from the penultimate ice age, when the Scandinavian land ice covered parts of the Netherlands and deposited loam with large boulders. These patches are on the island of Texel in the northernmost part of the province and on the former island of Wieringen, also in the north and now connected to the mainland by land reclamation.

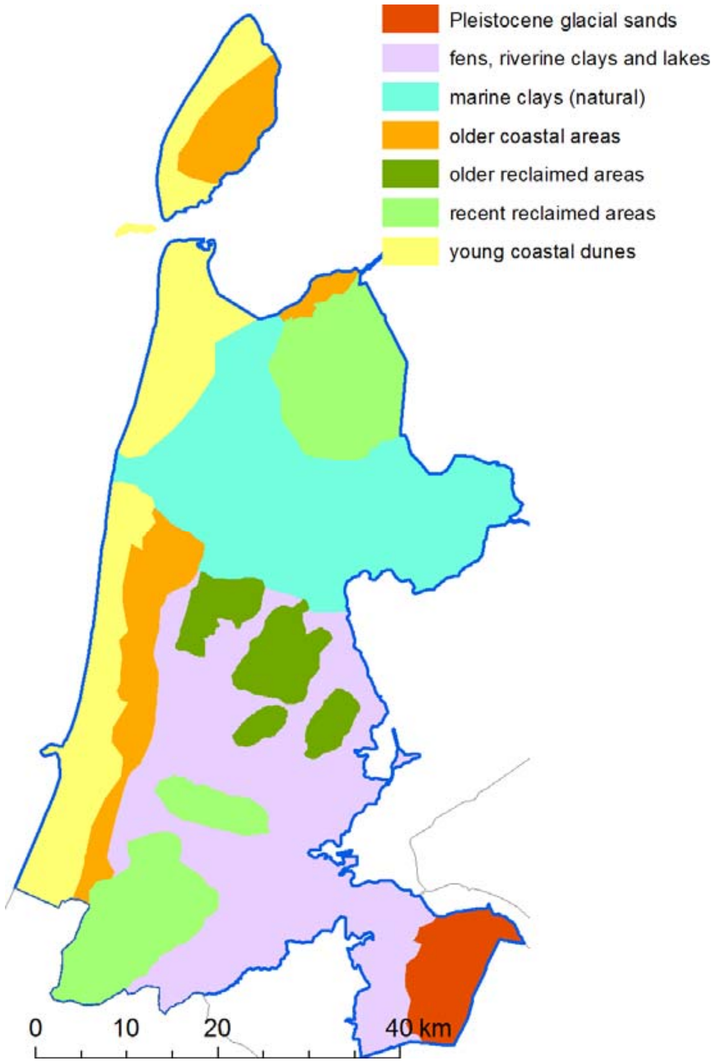

Figure 3. Landscape types

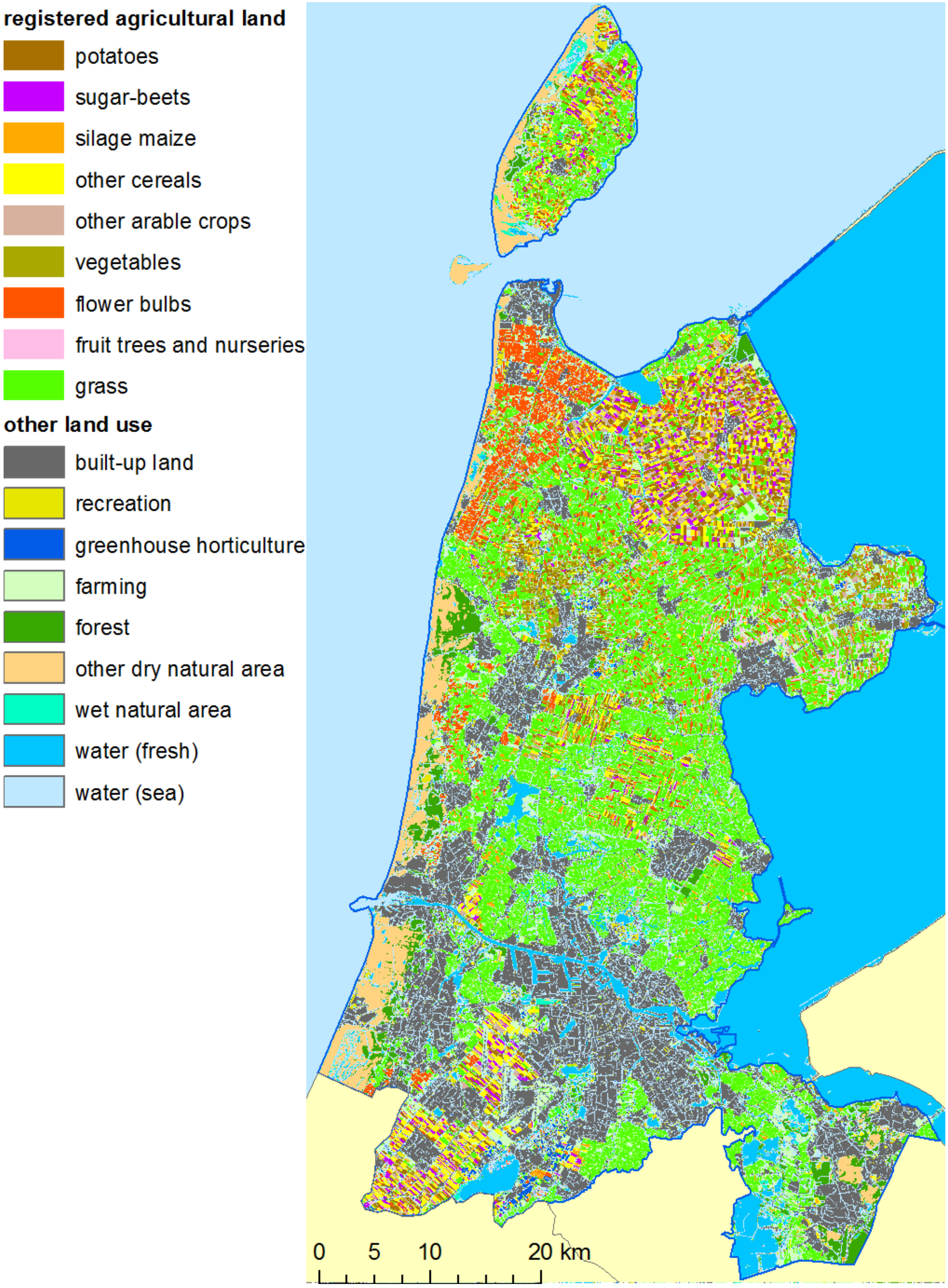

Figure 4. Land use map

Sources: Ministry of Agriculture, Nature & Food Quality (registered agricultural land); CBS,Land use statistic (other land use)

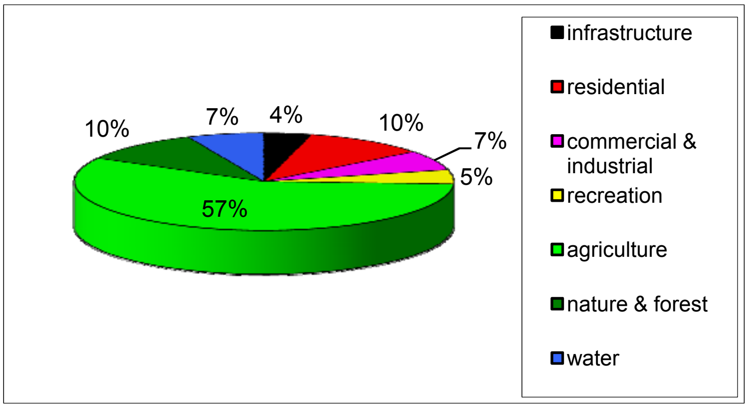

Figure 5. Land use graph
Source: CBS Land use statistics

2.3. Agriculture

In spite of the dense population, most of the land is still used for agriculture (Figure 5). The agricultural sector consists of about 5,000 farms – a number which is dropping by several percentage points a year as smaller farms cease operations. The agricultural area is also shrinking, urbanization and the purchase of land for converting into natural areas are also taking their toll.

Dairying is the largest subsector in terms of land use (Table 1). Grassland covers more than half of the agricultural area. Many dairy farmers have stopped dairying because their farms were too small to be viable with modern technology; quite a few of them still remain farmers, however, but they have moved into less capital-intensive types of pasture farming: sheep, horses or beef fattening; this is the category ‘other pasture’ in Table 1, and as can be seen this subsector contains a large number of small farms.

Arable farms are located in the two large modern reclaimed areas in the north (20th century) and the south (19th century); these are the multi-coloured patches in . The main crops are potatoes and sugar-beets, with cereals being grown primarily as part of rotation schemes. These farms are medium-sized for Dutch standards.

Horticulture (including perennial crops) is the largest subsector in terms of production, with more than 70% of total output in agriculture. In Table 1, as elsewhere in this report, we distinguish between production in the open air and production in greenhouses, although some farms actually have both. In the former category, flower-bulb growers are the largest group (especially in the northwest, see), but vegetables are also important. Fruit trees are also of some importance. Most greenhouse farmers grow ornamental crops (cut flowers and potted plants), but there are some large vegetable growers (tomatoes, sweet peppers and cucumbers). The town of Aalsmeer (near Amsterdam airport) is a world-class centre of flower production and marketing.

Zero-grazing livestock (mostly pigs and poultry) is a very important subsector in the Netherlands, but in Noord-Holland there are only a few such farms. Mixed farms are, of course, a mixed bunch, but as Table 1 shows, they tend to be fairly large in terms of area but relatively small in output.

Table 1. Structure of the agricultural sector, 2010

farm type	*number of farms*	*UAA (hectares)*	*average area per farm*	*economic size per farm (SO)*[2]
arable	603	27,516	46	167,856
dairy	979	49,401	50	249,869
other pasture	1,451	21,768	15	32,145
horticulture (open air)	1,193	21,527	18	426,439
horticulture (greenhouse)	531	1,963	4	1,112,479
zero-grazing livestock	36	375	10	405,481
mixed farming	224	8,192	37	205,518
total	**5,017**	**130,742**	**26**	**309,464**

Source: CBS, Farm Structure Survey

2.4. Multifunctionality in agriculture

Only a minority of farmers in the province have any sort of multifunctional activity. The propensity to engage in these differs markedly by farm type (Table 2). Generally, they are more common in extensive farms, most of all in dairy farms. Greenhouse farmers are most rarely involved. This has much to do with the types of multifunctionality (Table 3): most popular is nature conservation, which emphasizes the protection of meadow birds and is therefore very common on grassland-based farms; greenhouses offer no scope for this, nor does the highly intensive open-air horticulture. Zero-grazing livestock is slightly better off in this respect, because these farmers usually have some land which they need to dispose of their manure.

[2] SO (standard output) is the new European unit for the economic size of farms. It represents an estimate of the total sales of a farm, based on the areas of different crops and the numbers of animals, as registered in the Farm Structure Survey. It is expressed in euros.

Tourism, also, the second most important activity, is most suited to farms providing ample open space – not pigsties or greenhouses. It is particularly important in the category ‘other pasture’; as stated above, these are often former dairy farms, small in terms of agricultural production. for such farmers, tourism activities can be a welcome supplement to income from agriculture. Apart from receiving tourists on the farm, these activities also include storing caravans and looking after horses belonging to city folk; this is most common among ‘other pasture’ farms.

Sale and processing of agricultural products are particularly common in open-air horticulture, where they are more common than nature conservation.

Table 2. Multifunctional activities by farm type

farm type	*number with multifunctional activities*	*as % of total*
arable	178	30%
dairy	449	46%
other pasture	448	31%
open-air horticulture	181	15%
greenhouse farming	62	12%
zero-grazing livestock	9	25%
mixed farming	87	39%
total	**1414**	**28%**

Source: CBS, Farm Structure Survey

The category listed as ‘social activities’ experiences rapid growth. It includes caring for handicapped people and other patients on the farm, day care for children, and on-farm educational programmes. Some farms also have small-scale conference facilities.

Agricultural contract work (ploughing, harvesting, etc.) is most common on arable farms.

Renewable energy has been counted only if it involves the sale of such energy, usually to electricity companies. This can be done by having windmills installed, for instance (mostly on arable farms in the north), or by selling excess energy produced on the farm (which is the most common multifunctional activity on greenhouse farms). Not counted is energy produced by farmers for their own use, which occurs on 352 farms. This can be wind, solar or biomass energy. Curiously, there are only 3 farms with biogas digesters in the province - the Netherlands is not a strong promotor of biogas.

Table 3. Types of multifunctional activities

activity	*number of farms*	*as % of total*
nature conservation	717	14.3%
tourism	250	5.0%
on-farm produce sales	227	4.5%
processing produce	134	2.7%
social functions	179	3.6%
renewable energy sales	92	1.8%
aquaculture	1	0.0%
contract work for other farms	368	7.3%
contract work outside farming	122	2.4%
total multifunctional activities reported[3]	**1414**	**28.2%**

Source: CBS, Farm Structure Survey

Most of the farms that engage in these activities gain only a small proportion of their income from them (Table 4). However, some report that they get more than half of their income from multifunctional activities; most of these are 'other pasture' farms where, as we saw, agriculture is often a marginal source of income.

Table 4. Percentage of farm income derived from multifunctional activities

farm type	*<10%*	*10-30%*	*30-50%*	*>50%*
arable	75	57	22	24
dairy	294	110	31	14
other pasture	142	120	76	110
open-air horticulture	105	42	13	21
greenhouse	34	11	6	11
zero-grazing livestock	7	1		1
mixed farming	43	23	8	13
total	700	364	156	194
as % of all multifunctionalists	**50%**	**26%**	**11%**	**14%**

Source: CBS, Farm Structure Survey

[3] A multifunctional activity is defined as a non-agricultural activity undertaken by the farm as a unit and providing revenue. The official definition used by the Ministry of Economic Affairs, Agriculture and Innovation is more narrow and does not include contract work, aquaculture or energy supply. Farms can have more than one multifunctional activity, which is why the numbers per type do not add up to the total stated in the table.

2.5. Organic farming

Organic farming is of limited importance in Noord-Holland: only 2.5% of farms are classified as organic – a percentage which is similar to elsewhere in the Netherlands. The number of such farms has increased somewhat in recent years: only 2 more in three years, but this at a time when the total number of farms declined by about 400. It is most common in open-air horticulture, primarily in fruit trees. Also in the dairy sector it is relatively common. The proportion of land under organic farming is rather higher than the proportion of farmers, at 3.6%. This is partly because it is more common in extensive subsectors such as dairying; but it must be noted also that many of the larger 'other pasture' farms are organic.

Table 5. Organic farms in Noord-Holland, 2010

farm type	*number of farms*	*area under cultivation*
arable	7	521
dairy	34	1,796
other pasture	41	1,591
open-air horticulture	24	448
greenhouse	9	170
zero-grazing livestock	4	107
mixed farming	6	125
total	**125**	**4,758**

Source: CBS, Farm Structure Survey

3. The Rural Development Programme in Noord-Holland

3.1. Setup of the RDP in the Netherlands

In the Netherlands, the EU Rural Development Programme has been incorporated into a national programme called the Investment Budget for Rural Areas (ILG with its Dutch acronym). This programme, like the RDP-2, runs from 2007 to 2013 and covers investments in the areas of environment and nature conservation, agriculture, recreation, and socio-economic vitality. In this programme, 27 different national subsidy schemes and 19 provincial ones are combined with the various measures contained in the RDP. The ILG is implemented by provincial authorities, but the central government retains a fairly strong hand in determining priorities, allocating money and checking progress. The budget of the ILG is 6.5 billion euros over the entire period, and is distributed over various components and sources of financing as specified in Table 6**Errore. L'origine riferimento non è stata trovata.**. As the table shows, nature conservation is the most important component, especially when looking at public funds.

Table 6. the Investment Budget Rural Areas (ILG)

million euros

theme	*budget*	*of which government (inc. EAFRD)*	*provinces*	*third parties*	*%*
nature conservation	2,878	2,577	205	97	44%
agriculture	352	184	55	113	5%
recreation	868	547	99	221	13%
landscape	200	127	51	22	3%
soil	12	5	5	2	0.2%
water	499	129	86	284	8%
special focus regions[4]	1,686	572	386	727	26%
socio-economic vitality	10	10	0	0	0.2%
total	**6,505**	**4,151**	**887**	**1,466**	**100%**

Source: Veldman et al. 2011:34

The Rural Development Programme makes up about one third of the ILG effort, as Table 7 clarifies. Even though the RDP is incorporated into the ILG, one cannot say the two are *integrated*: their monitoring is quite separate, and the ILG themes do not necessarily correspond with the axes of the RDP. The budget in Table 7 is not entirely accurate, as it reflects the original EAFRD outlay. This has since been increased with funds from the CAP Health Check, the Economic Recovery Package, and some modulation money, to €593m (European Commission 2011:265). The table further shows the compulsory government contribution (European Union

[4] This theme is mainly concerned with land-use planning in regions with many intensive-livestock farms.

and member state each contribute half of the budget), plus additional amounts which the central government and the provinces make available. Third parties represent beneficiaries of subsidies, and their contribution is particularly significant in measures 121 (modernization of farms) and 313 (promotion of tourism), as well as in other measures under Axis 3. We can see that the EAFRD funds are allocated equally between Axes 1-3, with a smaller amount going to Axis 4. Compared to the average for all EU member states, the Dutch RDP spends less money on Axis 2 and more on Axes 3 and 4.

Table 7. The RDP budget, 2007-2013

million euros

	EAFRD	*government counterpart*	*government top-up*	*Provincial top-up*	*contribution third parties*	*total*	*%*
Axis 1	146	146	180	12	278	762	34%
Axis 2	146	146	414	6	6	716	32%
Axis 3	145	145	0	9	291	590	27%
Axis 4	48	48	0	0	48	145	7%
Technical assistance	3	3	0	0	0	7	0%
Total	**489**	**489**	**594**	**26**	**623**	**2,220**	**100%**

Source: adapted from Ecorys 2011:40.

3.2. How it works in Noord-Holland

At provincial level, the ILG budget is somewhat difficult to specify. The original contract between the central government and the province, which serves as a basis for the provincial programme, left many items unspecified (Rijksoverheid/Provincie Noord-Holland 2006). The budget has been modified since 2006 several times. Provincial and national documents do not always show the same figures, and the contributions by third parties are usually not listed. Table 8 shows some of the discrepancies – one of which is caused by the fact that EAFRD funds are considered by the central government as part of its contribution, whereas the province regards these moneys as its own.

Table 8. The ILG budget for Noord-Holland

	according to central government		*according to provincial authority*			
theme	*central government, incl. EAFRD*	*%*	*central government*	*EAFRD*	*province*	*third parties*
nature conservation	175.7	40%				
agriculture	8.0	2%				
recreation	159.5	37%				
landscape	13.0	3%				
soil	0.5	0.1%				
water	13.7	3%				
focus regions	65.3	15%				
socio-economic vitality	0.8	0.2%				
total	**436.5**	**100%**	**389.1**	**16.1**	**60.3**	**75.3**

Source: Veldman et al. 2001.

These difficulties are even bigger when we look at the RDP itself. Here, one complication is that the province actually controls only part of the budget, and that part is administered through a national agency in the Ministry of Economic Affairs, Agriculture and Innovation, called the Government Service for Land and Water Management (DLG by its Dutch acronym). The other part is controlled by the Ministry itself, through another agency whose name translates as the Regulations Implementation Services (acronym DR). This DR handles most of the subsidies to farmers, except for measure 311 (diversification).[5] These subsidies make up the bulk of the RDP in the Netherlands, so the province itself only deals with a minority of RDP measures. Since the budgetary outlays for the measures administered by DR are not broken down by provinces, one may say that the RDP budget by province is not known, only the part which is administered by DLG on behalf of the province. That part is shown in Table 9. We see that in Axis 1, the province manages only measure 125, which is concerned with agricultural infrastructure – e.g. land use planning, land consolidation and drainage works; these are not projects implemented by individual farmers. In Axis 2, only small outlays are budgeted for the province, and these have not materialized anyway. Most of the expenditure has taken place in Axis 3, with measure 313 (promotion of tourism) as the largest item. Most of this expenditure consists of hiking and cycling trails and visitor centres to nature areas, not subsidies to individual beneficiaries.

[5] Curiously, the programme through which the most important subsidies (those for nature conservation) are administered is known as the *Provincial* Subsidies for Nature Conservation (PSAN). The province does influence these subsidies, in the sense that it decides under what conditions farmers can qualify for them. The farmers then apply to DR directly, and the budget is controlled by the ministry at central level.

Table 9. Provincial RDP budget for Noord-Holland, 2007-2013

	million euros	
measure	*budget*	*spent until 31-12-2011*
111	0,5	0,0
121	0,0	0,0
123	0,0	0,0
125	5,2	7,5
Axis 1	**5,7**	**7,5**
212	1,5	0,0
214	0,3	0,0
216	1,4	0,0
221	0,0	0,0
Axis 2	**3,3**	**0,0**
311	1,4	1,6
312	0,1	0,2
313	6,2	9,0
321	0,8	2,1
322	0,8	0,7
323	5,1	5,4
341	0,0	0,0
Axis 3	**14,3**	**19,0**
411	0,2	0,2
412	0,0	0,03
413	1,3	1,2
421	0,1	0,04
431	0,1	0,2
Axis 4	**1,8**	**1,7**
Total	**25,1**	**28,3**

Source: Province of Noord-Holland

This also makes monitoring of the programme somewhat complex. The office which coordinates and monitors RDP progress in the Netherlands does not publish breakdowns by province (Regiebureau POP 2011, Ecorys 2011, Oltmer et al. 2011). However, DR does provide data on subsidies paid to beneficiaries under RDP, and by aggregating these it is possible to get an overall view, if not on the budget, at least on actual expenditure. Since the addresses of the beneficiaries are also provided, the data can also show the distribution by municipality – and these we use in our analysis. The figures for the province as a whole over 2010 (not including contributions by beneficiaries) are presented in Table 10. 48% of the expenditure came from the provincial budget, the remainder was paid out by DR.

Table 10. RDP subsidies paid, 2010

measure	*no. of projects*	*expenditure in NH 2010*	*%*
111	13	14,862	0.1%
121	6	257,918	2.5%
124	2	138,760	1.3%
125	4	47,568	0.5%
132	97	64,225	0.6%
Axis 1	**122**	**523,332**	**5.0%**
212	282	489,230	4.7%
214	1052	3,549,808	42.6%
Axis 2	**1334**	**4,479,682**	**47.3%**
311	7	594,929	5.7%
313	11	2,751,590	26.2%
321	3	180,069	1.7%
323	5	1,331,543	12.7%
Axis 3	**26**	**4,858,129**	**46.3%**
411	2	35,166	0.3%
413	4	118,452	1.1%
Axis 4	**6**	**153,618**	**1.5%**
total	**1.488**	**10,503,992**	**100%**

Source: Ministry of Economic Affairs, Agriculture and Innovation, Dienst Regelingen (processed by LEI)

As we can see from comparing Table 10 and Table 9, some measures are on the RDP budget but were not under implementation during 2010. These include nos. 123 (adding value to agricultural products), 216 (non-productive investments), 221 (afforestation of farmland), 312 (business creation), 322 (village renewal), and 341 (training in local development). Also in the LEADER programme, there are some measures on which small amounts of money are being spent, but not in the year under consideration: 412 (environmental initiatives), 421 (cooperation projects), and 431 (local action group skills).

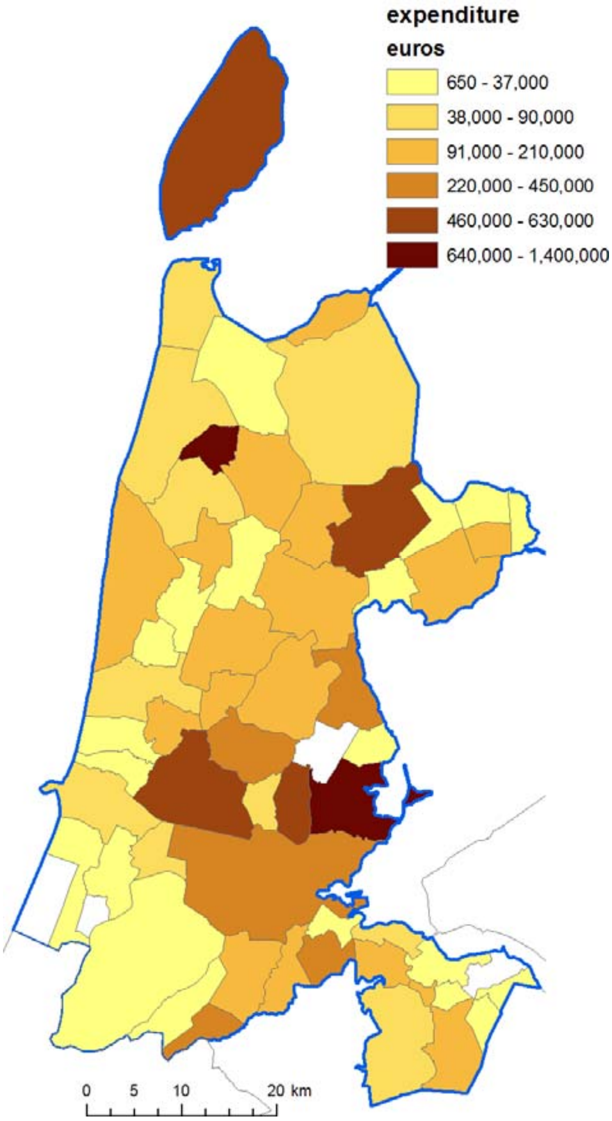

Figure 6. RDP expenditure by municipality, 2010
Source: Dienst Regelingen, processed by LEI

Figure 6 shows how expenditure (not counting third parties' contributions) is distributed over municipalities. Out of 60 municipalities, 7 do not participate in the RDP at all. Five of these have fewer than 10 farms; the other two are strongly specialized in horticulture, and horticultural farms generally have little diversification and little propensity for engaging in nature conservation. They can participate in Axis 1, but most measures in this axis have very few projects; the exception is measure 132 (food quality schemes), but in the Netherlands this is aimed only at organic farms – and in the province there are only 17 organic horticulturalists, none of which are in said two municipalities.

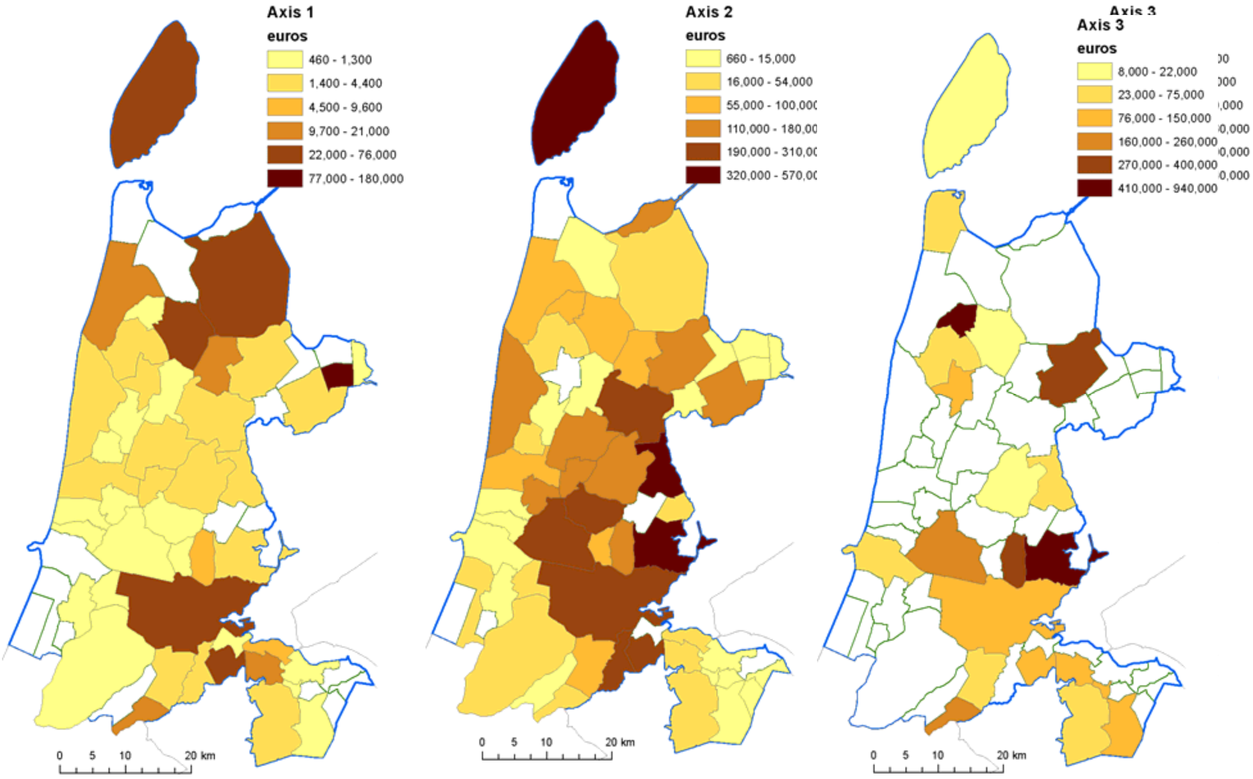

Figure 7. Expenditure by axis, 2010

Figure 7 shows the same for each axis. In Axis 1 the subsidies are highly concentrated, which is caused by the fact that more than half the money was spent on just three beneficiaries, only one of which is actually a farm. The spatial distribution of Axis 2 projects is mostly for on-farm nature conservation, which will be analyzed below. Axis 3, finally, covers only a limited number of municipalities. This is caused by the number of projects being small, as Table 10 shows.

3.3. The selected measures

At an early stage, one measure was selected for analysis in SPARD from each of the first three axes of the RDP – Axis 4 being merely a different approach to the three objectives of the RDP which govern Axes 1-3. These were 121 (modernization of farms), 214 (agri-environment schemes), and 311 (diversification into non-agricultural activities). The dependent variable was to be the participation rate in these measures among farmers, and the spatial resolution would be the municipality.[6]

However, we did not want to give up entirely the aim of evaluating also the *impact* of the RDP. For a programme to have a measurable impact, however, this requires some lapse of time – at least for most indicators. This presents a difficulty, because the RDP-2 really started off only in

[6] This is known as the LAU2 level, formerly known as NUTS5 which was abolished in 2003. LAU1 in the Netherlands is equal to NUTS3.

2008, and our data on indicators mostly refer to 2010. This means that, for the impact analysis we should use the expenditure of RDP-1 (2000-2006) as our independent variable, and measure the change in impact indicators for the period 2006-2010. There are two difficulties with that approach, however:

- The measures are not always comparable between RDP-1 and RDP-2; and
- The Common Monitoring and Evaluation Framework did not exist at the time, and the necessary data on RDP-1 expenditure are not readily available at the resolution required.

We have handled this problem in different ways. For Axis 1, we selected, for the impact analysis only, another measure, namely 125. As Table 9 shows, this measure not only has a much larger budget than 121 (and therefore hopefully a larger impact), but also the projects (which are only partially funded by the RDP tend to take many years, and have mostly been operating already during RDP-1.

For Axis 2, we were fortunate to obtain data on the precise location, area and beneficiary of on-farm nature conservation. Although we do not have the data on expenditure, the number of hectares per farm can serve as a good indicator of the amount of effort on this measure.

For Axis 3, we chose an alternative measure in RDP-2, namely 313 (promotion of tourism). This has the advantage that it is much larger in terms of expenditure, and also it is aimed at a single objective which can serve as dependent variable – namely, increase the number of tourists. Measure 121, on the other hand, is not only smaller but also supports a variety of multifunctional activities, each with its own objectives.[7]

The situation with regard to each of these selected measures is described below.

Measure 121 – modernization of farms

In the Netherlands, this measure is aimed at two objectives:

- Supporting young farmers (below 40) in taking over a farm and doing other necessary investments;
- Making agriculture more sustainable, for instance by improving animal welfare, reducing pollution or improving workers' conditions.

For the reason mentioned above, namely that this measure is not under provincial control, the province could not provide us with data on its implementation. The central government authority which does have the data does not publish them by province, let alone by municipality. They were, however, willing to aggregate the individual farm data for us at a cost. The result is shown in Table 11.

[7] There are data available on expenditure in projects comparable to measure 313 in the RDP-1 period. We could have used these instead of RDP-2 data, but some of the projects were difficult to allocate to specific municipalities.

Table 11. Beneficiaries for measure 121, per municipality

Municipality	*2007*	*2008*	*2009*	*2010*	*cumul*
Amstelveen		1			1
Anna Paulowna		1			1
Beemster		2		1	3
Bergen			1	1	2
Castricum			1		1
Drechterland	2		1		3
Graft-De Rijp		1	1		2
Haarlemmermeer		2		1	3
Harenkarspel	1	6	1		8
Heerhugowaard			2		2
Heiloo		1			1
Koggenland		2			2
Medemblik	1	2	2		5
Opmeer		1	1	1	3
Ouder-Amstel		1			1
Schermer			2		2
Texel			1		1
Uithoorn			1		1
Waterland		2			2
Weesp		1			1
Wieringermeer		1	2	2	5
Zeevang			1		1
Zijpe				2	2
total	**4**	**24**	**17**	**8**	**53**

Source: Dienst Regelingen

It is clear that, if any analysis is to be done, it will have to be on the cumulative number of farms participating in the measure up to 2010, as the number in that year alone is too small to do any meaningful analysis. Even so, only 23 out of the 60 municipalities in the province had any activity under this measure. We did not obtain data on expenditure, but the authority publishes data on payments individual beneficiaries which we aggregated to municipalities (Table 10); unfortunately, these data are only available for 2009 and 2010 and they do not entirely agree with the data in the table above. They do show that only 250,000 euro was spent on this measure in 2010 in the province as a whole. The projects in that year covered only 5 municipalities, and 72% of the money was spent on a single farm. A measurable impact on the competitiveness of farms with so few projects and such small amounts is unlikely. Moreover, although the names of the beneficiaries are known, we do not know their farm registration numbers, so we cannot relate the outcome to farm characteristics, only to aggregated characteristics at municipal level.

Measure 125 – agricultural infrastructure

This measure covers projects aimed at improving three aspects of the environment within which farming takes place, namely parcellation (i.e. how the land of a farm is divided into plots, how large these plots are, and how near they are to each other and to the farm buildings); water management (i.e. drainage and irrigation); and access (roads and waterways). These projects are of a collective nature: each one covers a number of farms simultaneously.

Projects to improve agricultural infrastructure have been undertaken in the Netherlands since the early decades of the 20th century, but mostly since 1945. They are presently managed by the Government Service for Land and Water Management (DLG, see section 3.2). since 1985, the objective of these projects is not only to improve agriculture, but also to enhance the quality of nature and landscape.

Table 12. Projects under measure 125, Noord-Holland

Name of project	*Municipality*	*Budget 2007-13*	*Expenditure 2007-11*
Kavelruil "De Oude Gouw"	Koggenland	167,472	37,335
Verbetering en versterking agrarische structuur op Texel	Texel	240,000	68,678
Beheer en inrichting Ilperveld	Landsmeer	75,477	37,738
Aanpassingswerken kavelruil Etersheim	Zeevang	115,274	0
Verbetering agrarische structuur Noordelijke Vechtstreek	Muiden/Weesp	648,106	55,926
Verbetering waterbeheer afdelingen A en B in de Zijpe	Zijpe	2,343,000	0
Verbetering Waterbeheer Afdelingen NM en R in de Zijpe	Zijpe	1,992,000	0
Verbetering Waterbeheer Bergermeer fase 1	Bergen	915,900	0
Verbetering Waterbeheer Texelse Polders	Texel	1,728,000	0
Hoofdwatergang hoofdpeilgebied Noorderlegmeerpolder	Amstelveen	1,121,040	0
Waterinrichtingsplan Kustpolders	Muiden	321,599	0
Waterberging Zuiderlegmeerpolder	Aalsmeer	2,300,000	0
Herstel oevers Hoofdwaterlopen Bergermeer	Bergen	1,026,122	0
Verbetering Watersysteem Afdelingen NS en Z in de Zijpe	Zijpe	1,429,000	0
Waterberging Afdeling OTPV	Zijpe	1,5444,000	0
Total projects: 15	**Municipalities: 10**	**29,866,990**	**199,677**

Source: Province of Noord-Holland

As Table 12 shows, the first five years of the programme have seen only limited implementation: only 4 projects covering 5 municipalities are being carried out as of early 2012, and less than 1% of the funds have been spent – very meagre for an impact analysis.

Measure 214 – agri-environment schemes and organic farming

As can be seen from Table 10, measure 214 is by far the largest one in the programme, taking up almost half the subsidies paid in 2010. Strictly speaking, most of these are not really subsidies, of course: they are compensation for costs and production losses incurred by the farmer who conserves nature on his land. Only in the case of organic farmers can we properly speak of a subsidy.

As stated earlier (section 2.3), there were 5,017 registered farms in the province in 2010. We have added to these some farms which, although the farm building itself is outside the province, use land inside; this brings our total to 5,238 farms. Out of these, 950 were beneficiaries of measure 214: 879 in nature conservation and 131 through organic farming; 60 were beneficiaries of both components of the measure.

The measure consists of many hundreds of 'packages', things which the farmer can opt to do. For the purpose of analysis, we have grouped these into five main categories. They are listed in Table 13. By far the most important category turns out to be bird protection. Of the other categories, only plant biodiversity appears large enough to be worth analyzing. As the table shows (the total figure being less than the sum of the categories), some farmers are engaged in more than one type of nature conservation.

Table 13. Agri-environment schemes in Noord-Holland, 2010

category	*farms*	*hectares*	*payment*[8]
1. Plant biodiversity	261	6,264	1,174,921
2. Bird protection	920	22,091	6,037,843
3. Other wildlife	7	18	12,292
4. Environment-friendly agriculture (e.g. reduced use of chemicals)	4	39	6,624
5. Landscape elements	18	471	24,338
total	**950**	**28,883**	**7,256,018**

Source: data Dienst Regelingen, processed by LEI

Quite separately from nature conservation, measure 214 also contains support to organic farmers. As mentioned in section 2.5, there are 125 such farms in the province. However, only 60 of these receive support from measure 214, as shown in Table 14, with a strong concentration in one municipality.

[8] The payments in this table have been calculated from the subsidies dues for each of the packages. They may be quite different from the payments actually made to farmers. Indeed, the total amount of actual payments (Table 10) is only half of the total payments due listed here.

Table 14. Organic farmers receiving support under measure 214 per municipality

Municipality	*2007*	*2008*	*2009*	*2010*	*cumul*
Amstelveen	1				1
Amsterdam	4				4
Castricum	1	1	1		3
Haarlemmermeer	1				1
Koggenland	2	1	1	1	5
Landsmeer	1	1	1		3
Medemblik	3				3
Muiden	1				1
Ouder-Amstel	1				1
Schagen	1				1
Texel	1				1
Waterland	8	3	2	1	14
Weesp	1				1
Wieringermeer	2	1	2		5
Wormerland		1			1
Zaanstad	1				1
Zeevang	1	1			2
Total	**34**	**33**	**24**	**10**	**60**

Source: Dienst Regelingen

Measure 311 – farm diversification

Measure 311 is aimed at those multifunctional activities which are considered as such by the Dutch government: tourism, sale of produce on the farm, processing of produce, and the social activities mentioned in section 2.4. Excluded are aquaculture and contract work because these are not considered as multifunctional categories, and also the storage of caravans on farms, because this is considered as not contributing to the rural character of the farm. Renewable energy (whether for own use or for supply to third parties) is not considered a multifunctional activity in the Netherlands, but is included as a separate sub-measure as it is considered a worthy cause.

From Table 15 it can be deduced that the number of projects is fairly small, that most of the money (59%) goes to agro-tourism and the remainder to social activities. The one energy project has not taken off yet. The 20 projects on the list (3 of which were not yet implemented as of 2010) are located in 14 municipalities, which bodes ill for the analysis. The table shows cumulative expenditure; we also have data on subsidies received in 2010 alone at individual level, but we cannot link the beneficiaries to the farm data in the Farm Structure Survey, so the analysis can be done only at municipal level.

Table 15. Projects and expenditure under measure 311 in Noord-Holland

ID number	type of activity	municipality	amount spent until 15-3-2011
1	agro-tourism	Beemster	94,743
2	agro-tourism	Waterland	30,000
3	agro-tourism	Waterland	100,000
4	agro-tourism	Waterland	70,000
5	farm education	Amstelveen	53,080
6	day-care for children	Schermer	58,274
7	agro-tourism	Weesp	98,042
8	agro-tourism	Waterland	0
9	health & social care	Zeevang	91,800
10	health & social care	Haarlemmermeer	90,000
11	agro-tourism	Weesp	7,983
12	agro-tourism	Uithoorn	100,000
13	health & social care	Amsterdam	9,114
14	health & social care	Andijk	43,047
15	renewable energy	Harenkarspel	0
16	agro-tourism	Wormerland	5,950
17	health & social care	Amsterdam	51,269
18	agro-tourism	Drechterland	0
19	agro-tourism	Medemblik	53,920
20	agro-tourism	Amstelveen	0
	total		**957,222**

Source: Province of Noord-Holland

Measure 313 – promotion of tourism

Measure 313 covers projects that enhance the infrastructure for rural tourism, and the development of innovative tourism products and services. It is by far the largest measure in Axis 3 in terms of expenditure. In theory, anyone except farmers can apply for a subsidy, but in practice most of the projects are implemented by public agencies. These include footpaths, cycling tracks, visitor centres and the like. Table 16 gives an impression. The projects are well distributed among municipalities (33 out of 60). Expenditure in 2010 was 2.8 million euro, divided over 7 municipalities.

Table 16. Projects under measure 313, Noord-Holland

project name	municipality	budget 2007-13	expenditure 2007-11
Visitors centre Nieuwe Nes	Schagen	1,121,652	450,000
Hiking route network Alkmaar-Bergen-Heiloo	Alkmaar, Bergen, Heiloo	262,000	27,354
Cycling path 3 Diemer Vijfhoek + oostelijke ontsluiting	Diemen	153,827	76,914
Development of canoeing route Vechtstreek	Muiden/Weesp/Wijdemeren	386,103	73,970
Cycling connection Florispark	Heemskerk	202,229	54,382
Green buffer Breekland (Diepsmeerpark)	Langedijk	921,351	58,201
Gaaspermolen path as cycling and hiking connection	Amsterdam	403,525	47,577

Hiking paths (17/18) + picknick place	Bergen	68,006	33,625
Automatic control of Bridge Noordeinde Oostzaan	Oostzaan	0	0
Renovation Van Zon bridge in Landsmeer	Landsmeer	555,444	241,550
Hiking routes Sint Maarten (Walking with Wheels)	Harenkarspel	299,412	135,433
Cycling paths Bovenkerkerpolder	Amstelveen	503,466	130,499
Cycling path Zuiderdijk	Drechterland	109,571	54,786
Expansion Egboetswater	Medemblik	1,850,098	158,281
Cycling pats Twisk-Broerdijk	Medemblik	1,076,332	0
Coastal strip resort De Koog, hiking path	Texel	203,810	30,780
Realisation terrain and sprots equipment and furniture	Haarlemmerliede en Spaarnwoude	175,049	0
Skeeler route Buitenhuizen & Spaarnwoude	Haarlemmerliede en Spaarnwoude	182,622	76,749
Redevelopment of surfing island	Aalsmeer	567,258	270,135
Mooring facilities for tourist boats Waterland West	Oostzaan	98,000	0
Development Recreation and Tourism Zeevang	Zeevang	96,244	29,233
Multifunctional centre Streekbos	Stede Broec/Medemblik	1,736,303	269,615
Cycling path Genieweg, connections between IJ en Z (RODS)	Zaanstad	323,819	106,000
Visitors centre Duinen-Noordkop, phase 2	Den Helder	1,054,586	265,072
Cycling and hiking connection Maer- or Korendijk	Castricum	298,870	137,454
Recreation plan Wormer- and Jisperveld	Wormerland	168,461	0
Saskevaart bridge and cycling tunnel N 54 Geestmerambacht	Langedijk	1,375,137	81,724
Nature boulevard Cycling path 4	Amsterdam/Diemen/Muiden	720,000	0
Recreational links + archaeology recreation area Geestmerambacht	Langedijk	1,862,541	113,788
Water-related playing facilities and swimming locations Geestmerambacht	Langedijk	44,125	17,896
Bridge between Westerwind path and the Belt	Zaanstad	180,458	0
Construction of detached Cycling path Reyndersweg Velsen-Noord	Velsen	823,741	411,838
Recreation access Heritage Park De Hoop	Uitgeest	391,000	0
Management and Information Centre 'Het Pakhuis'	Uitgeest	0	0
Founding a visitors centre for museum farm	Wieringen	415,000	171,717
East/West connection Texel	Texel	110,000	0
Walking tours Valkkoog	Harenkarspel	73,798	0
Cycling path network Texel	Texel	80,000	0
SGP Cycling path Middel-Rooswijk	Zaanstad	1,149,987	0
Founding Bovine museum Aat Grootes	Opmeer	549,235	0
Pilot horse-riding route West-Friesland	Wervershoof/Medemblik	0	0
Recreation node Gooi en Vechtstreek	Wijdemeren	3,026,670	0

Cycling and hiking path Oudendijk-Grosthuizen	Koggenland	640,725	0
Hiking trail network Zijpe	Zijpe	189,677	0
Qualty impulse Diemerbos	Diemen	1,065,000	128,498
Total: 45 projects	**33 municipalities**	**25,515,132**	**3,653,071**

Source: Province of Noord-Holland

4. Uptake analysis

This chapter explores which factors influence the participation of farmers in measures 121, 214 and 311. As explanatory factors for all of these measures, we have used three sets of variables, namely general characteristics of the municipality, variables concerning agricultural potential, and characteristics of the farming sector in each municipality. Although not all of these variables are considered relevant for all measures, we begin by listing them here, and by examining to what extent they are intercorrelated.

The general characteristics are:

- AREA: total land area
- POPUL: population (2010)
- DENSITY: inhabitants per km^2
- AVG_INCOME: average income per person in 2008
- PERC_NATURE: percentage of the total area which is forest or natural land
- WATER: whether or not the municipality has lakes within its boundaries, or is situated on the coast.

The variables on agricultural potential:

- PERC_AGRIC: percentage of the total area of the municipality which is under cultivation by farmers
- AGRIC_POTENTIAL: agricultural potential on the basis of yield reduction maps (quantitative)
- RANK_POTENTIAL: agricultural potential on the basis of landscape types (qualitative, ordinal variable)
- PERC_LFA: percentage of the utilized agricultural area (UAA) which is located in less favoured areas
- PERC_N2K: percentage of the UAA situated within Natura 2000 areas
- PERC_EHS: percentage of the UAA situated within the National Ecological Network

The farming-sector characteristics:

- FARMS: number of farms
- TOTAL_NGE: total agricultural production capacity (in Dutch accounting units)
- TOTAL_AREA: total utilized agricultural area (UAA) in hectares
- AVG_NGE: average economic farm size (in Dutch accounting units)
- AVG_AREA: average UAA per farm
- AGE: average age of farmers
- PERC_DAIRY: percentage of the TOTAL_NGE which is in dairy farms
- PERC_OTHPAST: percentage of the TOTAL_NGE which is in pasture-based farms other than dairy
- PERC_ALLPAST: percentage of the TOTAL_NGE which is in all pasture-based farms
- PERC_ARABLE: percentage of the TOTAL_NGE which is in arable farms
- PERC_GREENH: percentage of the TOTAL_NGE which is in greenhouse farms
- PERC_OTHHORT: percentage of the TOTAL_NGE which is in horticultural farms (including perennial crops) not primarily based on greenhouses

- PERC_ALLHORT: percentage of the TOTAL_NGE which is in horticultural farms
- LAB_PROD: average economic size per person-year of labour input. This variable serves as a proxy for labour productivity, which is not known at municipal level. Economic size, calculated from the average output per hectare per crop and per animal, is considered a fair approximation of total output.

In the sections below, we use these variables to explain the uptake of the selected measures. The uptake is the number of farmers participating as a percentage of the total number of farmers (PERC_PARTIC). In the first instance, we did all analyses at municipal level. However, for measure 214 we were fortunate to unearth data on participation at farm (and even plot) level. This, of course, allows a much closer look at how the explanatory variables affect participation in the measure. We have therefore done an analysis at municipal level for those variables which function at that level (i.e. the general characteristics per municipality), whereas an analysis at farm level has been carried out for the farm-specific variables. For subsidies to organic farms, we could not use the same data. That analysis is carried out separately (section 4.3), on the basis of which farmers are registered as organic, rather than on data concerning who actually received subsidies under measure 214.

4.1. Measure 121 – farm modernization

For analyzing the uptake of this measure (PERC_PARTIC), we used all of the above explanatory variables except PERC_NATURE and WATER, as these are unlikely to be relevant. The result is shown in Table 17.

Table 17. Correlation analysis: uptake of measure 121

		perc_partic		
		Pearson's r	Kendall's tau_b	Spearman's rho
area	Correlation Coefficient	.249	.343**	.470**
	Sig. (2-tailed)	.055	.001	.000
	N	60	60	60
popul	Correlation Coefficient	-.129	-.096	-.125
	Sig. (2-tailed)	.325	.328	.341
	N	60	60	60
density	Correlation Coefficient	-.344**	-.336**	-.456**
	Sig. (2-tailed)	.007	.001	.000
	N	60	60	60
avg_income	Correlation Coefficient	-.099	.021	.023
	Sig. (2-tailed)	.452	.840	.860

	N	60	60	60
perc_agric	Correlation Coefficient	.524**	.437**	.566**
	Sig. (2-tailed)	.000	.000	.000
	N	60	60	60
agric_potential	Correlation Coefficient	-.147	-.038	-.040
	Sig. (2-tailed)	.264	.700	.763
	N	60	60	60
rank_potential	Correlation Coefficient	-.256*	-.226*	-.273*
	Sig. (2-tailed)	.048	.034	.035
	N	60	60	60
perc_LFA	Correlation Coefficient	.000	.051	.062
	Sig. (2-tailed)	.999	.621	.637
	N	60	60	60
perc_N2k	Correlation Coefficient	-.198	-.122	-.149
	Sig. (2-tailed)	.129	.258	.256
	N	60	60	60
perc_EHS	Correlation Coefficient	-.319*	-.258**	-.337**
	Sig. (2-tailed)	.013	.009	.008
	N	60	60	60
farms	Correlation Coefficient	.529**	.477**	.646**
	Sig. (2-tailed)	.000	.000	.000
	N	60	60	60
total_nge	Correlation Coefficient	.369**	.399**	.559**
	Sig. (2-tailed)	.004	.000	.000
	N	60	60	60
total_area	Correlation Coefficient	.432**	.443**	.613**
	Sig. (2-tailed)	.001	.000	.000
	N	60	60	60
avg_nge	Correlation Coefficient	.048	.183	.256*
	Sig. (2-tailed)	.714	.064	.048
	N	60	60	60
avg_area	Correlation Coefficient	.044	.064	.098
	Sig. (2-tailed)	.741	.520	.456
	N	60	60	60

age	Correlation Coefficient	-.239	-.235*	-.320*
	Sig. (2-tailed)	.066	.018	.013
	N	60	60	60
perc_dairy	Correlation Coefficient	.135	.115	.145
	Sig. (2-tailed)	.305	.245	.269
	N	60	60	60
perc_othpast	Correlation Coefficient	-.217	-.169	-.228
	Sig. (2-tailed)	.096	.087	.080
	N	60	60	60
perc_allpast	Correlation Coefficient	-.096	-.083	-.114
	Sig. (2-tailed)	.467	.403	.385
	N	60	60	60
perc_arable	Correlation Coefficient	.167	.137	.169
	Sig. (2-tailed)	.203	.173	.198
	N	60	60	60
perc_greenh	Correlation Coefficient	.021	.201	.251
	Sig. (2-tailed)	.872	.054	.053
	N	60	60	60
perc_othhort	Correlation Coefficient	-.028	.018	.029
	Sig. (2-tailed)	.831	.858	.823
	N	60	60	60
perc_allhort	Correlation Coefficient	-.012	.059	.086
	Sig. (2-tailed)	.926	.557	.513
	N	60	60	60
lab_prod	Correlation Coefficient	.006	.208*	.292*
	Sig. (2-tailed)	.964	.035	.024
	N	60	60	60
perc_partic	Correlation Coefficient	1	1.000	1.000
	Sig. (2-tailed)		.	.
	N	60	60	60

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

At first sight, it would appear that the sparser the population density and the larger the agricultural land use as a proportion of the total area, the likelier are farmers to participate in measure 121. The number of farms also contributes positively, whereas the presence of areas gazetted as part of the National Ecological Network (EHS) has a negative influence. Total production capacity and total agricultural area also have a positive influence, but less than the number of farms; moreover, the average size of farms does not significantly affect the propensity to participate. Other factors, such as the dominant farm type do not appear significant - at least not on Pearson's correlation coefficient.

Unsurprisingly, some of these variables are strongly intercorrelated, as Table 18 makes clear. Clearly, municipalities that have a strong rural and agrarian character, as evidenced by a low population density, a large number of farms and a large proportion of land in agricultural use are the ones most likely to attract participants for measure 121. That land gazetted for nature conservation discourages participation is not surprising: such a situation tends to act as a disincentive for farmers to invest in modernization, because they fear restrictions on their freedom to operate. Such land, by the way, appears to be less common in strongly agricultural municipalities – which undoubtedly is good news for farmers.

Table 18. Correlations between significant explanatory variables (M121)

	density	perc_agric	farms	perc_EHS
density	1.00	-.695**	-.449**	0.204
perc_agric	-.695**	1.00	.622**	-.576**
farms	-.449**	.622**	1.00	-.527**
perc_EHS	0.204	-.576**	-.527**	1.00

For one variable we would expect a positive relation with participation in farm modernization, but without it showing up in Pearson's correlation coefficient as it is an ordinal variable. This is rank potential, which is a ranking of municipalities by landscape type, based on expert knowledge. Indeed, it shows up in the non-parametric coefficients (Kendall's tau and Spearman's rho), and there does appear to be a positive[9] relationship, although it is neither very strong nor very significant (Table 17). The suggestion is that areas with good potential for agriculture attract more investments in modernization than more marginal areas.

There are a few other variables with significant scores on non-parametric correlations, suggesting there may be a non-linear relationship. This is the case for area, age, and labour productivity. For these relationships, including rank potential, we constructed scatter-plots (Figures 8-11). For the physical size of the municipality, the apparent relationship is mainly due to outliers: a few large municipalities have above-average uptake rates. Agricultural potential (measured from 1 as the highest) does have some positive effect on uptake, although it is not linear. As for age, if we exclude the municipalities where there was no participation at all, there is indeed a clear effect: the higher the average age, the smaller the uptake. This is to be expected: older farmers are less likely to invest in modernization, and moreover one of the objectives of the measure is to support young farmers. Lastly, for labour productivity no clear relationship can be discerned.

[9] It appears negative, but that is because the highest rank is 1.

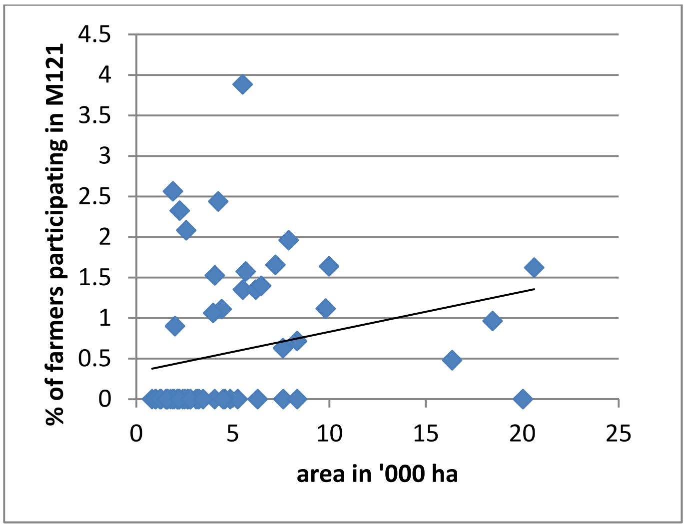

Figure 8. Relationship between size of municipality and uptake of M121

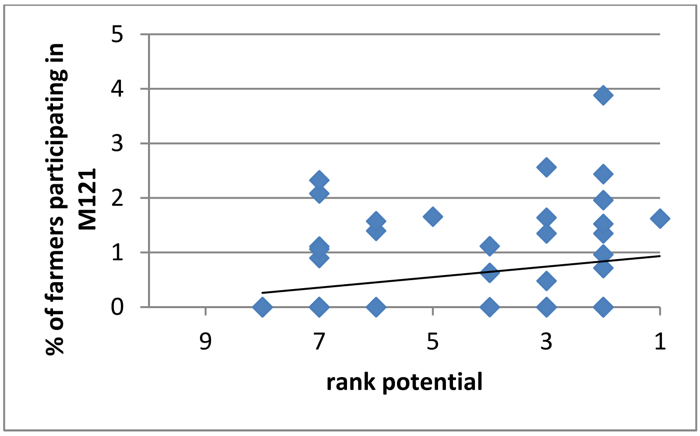

Figure 9. Relationship between agricultural potential and uptake of M121

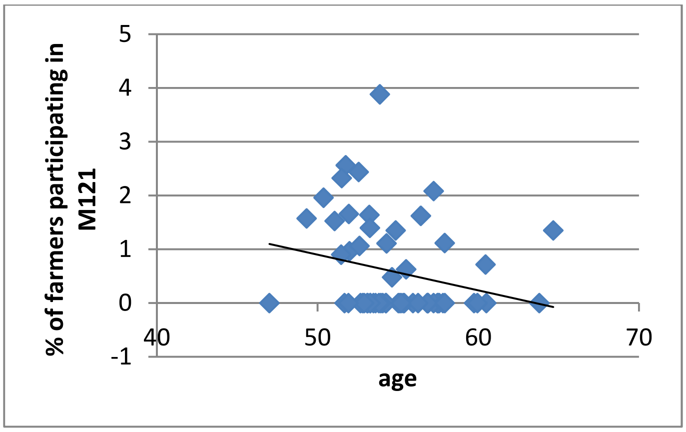

Figure 10. Relationship between average age of farmers and uptake of M121

Figure 11. Relationship between average labour productivity and uptake of M121

4.2. Uptake measure 214 – agri-environment schemes

We can measure the uptake of M214 (agri-environment schemes only, since subsidies to organic farms are discussed in the next section) through three different indicators: number of farmers participating, number of hectares under AES, and payments to farms for AES. For the explanatory variables, we use two different sets, namely those measured at farm level and those measured at municipal level.

4.2.1. Correlation analysis: number of participants, farm level

We begin with the analysis at farm level, which is the most promising. We use similar variables as in measure 121, but with some modifications:

- TOTAL_SO is equivalent to TOTAL_NGE, but using the more modern standard output measure for economic size. This is based on total estimated production, expressed in euros, whereas the Dutch size unit estimated farm income.
- UAA is equivalent to TOTAL_AREA.
- PERC_PASTURE is the proportion of the UAA under grass. This is an important variable, as bird protection is the most common form of on-farm nature conservation.
- FARMWORK is the proportion of a farmer's time spent on work in the farm. It is an ordinal variable, with 1 signifying farm work being a full-time job and 6 standing for almost no time spent on farm work. This may be relevant, as in some countries it is found that nature conservation can be an alternative to agricultural operations, where the farmer uses income from measure 214 to be able to live on the farm, while the farm is hardly a productive unit.
- PERC_OWNED: the percentage of the land used by the farmer which he actually owns. This variable is used in the Scottish case study, so we decided to see what it yields for our case.

In the analysis have been included not only farms located within the province, but also those located outside Noord-Holland but having land within it.

There are some interesting correlations found in Table 19. The size of the farm is clearly relevant, but only in terms of area, not in terms of economic size. This is because the largest farms in economic terms are greenhouse farms, which are rarely involved in agri-environment schemes. For land-based farms, however, the larger the farm the more likely it is to be involved in this measure. Also the percentage under grass is an important factor, as expected.

Table 19. Correlation analysis: uptake of M214 (agri-environment schemes, farm level)

		partic_m214		
		Pearson's r	Kendall's tau_b	Spearman's rho
Total_SO	Correlation coefficient	-.064**	.008	.009
	Sig. (2-tailed)	.000	.515	.515
	N	5017	5017	5017
UAA	Correlation coefficient	.159**	.220**	.269**
	Sig. (2-tailed)	.000	.000	.000
	N	5179	5179	5179
Perc_pasture	Correlation coefficient	.195**	.258**	.316**
	Sig. (2-tailed)	.000	.000	.000
	N	2850	2850	2850
age	Correlation coefficient	-.006	-.004	-.005
	Sig. (2-tailed)	.641	.712	.712
	N	5258	5258	5258

farmwork	Correlation coefficient	-.067**	-.062**	-.066**
	Sig. (2-tailed)	.000	.000	.000
	N	5258	5258	5258
perc_owned	Correlation coefficient	-.008	-.018	-.021
	Sig. (2-tailed)	.607	.143	.143
	N	4649	4649	4649
perc_LFA	Correlation coefficient	.309**	.309**	.309**
	Sig. (2-tailed)	.000	.000	.000
	N	4649	4649	4649
partic_m214	Correlation coefficient	1	1.000	1.000
	Sig. (2-tailed)		.	.
	N	5258	5258	5258

The variable FARMWORK, too, has some influence, but not as we had hypothesized: the more time the farmer spends on his farm, the more likely he is to participate in measure 214. Age and ownership turn out to be irrelevant. Whether the farm is wholly or partly located in less-favoured areas appears to be an important explanatory variable. This indicates that the more marginal farmland tends to be more attractive for nature conservation – as the loss of income from agriculture will be less, of course.

As we has expected, the variables UAA and PERC_PASTURE are strongly correlated (Table 20). We shall select UAA for our regression analysis; although PERC_PASTURE shows a slightly stronger association with the dependent variable, we expect to capture that effect by including the farm types as explanatory variables: dairy farmers are probably more likely to participate in measure 214. FARMWORK is more strongly correlated with UAA and PERC_PASTURE than with the dependent variable, which is cause for us to drop it as we surmise its effect on uptake to be caused by these intercorrelations. In other words: the small effect that the amount of time spent on farm work on the participation in agri-environment schemes is probably not an independent effect, but caused by the fact that farmers with more land (and especially dairy farmers) tend to be full-time farmers. As for the location in less-favoured areas, this is correlated with the percentage under pasture; that correlation is due to the fact that most less-favoured areas are in the fen region (section 2.2), which is unsuitable for anything other than pasture.

Table 20. Correlations between significant explanatory variables (M214)

	UAA	perc_pasture	farmwork	perc_LFA
UAA	1.00	.709**	-.244**	0.006
perc_pasture	.709**	1.00	-.276**	.156**

farmwork	-.244**	-.276**	1.00	.097**
perc_LFA	0.006	.156**	.097**	1.00

4.2.2. Correlation analysis: number of participants, municipal level

A separate analysis was carried out for the variables at municipal level (Table 21). This yields useful additional information on explanatory variables: low population density, a high proportion of land under agriculture, and low agricultural potential[10] are the properties that make a municipality have a high uptake rate. The presence of Natura 2000 areas in the municipality has a positive, but non-linear effect on participation in agri-environment schemes. That relationship is weak, however (Figure 12). A more surprising non-parametric correlation is the negative one between population size and uptake rate. This correlation disappears, however, when we leave out the city of Amsterdam, with a population far in excess of all other municipalities; this is done in Figure 13.

Table 21. Correlation analysis: uptake of M214 (agri-environment schemes, municipal level)

		perc_partic		
		Pearson's r	Kendall's tau_b	Spearman's rho
area	Correlation Coefficient	-.024	.044	.062
	Sig. (2-tailed)	.856	.627	.635
	N	60	60	60
popul	Correlation Coefficient	.028	-.314**	-.455**
	Sig. (2-tailed)	.830	.000	.000
	N	60	60	60
density	Correlation Coefficient	-.332**	-.253**	-.379**
	Sig. (2-tailed)	.010	.005	.003
	N	60	60	60
avg_income	Correlation Coefficient	.138	.118	.158
	Sig. (2-tailed)	.295	.206	.227
	N	60	60	60
perc_nature	Correlation Coefficient	-.155	-.153	-.213
	Sig. (2-tailed)	.236	.089	.102
	N	60	60	60

[10] The sign for rank potential is opposite to that for agricultural potential, but this is because the highest rank is 1.

water	Correlation Coefficient	-.043	-.018	-.022
	Sig. (2-tailed)	.745	.867	.869
	N	60	60	60
perc_agric	Correlation Coefficient	.361**	.277**	.399**
	Sig. (2-tailed)	.005	.002	.002
	N	60	60	60
agric_potential	Correlation Coefficient	-.492**	-.411**	-.548**
	Sig. (2-tailed)	.000	.000	.000
	N	60	60	60
rank_potential	Correlation Coefficient	.349**	.140	.197
	Sig. (2-tailed)	.006	.148	.131
	N	60	60	60
perc_N2k	Correlation Coefficient	.231	.213*	.272*
	Sig. (2-tailed)	.076	.030	.036
	N	60	60	60
perc_EHS	Correlation Coefficient	.021	.119	.154
	Sig. (2-tailed)	.875	.183	.241
	N	60	60	60
perc_partic	Correlation Coefficient	1	1.000	1.000
	Sig. (2-tailed)		.	.
	N	60	60	60

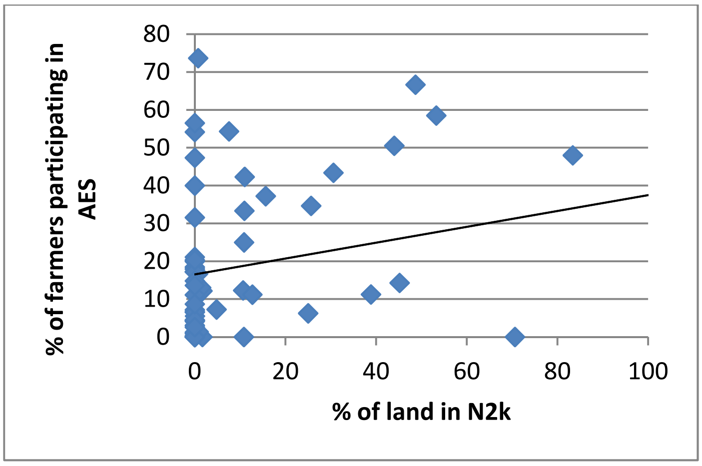

Figure 12. Relationship between percentage of land in Natura 2000 and uptake of M214

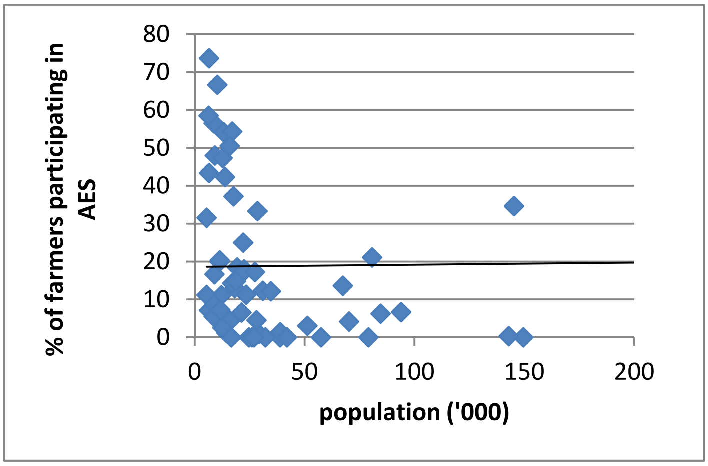

Figure 13. Relationship between population size and uptake of M214 (excluding Amsterdam)

Obviously, some of the explanatory variables for which we found significant correlations are intercorrelated too. We already noted the correlation between population density and percentage of agricultural land (Table 18), and we opt for the latter as our determinant in the regression analysis as it shows up the highest correlation with the dependent variable. The link with agricultural potential is more tenuous. The two variables we identified for this are not themselves significantly intercorrelated, which is perhaps a surprise. We constructed AGRIC_POTENTIAL as an attempt to include a variable for soil quality measured at interval level. This is always a difficult proposition, because a soil may be good for one crop but not for another. We did this by relating the quality of the soil for different crops to the value of each crop (and aggregating the different soil types to the municipal level), but we consider the result less valid than the ordinal variable RANK_POTENTIAL. We have to confess that our variable AGRIC_POTENTIAL does not work.

Table 22. Correlation between explanatory variables (M214, municipal analysis)

	density	perc_agric	agric_potential	rank_potential
density	1.00	-.695**	.306*	0.099
perc_agric	-.695**	1.00	-.316*	-.337**
agric_potential	.306*	-.316*	1.00	-0.235
rank_potential	0.099	-.337**	-0.235	1.00

4.2.3. Regression analysis: number of participants, farm and municipal level combined

The next step now is a regression analysis, using the outcomes of the various correlation analyses described above. For the dependent variable participation we have opted for a logistic regression, with the following equation:

$$p_i = \frac{1}{e^{-(a+\propto.logL_i+\beta G_i+\gamma W_i+\delta F_i+\varepsilon T_i+\theta D_i+\mu N_i+\pi A_i+\rho R_i+\sigma K_i)}+1} \qquad (1)$$

in which p_i is the chance that farmer i will participate in an agri-environment scheme;

L_i is the UAA of farm i, which we have taken as a logarithm of the number of hectares;

G_i is the proportion of L_i which is under grass;

W_i is a ranked representation of the amount of time a farmer spends on his farm;

F_i is the proportion of L_i which is located in a less-favoured area;

T_i is the farm type of farm i (actually, this variable has been split into dummies for the various types, with mixed farming as a residual category);

D_i is the population density of the municipality where farm i is situated;

N_i is the proportion of all land in the municipality where farm i is located which is in forest or natural areas;

A_i is the proportion of all land in the municipality where farm i is located which is in agricultural use;

R_i is a ranked variable which stands for the agricultural potential of said municipality;

K_i is the proportion of all land in the municipality which is located in a Natura 2000 area; and

α, β, γ, δ, ε, θ, μ, π, ρ and σ are the regression coefficients.

The regression analysis was carried out on a balanced sample, in which the number of non-participants (chosen randomly from among the total) was made equal to the number of participants. The result is presented in Table 23.

Table 23. Regression analysis for the uptake of AES

r^2		0.2604845			
Deviance Residuals:					
	Min	1Q	Median	3Q	
	-2.9393	-0.8475	0.3442	0.8258	
Coefficients:					
		Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)		-3.74799	0.56628	-6.61900	0.00000
log(UAA)		0.57400	0.08246	6.96100	0.00000
perc_pasture		0.01515	0.00489	3.09900	0.00194
farmwork		0.06330	0.06411	0.98700	0.32351
perc_LFA		1.59309	0.23339	6.82600	0.00000
density		0.00033	0.00015	2.25800	0.02397
perc_nature		-0.01187	0.00462	-2.56800	0.01024
perc_agric		0.01374	0.00499	2.75200	0.00593
rank_potential		-0.03920	0.04577	-0.85600	0.39180
perc_N2k		0.01488	0.00589	2.52500	0.01158
as.factor(type)dairy		0.93334	0.25573	3.65000	0.00026
as.factor(type)greenhouse horticulture		0.39762	0.42960	0.92600	0.35468
as.factor(type)mixed farming		0.46971	0.37080	1.26700	0.20524
as.factor(type)open-air horticulture		0.35678	0.25948	1.37500	0.16913
as.factor(type)other pasture		1.15021	0.24278	4.73800	0.00000
as.factor(type)zero-grazing livestock		-0.17104	0.81120	-0.21100	0.83300

Judging from the R-square value of 0.26, the explanatory variables we identified have some impact on the uptake of agri-environment schemes. Spectacular their impact is not. There must be other factors at play which we have not identified – probably including personal characteristics of farmers of which we have no knowledge. Several other models have been tried, but the use of a balanced sample and the conversion of UAA into logarithmic shape gave the best result.

From Table 24 we may conclude that by far the largest explanatory value comes from the percentage of grassland (pasture) in a farm, and from the extent to which it is located in a less-favoured area. The impact of these variables on participation rate is, however, rather trivial: as Figure 14 shows, most less-favoured areas are located on peat soils (because of the limitations these impose on agriculture), and peat soils are almost exclusively used for pasture. Since the protection of farmland birds (primarily meadow birds), as we saw in Table 13, is by far the largest component of AES in Noord-Holland, it is not surprising that most nature conservation on farms takes place on those grasslands which in any case are less than optimal for dairy production. The primary factors affecting participation appear to be spatially determined.

Table 24. Bottom and top uncertainty contributions based on linear fit

input	estimate	bottom%	top%	Sumdf
farmwork	-1.97E-02	0.4	0.6	1
density	1.60E-05	0	0	1
perc_LFA	2.93E-01	3.6	12.9	1
perc_N2K	2.11E-03	0.3	6.2	1
perc_agric	1.61E-03	0.3	0	1
perc_nature	-1.36E-03	0.2	1.3	1
perc_pasture	4.44E-03	5	12.2	1
rankpotential	3.48E-04	0	5.7	1
greenhouse	1.52E-02	0	0	1
mixed farming	-1.48E-02	0	0	1
dairy	-2.05E-02	0	0	1
arable	8.68E-03	0	0	1

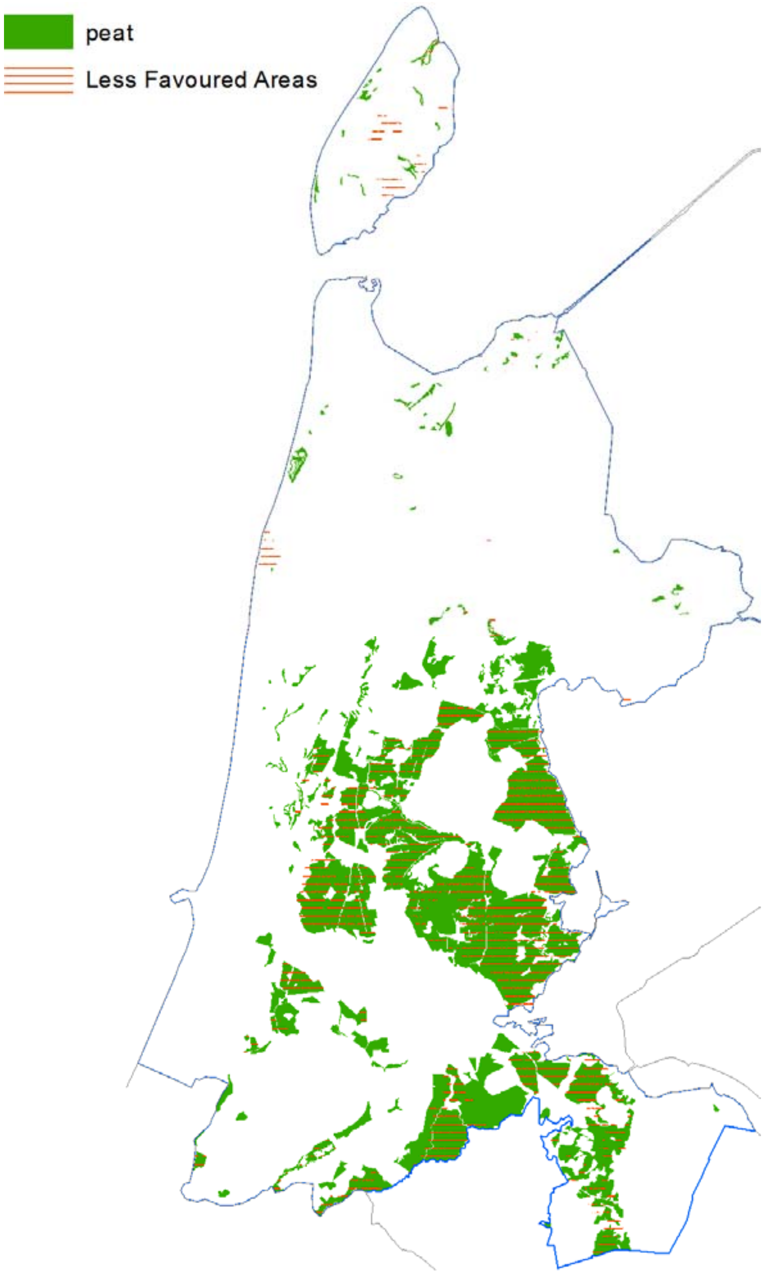

Figure 14. Peat soils and LFAs

4.2.4. Correlation analysis: hectares and payments, farm level

So far, we have used only one dependent variable, namely whether or not a farmer participates in a scheme. We have data, however, for several more: the amount of subsidy, the number of hectares under conservation, and the different categories of nature conservation – two of which we found relevant, namely plant biodiversity and bird protection. We have excluded some of the explanatory variables which were shown to be irrelevant in the number of participant farmers.

We re-encounter the familiar explanatory variables, but what is interesting is their differential effect on the four dependents. The land area of a farm, the percentage of pasture, and the percentage located in less-favoured areas all seem to have a significant effect on the amount of payment for bird protection, but much less or not at all on the number of hectares. This means that these variables affect the type of package used: the more intensive protective measures (which attract higher subsidies per hectare) are influenced by the variables displayed in Table 25, but not the area under protection. Why this should be so is unclear, however. The economic size of a farm makes little difference, as it did in the analysis in section 4.2.

Table 25. Correlation analysis: uptake of M214 in hectares and euros, per category (farm level)

		Plant biodiversity - hectares	Bird protection - hectares	Plant biodiversity - payments	Bird protection - payments
Total_SO	Pearson Correlation	-.019	-.005	-.022	-.036**
	Sig. (2-tailed)	.171	.705	.117	.009
	N	5258	5258	5258	5258
UAA	Pearson Correlation	.067**	.024	.049**	.232**
	Sig. (2-tailed)	.000	.088	.000	.000
	N	5258	5258	5258	5258
perc_pasture	Pearson Correlation	.105**	.034*	.100**	.331**
	Sig. (2-tailed)	.000	.015	.000	.000
	N	5258	5258	5258	5258
perc_LFA	Pearson Correlation	.124**	.012	.123**	.298**
	Sig. (2-tailed)	.000	.409	.000	.000
	N	4640	4640	4640	4640

4.2.5. Correlation analysis: hectares and payments, municipal level

The same analysis is also done at municipal level (Table 26). We again find the same curious discrepancy between correlation with hectares and with payments for bird protection (HA214_CAT2 and PAYMT214_CAT2). For plant biodiversity the correlations are more nearly parallel, and fortunately there is also a strong correlation between hectares and payments. Perhaps the area under protection is not a very accurate indicator for the degree of uptake. There are many different packages, varying from very light to quite incisive. This may be better expressed by the amount of money, which after all stands for the income supposedly forfeited by the farmer when he applies a particular package.

Using this indicator, we can discern in the table several variables that affect it: total area of the municipality, density (negative), percentage of nature (negative), percentage under agriculture, and agricultural potential (negative). It is also highly correlated with activities under category 1, meaning that the two types of nature conservation tend to be implemented in the same areas. The negative correlation between payments for bird protection and percentage under nature can be explained: more land under nature means less land under agriculture, and thus less opportunity for protection of farmland birds.

As for plant biodiversity packages (HA214_CAT1 and PAYMT214_CAT1), there is only one explanatory variable that appears to have an effect on them, and this is the total area of the municipality. Since our dependent variables are absolute numbers (total payments and total area protected), this correlation is trivial: other things being equal, the larger the territory of a municipality, the more nature conservation can take place there.

Table 26. Correlation analysis: uptake of M214 in hectares and euros, per category (municipal level)

		Plant biodiversity - hectares	Bird protection - hectares	Plant biodiversity - payments	Bird protection - payments
area	Pearson Correlation	.348**	.096	.368**	.351**
	Sig. (2-tailed)	.007	.463	.004	.006
	N	60	60	60	60
popul	Pearson Correlation	-.039	.008	-.026	.121
	Sig. (2-tailed)	.769	.951	.844	.355
	N	60	60	60	60
density	Pearson Correlation	-.200	-.148	-.197	-.298*
	Sig. (2-tailed)	.126	.258	.132	.021
	N	60	60	60	60
avg_income	Pearson Correlation	-.095	.406**	-.096	-.074
	Sig. (2-tailed)	.470	.001	.464	.576
	N	60	60	60	60
perc_nature	Pearson Correlation	-.139	-.015	-.145	-.276*
	Sig. (2-tailed)	.289	.912	.269	.032
	N	60	60	60	60
water	Pearson Correlation	.103	.126	.103	.038
	Sig. (2-tailed)	.433	.336	.431	.775
	N	60	60	60	60
perc_agric	Pearson Correlation	.196	-.032	.189	.463**
	Sig. (2-tailed)	.133	.809	.147	.000
	N	60	60	60	60
agric_potential	Pearson Correlation	-.076	-.136	-.072	-.363**
	Sig. (2-tailed)	.564	.299	.582	.004
	N	60	60	60	60

rank_potential	Pearson Correlation	-.002	.191	-.005	.080
	Sig. (2-tailed)	.989	.143	.967	.544
	N	60	60	60	60
perc_N2k	Pearson Correlation	.097	.031	.088	.143
	Sig. (2-tailed)	.462	.814	.504	.274
	N	60	60	60	60
perc_EHS	Pearson Correlation	-.039	.111	-.036	-.125
	Sig. (2-tailed)	.768	.398	.787	.343
	N	60	60	60	60
Ha214_cat1	Pearson Correlation	1	.202	.999**	.598**
	Sig. (2-tailed)		.121	.000	.000
	N	60	60	60	60
Ha214_cat2	Pearson Correlation	.202	1	.200	.254*
	Sig. (2-tailed)	.121		.125	.050
	N	60	60	60	60
paymt214_cat1	Pearson Correlation	.999**	.200	1	.594**
	Sig. (2-tailed)	.000	.125		.000
	N	60	60	60	60
paymt214_cat2	Pearson Correlation	.598**	.254*	.594**	1
	Sig. (2-tailed)	.000	.050	.000	
	N	60	60	60	60

4.2.6. Regression analysis: payments per UAA hectare, farm and municipal level combined

All in all, we get very limited results from the separation of measure 214 into different categories. Furthermore, payments may tell us more about the amount of conservation done than the areas under different forms of conservation. Finally, we may relate the indicator of total payment to the size of the farm, and convert it to payments per hectare of utilized agricultural area, so as to remove any spurious correlation with farm size. Therefore, we do a regression analysis on the total payments per hectare of UAA for M214 (except subsidies for organic farming) as indicator for uptake. In this analysis, carried out in STATA (Table 27), we have used dummy variables for all farm types except zero-grazing livestock (a very small category in this province). The result is very meagre: apparently, the variables we identified have hardly any effect on the uptake of M214, as measured by the payments for AES per hectare of agricultural land.

Table 27. Regression analysis for payments per hectare under M214, 2010

Summary of analysis

Source	d.f.	s.s.	m.s.	v.r.
Regression	12	6186703	515559	9.24
Residual	4386	2.45E+08	55817	
Total	4398	2.51E+08	57071	

Percentage variance accounted for 2.2 (r^2=0.02)

Standard error of observations is estimated to be 236.

Estimates of parameters

Parameter	estimate	s.e.	t(4386)
Constant	-22.9	22.6	-1.01
farmwork	12.7	2.73	4.65
density	-0.00079	0.0077	-0.1
perc_LFA	61.8	14	4.41
perc_N2K	0.423	0.341	1.24
perc_agric	0.312	0.267	1.17
perc_nature	-0.526	0.269	-1.96
perc_pasture	0.243	0.181	1.35
rankpotential	2.46	2.45	1
greenhouse	-3.9	11.6	-0.33
mixed farming	-4.2	19.2	-0.22
dairy	3.43	9.43	0.36
arable	-4.9	11	-0.44

4.2.7. Spatial analysis

In our farm database, we had included all farms that have land within the case-study area, whether or not the farms themselved are actually located there. For the spatial analysis, however, we use farm locations rather than parcels of land, and we would get very strange patterns if we included farms that are remote from the province. Therefore, we we have removed from our database those farms which are more than 5 km from the provincial boundary of Noord-Holland. As Figure 15 shows, there are clearly spatial patterns in the participation of farmers, and even more evidently in the payments (Figure 16, which was made using inverse distance weighting).

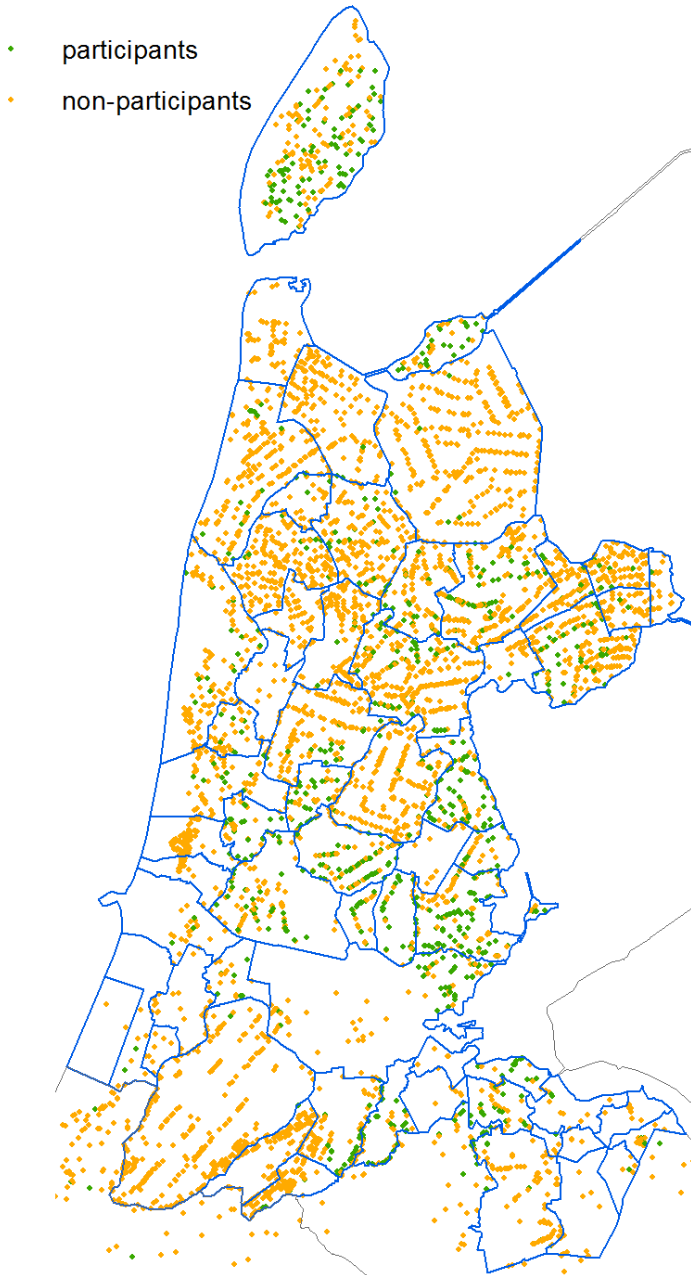

Figure 15. Participation of farmers in agri-environment schemes, 2010

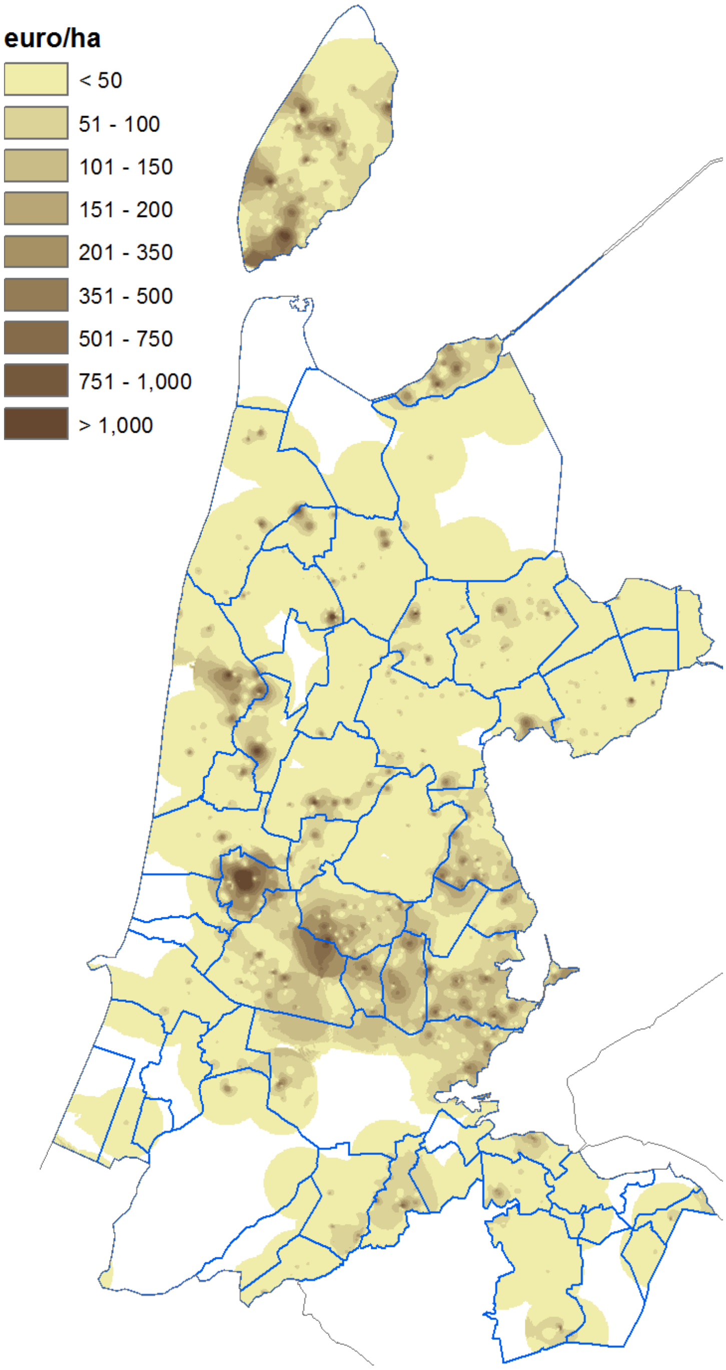

Figure 16. Spatial distribution of payments for AES, 2010

These spatial patterns can be explored further with LISA maps. A spatial weights matrix was built, based on the inverse-distance method (assuming that the spatial influence decreases with the square of the distance, and using a minimum of 10 neighbours). The result is Figure 17 for the binary variable participation in AES and Figure 18 for the variable AES payments. Unfortunately, neither is very clear, although at least for participation there are clusters visible where high values are grouped together. For the payments variable, this seems to be the case

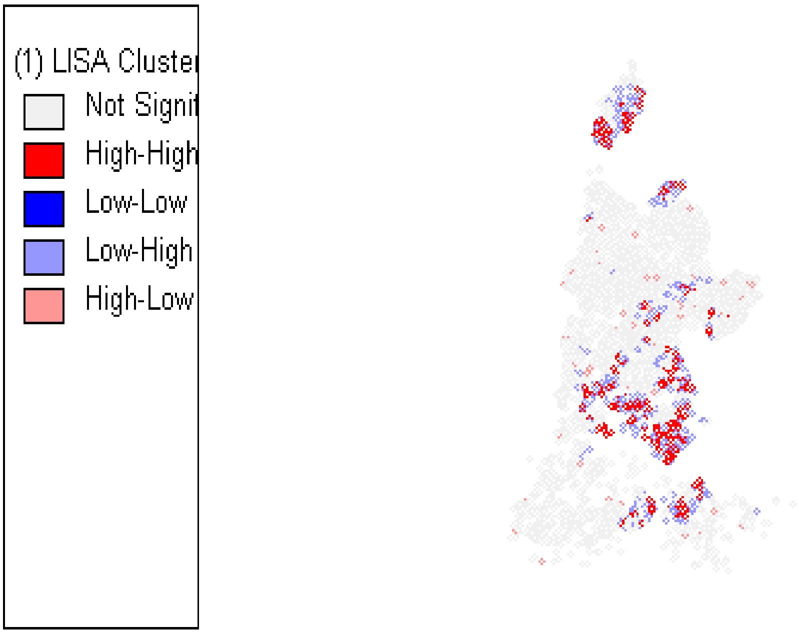

Figure 17. LISA cluster map for participation in AES

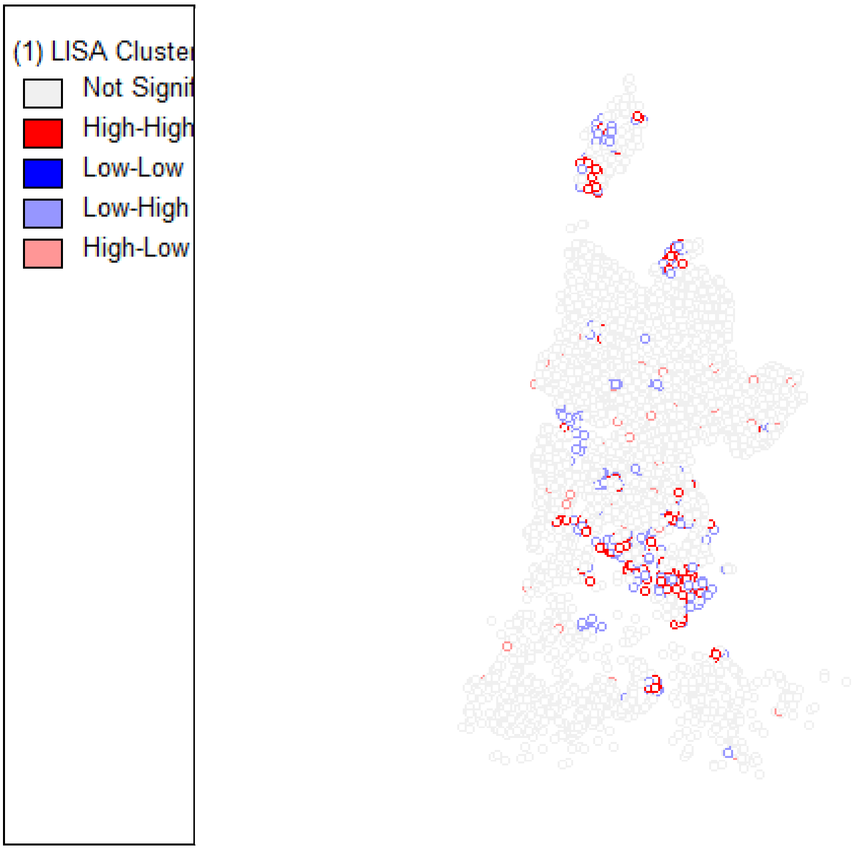

Figure 18. LISA map for AES payments

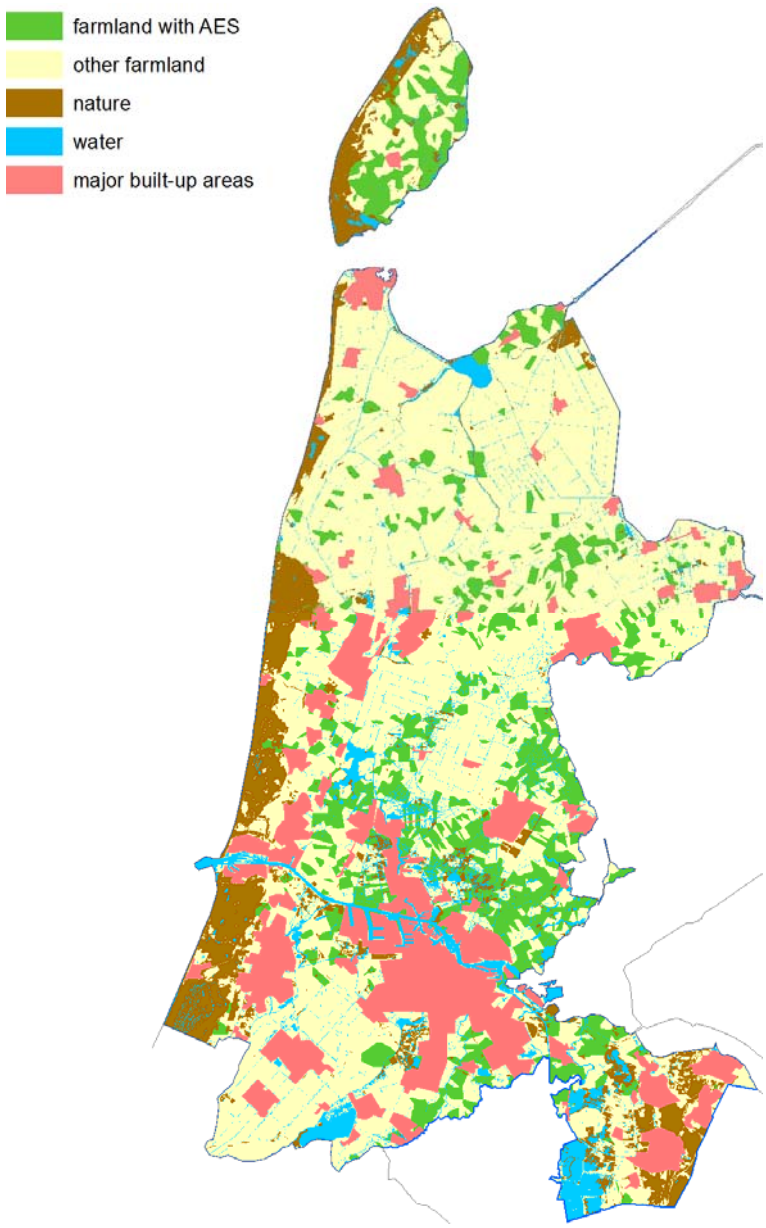

Figure 19. Prevalence of on-farm nature conservation, 2010

Also, but to a lesser extent. The lack of clarity may be due to the fact that we use point locations as input, so in order to rectify this, Thiessen polygons were created.[11] However, although these polygons can produce a very clear map of the spatial distribution of participation (Figure 19), it did not yield a better LISA map.

[11] This ran up against a problem: several farms are sometimes registered at the same address; this turned out to be the case for 267 farms. Duplicates were deleted randomly from the file, meaning 5012 farms were left over for spatial analysis.

Next, we measured spatial autocorrelation with Moran's I. the values found and the associated scatter-plots are presented in Figure 20 and Figure 21 for the two dependent variables. P-values were 0.000 in both cases, but Moran's I itself is very low for the payments variable.

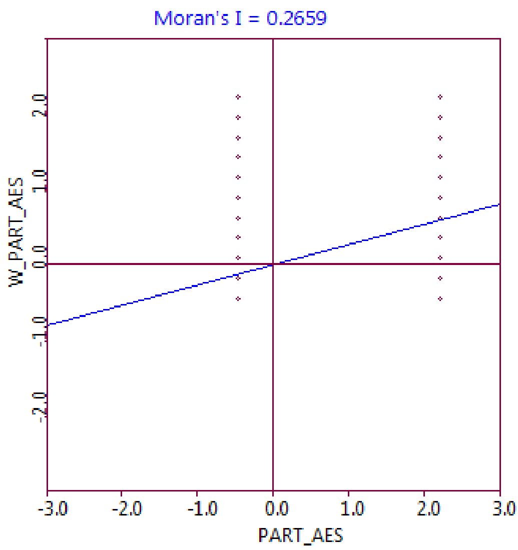

Figure 20. Scatter-plot for spatial autocorrelation of participation in AES

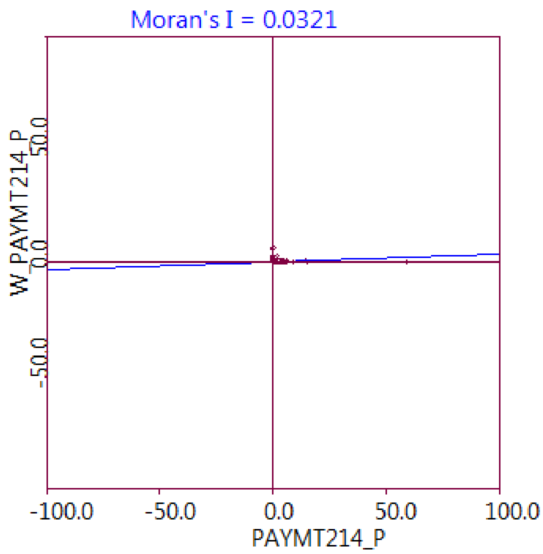

Figure 21. Scatter-plot for spatial autocorrelation in AES payments

Hence, it was decided to run a spatial model only on the participation variable, even though the pattern shown in Figure 20 seems somewhat odd – perhaps because it is a binary variable. The question is whether this should be a spatial lag or a spatial error model. Theoretically, either might apply: farmers may follow the example of their neighbours in participating (spatial lag), or participation may be influenced by spatial characteristics not captured in the variables used in the conventional regression (spatial error). The Lagrange Multiplier analysis gave the following results (Table 28):

Table 28. LM diagnostics for AES participation

(row-standardized weights)

\b TEST		MI/DF	VALUE	PROB \b0
Moran's I (error)		0.149295	25.78299	0
Lagrange Multiplier	(lag)	1	589.483	0
Robust LM (lag)		1	47.88005	0
Lagrange Multiplier	(error)	1	558.5653	0
Robust LM (error)		1	16.9623	3.81E-05
Lagrange Multiplier	(SARMA)	2	606.4453	0

We decided to run a probit model, first without spatially lagged variables (Table 29). Here, as in Table 27, we have used dummy variables for the farm types, and we can see that this is an important determinant of uptake: arable farmers and market gardeners are unlikely to take up nature conservation, whereas in dairy farms the uptake is higher. This time we have also compared uptake of AES with organic farming, and unsurprisingly organic farmers are more likely to engage in AES than conventional farmers. Furthermore, AES farmers are likely to be situated in less favoured areas. The Breusch-Pagan test shows that the variance is heteroskedastic, which makes our regression less reliable.

Table 29. Probit model without spatially lagged variables

Deviance	Residuals:			
Min	1Q	Median	3Q	Max
-4.46	-0.5272	-0.3567	-0.1896	2.9553

Coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	significance
(Intercept)	-1.255000	0.206100	-6.091000	0.000000	***
AGE	-0.001949	0.002258	-0.863000	0.387960	
FARMWORK	-0.071070	0.022050	-3.223000	0.001270	**
UAA	0.001865	0.000803	2.322000	0.020210	*
PERC_OWNED	-0.102000	0.065690	-1.552000	0.120620	
PERC_LFA	0.993800	0.083750	11.866000	0.000000	***
MUN_DENSIT	-0.000004	0.000050	-0.077000	0.938270	
PERC_PASTU	0.007917	0.001511	5.239000	0.000000	***
PERC_AGRIC	0.004843	0.001857	2.608000	0.009100	**
RANK_POTEN	-0.000390	0.016370	-0.024000	0.981000	
PERC_N2K	0.005658	0.001994	2.838000	0.004540	**
ORGANIC	0.436400	0.137900	3.165000	0.001550	**
DAIRY	0.205300	0.073070	2.810000	0.004950	**
ARABLE	-0.381300	0.095500	-3.993000	0.000065	***
OPEN_AIR_H	-0.469300	0.085200	-5.509000	0.000000	***
GREENHOUSE	-0.893900	0.139800	-6.394000	0.000000	***

MIXED FARMING	-0.122400	0.136100	-0.899000	0.368580

(Dispersion parameter for binomial family taken to be 1)

Null deviance:	4437.3	on 4860	degrees of freedom
Residual deviance:	3409.7	on 4844	degrees of freedom
AIC:	3443.7		

Number of Fisher Scoring iterations: 6

studentized Breusch-Pagan test

data: lmprobmod

BP =	697.6729	df = 16	p-value <	2.2E-16

Finally, we ran a spatial probit model, with the variables age, population density and physical farm size as spatially lagged variables. The results are presented in Table 30. The only variable that shows a spatially significant result is, curiously enough, age. Although older farmers are not more likely to participate in this measure than younger ones, areas with relatively old farmers have a slightly higher uptake. This is indeed also true at the municipal level: municipalities with a high average age of farmers have a higher uptake rate, with a Pearson's correlation coefficient of 0.261 and a significance value of 0.044. This is due to the fact that the areas where participation is highest are characterized by grassland on peat soils. In these areas there are many former small dairy farmers who have shifted to less capital-intensive forms of grassland management: keeping sheep or beef cattle. Many of these farmers are old.

Table 30. Probit model with spatially lagged variables

Deviance		Residuals:			
Min		1Q	Median	3Q	Max
	-4.3829	-0.529	-0.3562	-0.1913	3.036

Coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	significance
(Intercept)	-2.044000	0.405500	-5.041000	0.000000	***
AGE	-0.002138	0.002267	-0.943000	0.345590	
FARMWORK	-0.071690	0.022070	-3.248000	0.001160	**
UAA	0.001832	0.000807	2.270000	0.023200	*
PERC_OWNED	-0.102000	0.065780	-1.551000	0.120910	
PERC_LFA	0.976200	0.084310	11.579000	0.000000	***

MUN_DENSIT	-0.000091	0.000075	-1.202000	0.229440	
PERC_PASTU	0.007875	0.001515	5.198000	0.000000	***
PERC_AGRIC	0.005323	0.001904	2.796000	0.005180	**
RANK_POTEN	-0.004466	0.016540	-0.270000	0.787080	
PERC_N2K	0.005428	0.002036	2.666000	0.007670	**
ORGANIC	0.421800	0.138400	3.048000	0.002310	**
DAIRY	0.206900	0.073220	2.826000	0.004710	**
ARABLE	-0.380200	0.096600	-3.936000	0.000083	***
OPEN_AIR_H	-0.443000	0.086240	-5.136000	0.000000	***
GREENHOUSE	-0.865300	0.142100	-6.088000	0.000000	***
MIXED FARMING	-0.114400	0.136400	-0.839000	0.401450	
lag.listw(wknn10, AGE)	0.013240	0.006293	2.104000	0.035360	*
lag.listw(wknn10, UAA)	0.001841	0.001808	1.019000	0.308310	
lag.listw(wknn10, MUN_DENS)	0.000124	0.000084	1.487000	0.137140	

(Dispersion parameter for binomial family taken to be 1)

Null deviance:	4437.3	on 4860	degrees of freedom
Residual deviance:	3402.7	on 4841	degrees of freedom
AIC:	3442.7		

Number of Fisher Scoring iterations: 6

studentized Breusch-Pagan test

data: lmprobmod1

BP=	699.7989	df=	19	p-value <	2.20E-16

4.3. Measure 214 – organic farming

As stated in the introductory part of this chapter, in this section we analyze the factors that contribute to the propensity of farmers to go organic. We do not use for this the figures in Table 14, which include the 60 farmers receiving support under measure 214, but the total number of 125 registered organic farmers as enumerated in Table 5. Not only do we have a larger number in this way, but we also know who these farmers are, so we can link them to the Farm Structure Survey database.

Table 31. Correlation analysis: organic farming (farm level)

		perc_organic		
		Pearson's r	Kendall's tau_b	Spearman's rho
Total_SO	Pearson Correlation	-.014	.003	.004
	Sig. (2-tailed)	.332	.779	.779
	N	5017	5017	5017
UAA	Pearson Correlation	.054**	.046**	.056**
	Sig. (2-tailed)	.000	.000	.000
	N	5017	5017	5017
Age	Pearson Correlation	-.027	-.022	-.026
	Sig. (2-tailed)	.058	.065	.065
	N	5017	5017	5017
Farmwork	Pearson Correlation	-.039**	-.034**	-.037**
	Sig. (2-tailed)	.006	.010	.010
	N	5017	5017	5017
perc_owned	Pearson Correlation	-.020	-.019	-.023
	Sig. (2-tailed)	.176	.130	.130
	N	4408	4408	4408
perc_LFA	Pearson Correlation	.118**	.099**	.105**
	Sig. (2-tailed)	.000	.000	.000
	N	4399	4399	4399
organic	Pearson Correlation	1	1.000	1.000
	Sig. (2-tailed)		.	.
	N	5017	5017	5017

Generally, the relationships between the explanatory and the dependent variables appear to be weak: larger farms (in area) are a little more likely to engage in organic farming, and also organic farmers have a slight tendency to be full-time farmers (which in any case seems rather obvious). The strongest relationship is that organic farmers are more often found in less favoured areas, but even this correlation is not strong.

Turning to the correlations at municipal level (Table 32), it appears that organic farming is more common in large municipalities – large in population terms, that is; and also in areas with low agricultural potential. This last result is curious, the more so as it is not matched by a correlation in the ranked variable for potential – which in our opinion is the more reliable one. We shall regard this correlation as coincidental – its p-value is only just below 0.05. As for the relation with population size, this is due to the high proportion of organic farmers in the rural part of Amsterdam; very probably this is due to the presence of a large niche market for organic products, and local products are particularly popular in this niche market. Among the non-parametric correlations, there is a significant relationship with the percentage of agricultural land. Figure 22 shows that there is indeed such a positive relation, if we disregard a few outliers with little agricultural land but many organic farmers; the most prominent among these outliers is, again, the city of Amsterdam which, as explained, has a high proportion of organic farms for a different reason.[12]

Table 32. Correlation analysis: organic farming (municipal level)

		perc_organic		
		Pearson's r	Kendall's tau_b	Spearman's rho
area	Correlation Coefficient	.095	.078	.105
	Sig. (2-tailed)	.470	.402	.424
	N	60	60	60
popul	Correlation Coefficient	.276*	-.188*	-.266*
	Sig. (2-tailed)	.033	.042	.040
	N	60	60	60
density	Correlation Coefficient	-.071	-.168	-.250
	Sig. (2-tailed)	.590	.071	.054
	N	60	60	60
avg_income	Correlation Coefficient	-.097	.070	.082
	Sig. (2-tailed)	.461	.468	.535
	N	60	60	60
perc_nature	Correlation Coefficient	-.002	-.082	-.105
	Sig. (2-tailed)	.988	.380	.424
	N	60	60	60
water	Correlation Coefficient	-.105	-.090	-.105
	Sig. (2-tailed)	.425	.422	.427
	N	60	60	60

[12] The other outlier is a town with only one organic farm, out of a total of 8 farms.

perc_agric	Correlation Coefficient	.174	.236*	.352**
	Sig. (2-tailed)	.183	.011	.006
	N	60	60	60
agric_potential	Correlation Coefficient	-.255*	-.330**	-.420**
	Sig. (2-tailed)	.049	.000	.001
	N	60	60	60
rank_potential	Correlation Coefficient	.133	.045	.053
	Sig. (2-tailed)	.310	.652	.688
	N	60	60	60
perc_N2k	Correlation Coefficient	.078	.140	.192
	Sig. (2-tailed)	.555	.168	.141
	N	60	60	60
perc_EHS	Correlation Coefficient	.067	.071	.085
	Sig. (2-tailed)	.612	.447	.520
	N	60	60	60
perc_partic	Correlation Coefficient	1	1.000	1.000
	Sig. (2-tailed)		.	.
	N	60	60	60

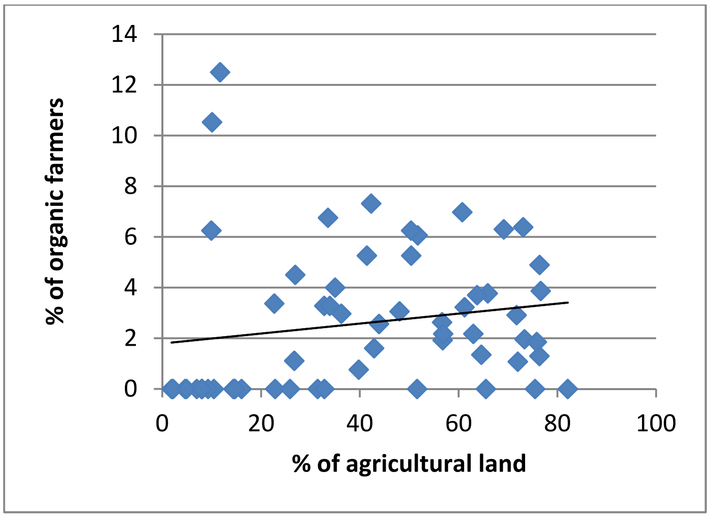

Figure 22. Relationship between percentage of organic farmers and percentage of agricultural land

In conclusion, we are left with a rather meagre set of correlations for this part of the programme. All we can say is that organic farms are a little larger in area (not in economic size) than conventional ones; that organic farmers are slightly more likely to be full-time rather than part-time farmers; that the proximity of a large city may be an advantage to organic farmers; and that strongly agrarian areas also tend to have a slightly higher proportion of organic farms – other things being equal. We may add to that what we observed when interpreting Table 5 with respect to the distribution of organic farms among farm types. It does not appear worthwhile to carry out a regression analysis, however. Nor is there an obvious spatial pattern in the location of organic farms, as Figure 23 illustrates.

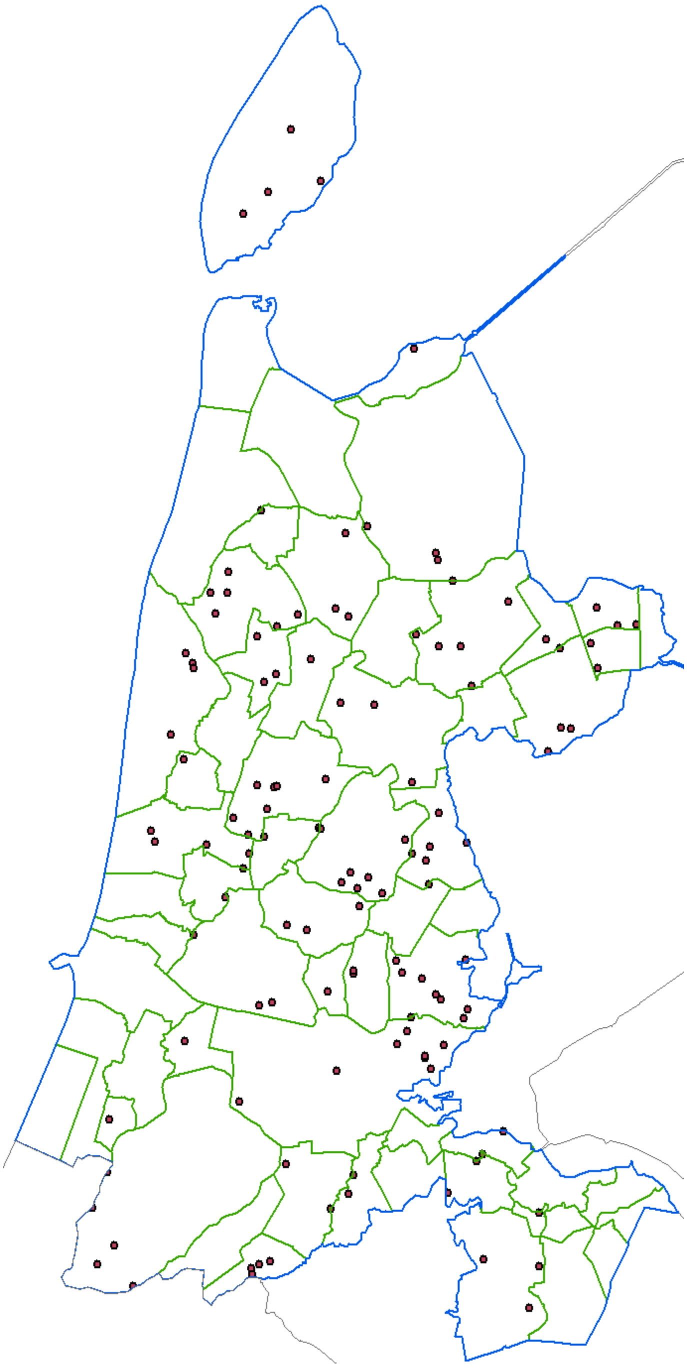

Figure 23. Organic farming in Noord-Holland

4.4. Measure 311 – diversification of the farm economy

This measure we have analyzed in the same way as measure 121, except that in this case we have included the general characteristics PERC_NATURE and WATER, since these are likely to influence the number of agrotourism activities. As we saw in section 3.3, all projects except one are related to either agrotourism or social care, but as the number of projects is quite small we have refrained from making separate analyses for the different types of multifunctional activities.

Table 33. Correlation analysis: uptake of measure 311

		perc_partic		
		Pearson's r	Kendall's tau_b	Spearman's rho
area	Correlation Coefficient	.113	.217*	.288*
	Sig. (2-tailed)	.391	.033	.026
	N	60	60	60
popul	Correlation Coefficient	.245	-.064	-.077
	Sig. (2-tailed)	.059	.529	.557
	N	60	60	60
density	Correlation Coefficient	-.021	-.155	-.191
	Sig. (2-tailed)	.871	.127	.143
	N	60	60	60
avg_income	Correlation Coefficient	-.002	.090	.100
	Sig. (2-tailed)	.991	.394	.449
	N	60	60	60
perc_nature	Correlation Coefficient	.258*	-.036	-.059
	Sig. (2-tailed)	.046	.723	.657
	N	60	60	60
water	Correlation Coefficient	.123	.104	.109
	Sig. (2-tailed)	.348	.400	.405
	N	60	60	60
perc_agric	Correlation Coefficient	.194	.252*	.328*
	Sig. (2-tailed)	.138	.013	.011
	N	60	60	60
agric_potential	Correlation Coefficient	-.177	-.157	-.183
	Sig. (2-tailed)	.177	.122	.161
	N	60	60	60
rank_potential	Correlation Coefficient	.207	.013	.008
	Sig. (2-tailed)	.113	.908	.954
	N	60	60	60
perc_LFA	Correlation Coefficient	-.069	-.051	-.061
	Sig. (2-tailed)	.600	.633	.646

	N	60	60	60
perc_N2k	Correlation Coefficient	-.001	-.012	-.012
	Sig. (2-tailed)	.996	.916	.930
	N	60	60	60
perc_EHS	Correlation Coefficient	-.151	-.155	-.204
	Sig. (2-tailed)	.250	.129	.119
	N	60	60	60
farms	Correlation Coefficient	.104	.312**	.447**
	Sig. (2-tailed)	.430	.002	.000
	N	60	60	60
total_nge	Correlation Coefficient	.003	.255*	.353**
	Sig. (2-tailed)	.982	.012	.006
	N	60	60	60
total_area	Correlation Coefficient	.042	.273**	.376**
	Sig. (2-tailed)	.749	.007	.003
	N	60	60	60
avg_nge	Correlation Coefficient	-.055	.017	.021
	Sig. (2-tailed)	.677	.870	.874
	N	60	60	60
avg_area	Correlation Coefficient	-.043	-.046	-.060
	Sig. (2-tailed)	.743	.654	.647
	N	60	60	60
age	Correlation Coefficient	-.311*	-.368**	-.461**
	Sig. (2-tailed)	.016	.000	.000
	N	60	60	60
perc_dairy	Correlation Coefficient	.146	.040	.041
	Sig. (2-tailed)	.266	.691	.755
	N	60	60	60
perc_othpast	Correlation Coefficient	.126	-.012	.000
	Sig. (2-tailed)	.337	.904	.998
	N	60	60	60
perc_allpast	Correlation Coefficient	.168	-.008	-.009
	Sig. (2-tailed)	.201	.938	.948
	N	60	60	60

perc_arable	Correlation Coefficient	-.102	.065	.080
	Sig. (2-tailed)	.439	.532	.545
	N	60	60	60
perc_greenh	Correlation Coefficient	.081	.150	.186
	Sig. (2-tailed)	.536	.161	.154
	N	60	60	60
perc_othhort	Correlation Coefficient	-.222	-.108	-.136
	Sig. (2-tailed)	.088	.298	.298
	N	60	60	60
perc_allhort	Correlation Coefficient	-.134	-.025	-.030
	Sig. (2-tailed)	.307	.808	.820
	N	60	60	60
lab_prod	Correlation Coefficient	-.083	.064	.090
	Sig. (2-tailed)	.530	.529	.496
	N	60	60	60
perc_partic	Correlation Coefficient	1	1.000	1.000
	Sig. (2-tailed)		.	.
	N	60	60	60

As might have been expected with so few observations, only a few of the explanatory variables show any significant relationship to the dependent: the percentage of forest and natural land (barely significant), and the average age of farmers: even though the spread of this latter variable between municipalities is slight, apparently older farmers are less likely to invest in diversification than younger ones – perhaps not surprisingly. We would hardly expect these two variables (age and nature areas) to be correlated, and indeed they are not: Pearson's correlation coefficient measures 0.092, with a two-tailed significance of 0.484.

There are a few other variables with significant scores on non-parametric correlations, suggesting there may be a non-linear relationship. This is the case for area, the percentage of agricultural land, and the variables related to the number of farms and their size. Since the average size of farms is not a significant variable, we must deduce that the effect of these variables is due to the number of farms alone, which shows the strongest score.

The scatter-plots (Figure 24, Figure 25 and Figure 26) do not make it any easier to interpret these relationships. If we exclude the large number of municipalities without any projects under this measure, there would appear to be a negative non-linear correlation between uptake on the one hand and both the size of the municipality and the number of farms. In the case of the proportion of agricultural land, the correlation seems to be mainly due to a few outliers.

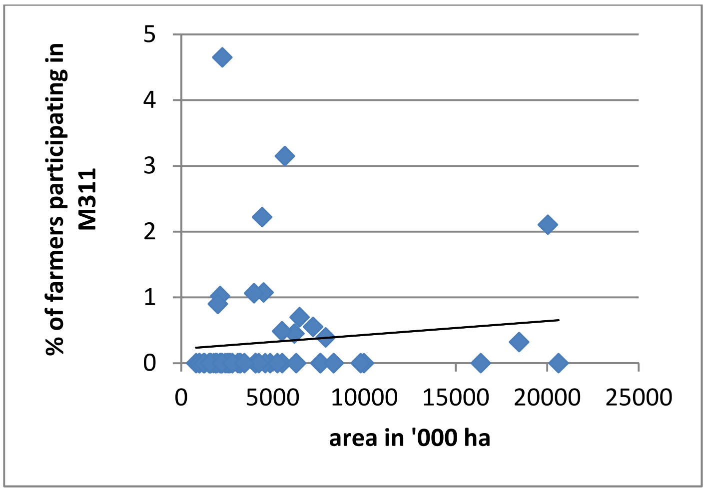

Figure 24. Relationship between physical size of municipality and uptake of M311

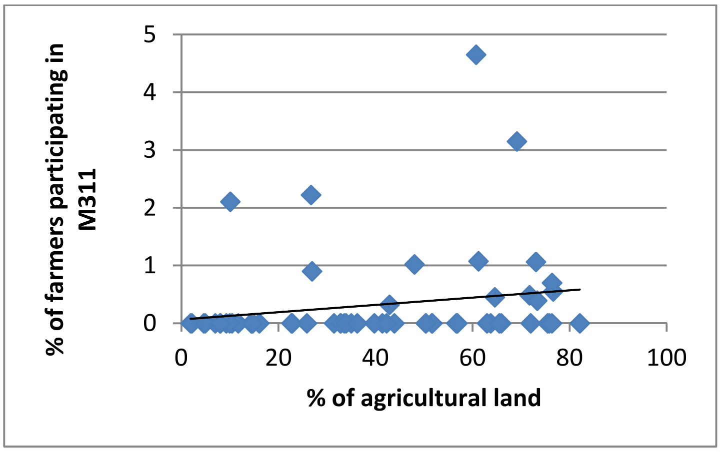

Figure 25. Relationship between % of municipality under agriculture and uptake of M311

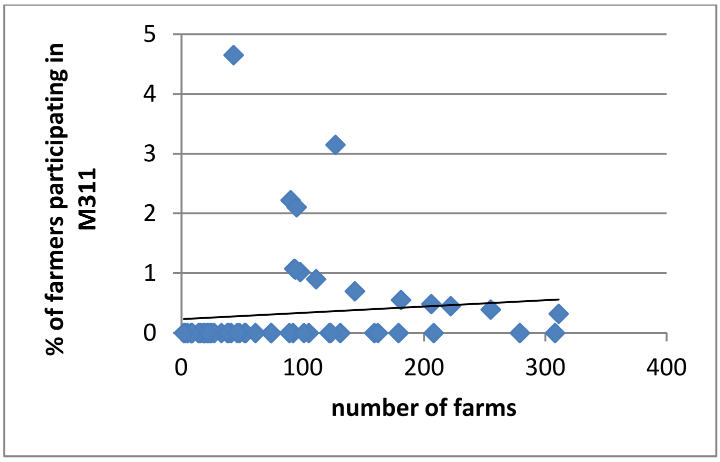

Figure 26. Relationship between number of farms and uptake of M311

5. Impact analysis

This chapter describes our attempts to assess the impact of the selected measures 125, 214 and 313. For each of these measures we identify indicators through which such impacts can be measured, in accordance with the objectives of the respective axis.

5.1. Measure 125 – agricultural infrastructure

The objective of Axis 1 is to improve the competitiveness of the agricultural sector (European Council 2005). A suitable indicator of competitiveness would be labour productivity. Agricultural labour productivity is stated as an objective-oriented baseline indicator in the CMEF (European Commission 2006). The problem is that this quantity is known only from the Farm Accountancy Data Network (FADN), which is based on sample data. It can be estimated at the level of NUTS2 regions, but not below. However, we can construct a proxy indicator with data from the Farm Structure Survey (FSS), which in the Netherlands are collected annually. In statistics, a proxy variable is something that may not in itself be of any great interest, but from which has a close correlation (not necessarily linear or positive) to the variable of interest (Toutenburg & Trenkler 1992).

Labour productivity is the relationship between production (in terms of gross value added) and labour input. The FSS provides data for labour input, in the shape of full-time equivalent person-years (FTEPY). As a proxy for value added we use the standard output per farm (SO), which is stated in euros. We have calculated these quantities for 2006 and 2011. Our formula for this indicator therefore becomes:

$$\boldsymbol{Y_i} = \frac{\boldsymbol{SO_i^{2011}} / \boldsymbol{FTEPY_i^{2011}}}{\boldsymbol{SO_i^{2006}} / \boldsymbol{FTEPY_i^{2006}}} \qquad (2)$$

In which Y_i is the proxy indicator for change in agricultural labour productivity between 2006 and 2011 in municipality *i*, expressed as a percentage.

Unfortunately, as we saw in Table 12, only 4 out of 15 projects under measure 125 had actually been at least partially implemented by 2011, covering 5 municipalities. Details of these projects are shown in Table 34. A correlation analysis with so few observations would not make sense, however we have examined the values for equation 2 for the five municipalities concerned, and compared them with those for the province as a whole. The results are shown in Table 35.

Table 34. Projects under implementation for measure 125, 2007-2011

Name of project	*Municipality*	*Total budget (in euros)*	*Total realized*	*In percentage*
Exchange of parcels "De Oude Gouw"	Koggenland	167,472	37,335	22%
Improvement and strengthening of the agricultural structure on Texel	Texel	240,000	68,678	29%
Management and redesign Ilperveld	Landsmeer	75,477	37,738	50%
Improvement agricultural structure Noordelijke Vechtstreek	Muiden, Weesp	648,106	79,555	12%
Total		**1,131,055**	**223,306**	**20%**

Table 35. Change in agricultural labour productivity 2006-2011

	Average standard output per person-year			
Municipality	*2006*	*2011*	*Absolute difference*	*Relative difference*
Koggenland	91,707	98,886	7,180	7.8%
Texel	87,782	86,612	-1,170	-1.3%
Landsmeer	64,776	21,040	-13,736	-21.2%
Muiden	58,974	73,774	14,800	25.1%
Weesp	55,062	69,439	14,377	26.1%
Noord-Holland	**93,268**	**89,613**	**-3,655**	**-3.9%**

Curiously, agricultural labour productivity seems to have declined across the board in the province as a whole. Further research reveals that this is indeed the case: not for the Netherlands as a whole (it rose by 7.7% on average), but for this province as well as Zuid-Holland. The reason lies in the vicissitudes of the various subsectors: the total value of flower production (flower bulbs as well as cut flowers and potted plants) experienced a significant decline in recent years due to low prices. These crops represent 17% and 19% in Noord- and Zuid-Holland respectively, but only 1-6% in all other provinces. There has been no decline in production volume, but only in total value.

Looking now at the values for the municipalities under consideration, we see that three out of the five where projects under measure 125 were being implemented experienced an increase in labour productivity. One municipality (Texel, where as it happens flower-bulbs are important) saw a modest decline – less than the provincial average; and one (Landsmeer) saw a significant decline. However, it must be pointed out that the particular project under implementation there is concerned with the creation of a new nature area, rather than promoting agricultural competitive-ness.

In conclusion, we cannot prove that measure 125 has a positive effect on labour productivity, but the limited data at least do not belie that possibility.

5.2. Measure 214 – nature conservation

This section deals with measure 214, which concerns improving the environment and the countryside. Measure 214 consists of agri-environmental schemes (AES). These are contracts between farmers and the governing authority, in which farmers commit themselves to adopt environmentally friendly farming practices that go beyond usual good agricultural practice. In return they receive payments that compensate for additional costs and loss of income that arise as a result of altered farming practices (European Commission 2005). AES are a mandatory component of the RDPs. Most AES aim at taking action rather than achieving environmental results (Uthes et al. 2011).

5.2.1. The indicator

The impact of agri-environmental schemes on the natural environment can be measured in several ways. For the present case study we have considered two:

- Changes in the population of relevant species. A popular one is farmland birds, which, as we saw above (section 3.3) is the one on which the AES in Noord-Holland is focused. More specifically, a large part of the effort is directed towards species living on grassland. In the Netherlands, 14 species of these meadow-birds are recognized as of high importance, and one could measure the changes in their population.
- Changes in the qualification of agricultural land as high-nature value (HNV) farmland. In the definition given by Andersen et al. (2003), HNV farmland is described as: 'those areas in Europe where agriculture is a major (usually the dominant) land use and where that agriculture supports or is associated with either a high species and habitat diversity or the presence of species of European conservation concern or both'. In this definition, one can characterize HNV as a quality that farmland either has or has not. However, one can also give any piece of farmland an HNV score – high or low as the case may be. This is the approach we follow.

For the first indicator, data are collected regularly by the Stichting Vogelonderzoek Nederland (SOVON, a private nature organization) and by the province. They use a network of 73 enumeration plots (in Noord-Holland) where bird populations are counted annually; these plots cover a total of 4,200 hectares (Kenniscentrum Weidevogels 2012). As an indicator, we could use the numbers of each of the 14 aforementioned species, weighed by their perceived ecological value so as to arrive at a single figure expressing the ornithological quality of the enumeration plot. Since the meadow-bird protection schemes have been designed primarily with one species in mind, the black-tailed godwit (*Limosa limosa*), we might add an indicator for the population of this species alone.

The problem would be how to infer scores on these indicators per municipality from the scores per eumeration plot. Although there are more plots than municipalities, not all municipalities have such plots – they are distributed accorded to the prevalence of grassland. It would be preferable to extrapolate the measurements from the plots to all other lands in the province on the basis of mapped characteristics of the land. After thus having constructed a prediction map of meadow-bird populations, this map could be compared with the spatial distribution of AES, or it could be aggregated to municipal level. As it happens, SOVON has developed a model for such a prediction map. Unfortunately, budgetary and time constraints led the team to drop this option. All we can say is that the data for this indicator are not readily available, and that obtaining them would be costly.

This leaves the HNV indicator, which can be considered a proxy for biodiversity in agricultural areas (or for forestry, as the case may be). Areas with a favourable HNV score are characterized by extensive farming practices, associated with a high species and habitat diversity or the presence of species of European conservation interest (Paracchini, 2006). Among other factors, the type of agriculture is relevant for biodiversity (Paracchini and Britz, 2010). Arable land is not generally considered as the main source of biodiversity in agricultural land, especially when compared to semi-natural grasslands or traditional orchards. Nevertheless there are conditions under which arable land provides relevant habitats for biodiversity and can be classified as being of high nature value. Such conditions are linked to a few characteristics identified by several authors (European Commission 2009; EEA 2004): low intensity of management, presence of semi-natural vegetation and crop diversity.

Semi-natural grasslands are well known as biodiversity hotspots, they are among the most species-rich habitats (Pykälä, 2007) and for this reason they have been identified as a primary component of High Nature Value farmland (Andersen et al., 2003; Beaufoy et al., 1994). Permanent crops are associated to a high nature value when they are traditionally managed. This is normally linked to the presence of old trees, permanent vegetation cover of the floor, and no or very low input of pesticides and fertilizers. Vineyards and olive groves can be associated to arable crops or grasslands; the floor of traditional orchards is likely to be constituted by grassland (mown, grazed, or both).

An increase in the score of HNV farmland stands for an improvement of environmental quality. According to the European Commission (2009), the three key characteristics of HNV farmland are:

- Low-intensity farming characteristics (livestock/ha; nitrogen/ha; biocides/ha)
- High proportion of semi-natural vegetation (grass, trees, shrubs, water bodies, field margins)
- High diversity of land cover (crops, fallows, shrubs, grass, features).

Essentially, low-intensity farming, high crop diversity and a high proportion of semi-natural vegetation are regarded as biodiversity-friendly farming practices. These practices promote the maintenance and improvement of HNV farmland. We use the following indices to compose an HNV farmland indicator:

1. Crop diversity index
2. Management intensity index
3. Ruminant stocking density index

In addition to these three, the presence of semi-natural vegetation is acknowledged (Billeter et al. 2008; Duelli & Obrist 2003) as probably the most important factor explaining species richness across different taxonomic groups on agricultural land. The presence of a network of natural and semi-natural vegetation (i.e. field margins, hedges, edges, woodlots, ditches etc.) leads to the creation of multiple habitats hosting a great variety of species. Unfortunately, too little information is available to develop an index for the presence of semi-natural vegetation in Noord-Holland. Consequently, no index for the presence of semi-natural vegetation is included in the HNV farmland indicator.

Ad 1. Crop diversity index

Crop diversity per se cannot be directly linked with management intensity (Herzog et al. 2006), but is rather associated with low inputs and a network of natural/semi-natural features. As such it constitutes one of the categories of HNV farmland (Andersen et al. 2003; Paracchini et al. 2008). Crop diversity contributes to the HNV indicator with the assumption that the richer the crop composition and the more equal the shares, the better for biodiversity. We applied a Shannon index to measure changes in crop diversity and evenness in crop distribution (Paracchini and Britz, 2010). To calculate the index, we used crop data for 80 different crops from the Farm Structure Survey (FSS).

The Shannon crop diversity index (CDI) returns values within the 0 to 1 range. It will return a value of 1 if all crops have the same acreage (and share), and 0 in case of only one crop. The formula is based on Paracchini & Britz (2007):

$$CDI = \min\,[1, -\textstyle\sum_{n=1}^{n=N}(S_n * log_{10}\, S_n) \qquad (3)$$

CDI = Crop diversity index

S = share of crop (n=1,…, N)

N = number of crops distinguished

Ad 2. Management intensity index

To measure management intensity for arable and permanent crops, we use the sum of manure and mineral nitrogen applied per hectare (data collected from the MAMBO model[13]). As suggested by Paracchini and Britz (2007), we use the following function:

$$MII = 2.25 - 0.97 * log_{10}(NS) \qquad (4)$$

[13] MAMBO is a model developed by LEI for estimating nutrient flows from agricultural land on the basis of farm data (Woltjer et al. 2011). It is calibrated by a network of measurement sites.

MII = Management intensity index

NS = Nitrogen surplus

The function assumes full benefits from high crop diversity under management practices generating a nitrogen surplus of 20 kg/ha or less. Such low surpluses are feasible only under very moderate fertilizing practices, with low yield expectations, and are typically coupled with low-input or extensive farming system, especially regarding plant protection. Under a surplus of 40 kg, 2/3 is assumed as the multiplier for the crop diversity effect, 1/6 at 150 kg and zero for 200 kg or above. The result is bounded to the 0 to 1 range (Paracchini & Britz 2007).

Ad 3. Stocking density index

Stocking density is used as a proxy for management intensity on grassland. We calculate this index by converting the different types of ruminants (cattle, sheep and goats) from the FSS database to livestock units, and then relating the resulting livestock unit sum to the grassland area. Next, we converted the ruminant stocking density into a Stocking Density Index (SDI), that produces values within a 0 to 1 range. The formula implies that a stocking density below 0.25 returns a SDI of 1 and a stocking density over 1.78 returns 0 (Paracchini & Britz 2007).

$$SDI = 1.6 - 1.2 * \sqrt{SD} \tag{5}$$

SDI = Stocking density index

SD = Stocking density = LSU / ha grassland

The composite High Nature Value farmland indicator

The High Nature Value farmland indicator is computed based on the stocking density index (SDI), the management intensity index (MII) and the crop diversity index (CDI). Since the SDI relates to management intensity on grassland, this index is multiplied by the share of grassland in the total agricultural area. Likewise, the geometric mean of the CDI and MII is multiplied by the share of crops in the total agricultural area (cf. Paracchini & Britz 2010):

$$HNV = SDI * \frac{GA}{TA} + \sqrt{CDI * MII} * \frac{CA}{TA} \tag{6}$$

HNV = High Nature Value farmland indicator

SDI = Stocking density index

CDI = Crop diversity index

MII = Management intensity index

GA = Grassland area

CA = Crop area

TA = Total agricultural area = GA + CA

This indicator can be calculated for each farm in Noord-Holland. However, our dependent variable is not HNV as such, but the change over a certain period – in this case, between 2006 and 2010. A difficulty with this is that the datasets for the two years are not entirely comparable, as some farms cease to exist while others change their registration numbers. Hence, we have opted for the municipality as our unit of analysis. Even this presents some problem, because changes in municipal territories take place continuously. Fortunately, that problem can be solved because we have maps of the location of all farms since 2001, so we can locate the farms of the year 2006 in the municipalities of the year 2010 – thus making the two datasets comparable. Figure 27 shows the scores in the year 2010.

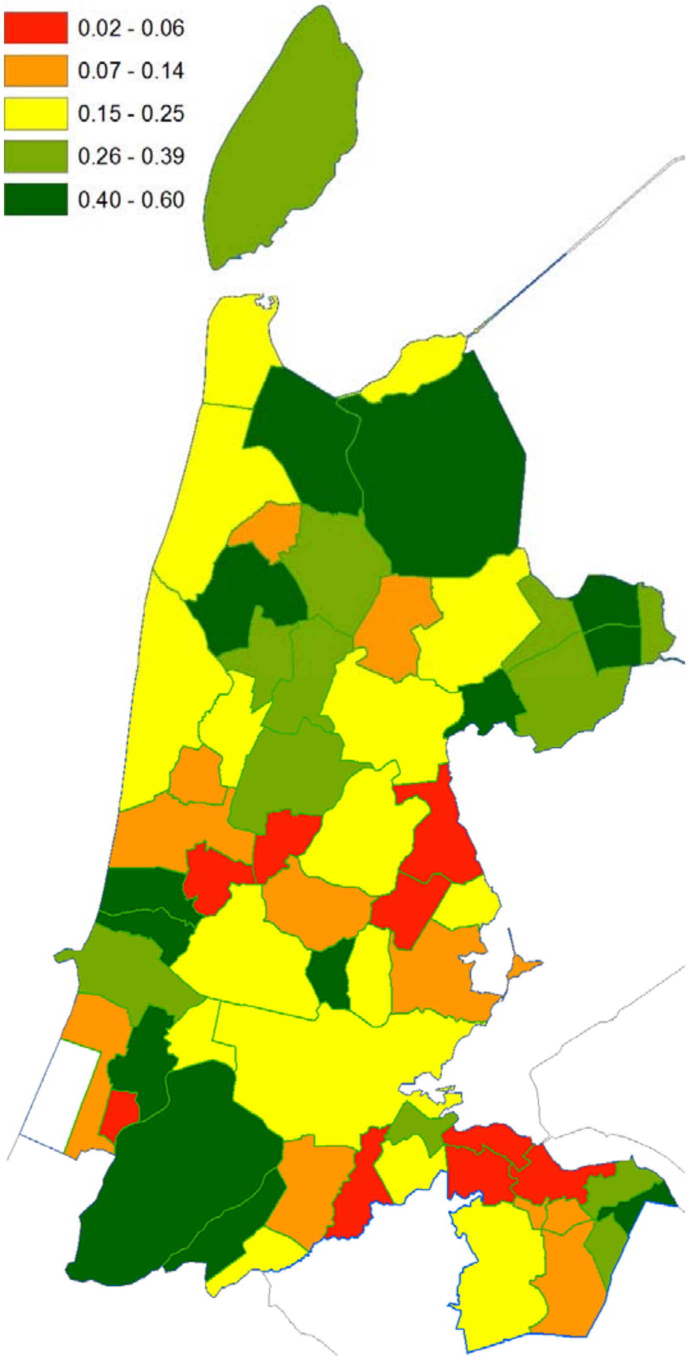

Figure 27. HNV index by municipality, 2010

Following this approach, we calculated the change of HNV farmland in Noord-Holland in the period 2006 – 2010:

$$\Delta\, HNV = HNV_{2010} - HNV_{2006} \qquad (7)$$

Δ HNV	=	change in High Nature Value farmland
HNV_{2006}	=	HNV farmland indicator for 2006
HNV_{2010}	=	HNV farmland indicator for 2010

Similarly, we calculated the change of other indices Δ SDI, Δ CDI and Δ MII.

5.2.2. Analysis

We now have our dependent variable. As independent variable, it would not make much sense to use expenditure under measure 214: since this only took off in 2008, it would be unrealistic to expect any effect on HNV by 2010. Therefore, in order to assess whether on-farm nature conservation has an impact on HNV scores, we opted for expenditure under RDP-1 as our independent variable. Although there was no measure 214, there were similar agri-environment schemes, and we were fortunate to lay our hands on detailed farm-level data concerning participation. These data allowed us to determine the number of hectares under AES in 2006, which we take as a proxy for the 2000-2006 programme period. We do not, however, have payment details for these schemes, as we have them for RDP-2. As we work at municipal level, we decided to weigh the AES hectares to the total utilized agricultural area (UAA) within the municipality. Our independent variable then becomes:

$$X_i = \frac{Ha\_AES_i}{Ha\_UAA_i} \qquad (8)$$

Where X_i is the value of the independent variable for municipality i;

Ha_AES is the number of hectares under EU-supported agri-environmental schemes in 2006;

And Ha_UAA is the total area in agricultural use, in hectares.

Thus, we need to correlate the change of the HNV in the period 2006 – 2010 to the variable 'AES as percentage of UAA' in 2006. This is done in Table 36, for the composite HNV index as well as for its components.

Table 36. Correlation analysis: HNV change 2006-2010 and AES as percentage of UAA, 2006

		AES as percentage of UAA, 2006		
		Pearson's r	Kendall's tau_b	Spearman's rho
Δ HNV	Correlation coefficient	0.063	0.122	0.186
	Sig. (2-tailed)	0.637	0.173	0.158
	N	59	59	59

Δ SDI	Correlation coefficient	-0.188	-0.232*	-0.330*
	Sig. (2-tailed)	0.154	0.012	0.011
	N	59	59	59
Δ CDI	Correlation coefficient	-0.049	0.085	0.127
	Sig. (2-tailed)	0.727	0.373	0.365
	N	53	53	53
Δ MII	Correlation coefficient	0.314*	0.269**	0.385**
	Sig. (2-tailed)	0.015	0.003	0.003
	N	59	59	59

Neither the Pearson correlation coefficient, nor the non-parametric coefficients Kendall's tau and Spearman's rho turn out to be significant. The only significant correlation according to Pearson is the relationship between the independent variable and the change in the management intensity index (MII); even this correlation is moderate at best. The same is true for the non-parametric correlations of AES as percentage of UAA with Δ MII (weak/moderate, positive relationship) and Δ SDI (weak/moderate, negative relationship).

To test these relationships further, we applied regression analysis, with Δ HNV as dependent variable and AES as percentage of UAA as independent variable. Table 37 and Figure 28 present the results.

Table 37. Linear regression: effect of AES as percentage of UAA on change in HNV

Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.063	0.004	-0.014	0.13423

The independent variable is AES as percentage of UAA.

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.004	1	0.004	0.225	0.637
Residual	1.027	57	0.018		
Total	1.031	58			

The independent variable is AES as percentage of UAA.

Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.042	0.023		-1.822	0.074
AES as percentage of UAA	0.036	0.076	0.063	0.475	0.637

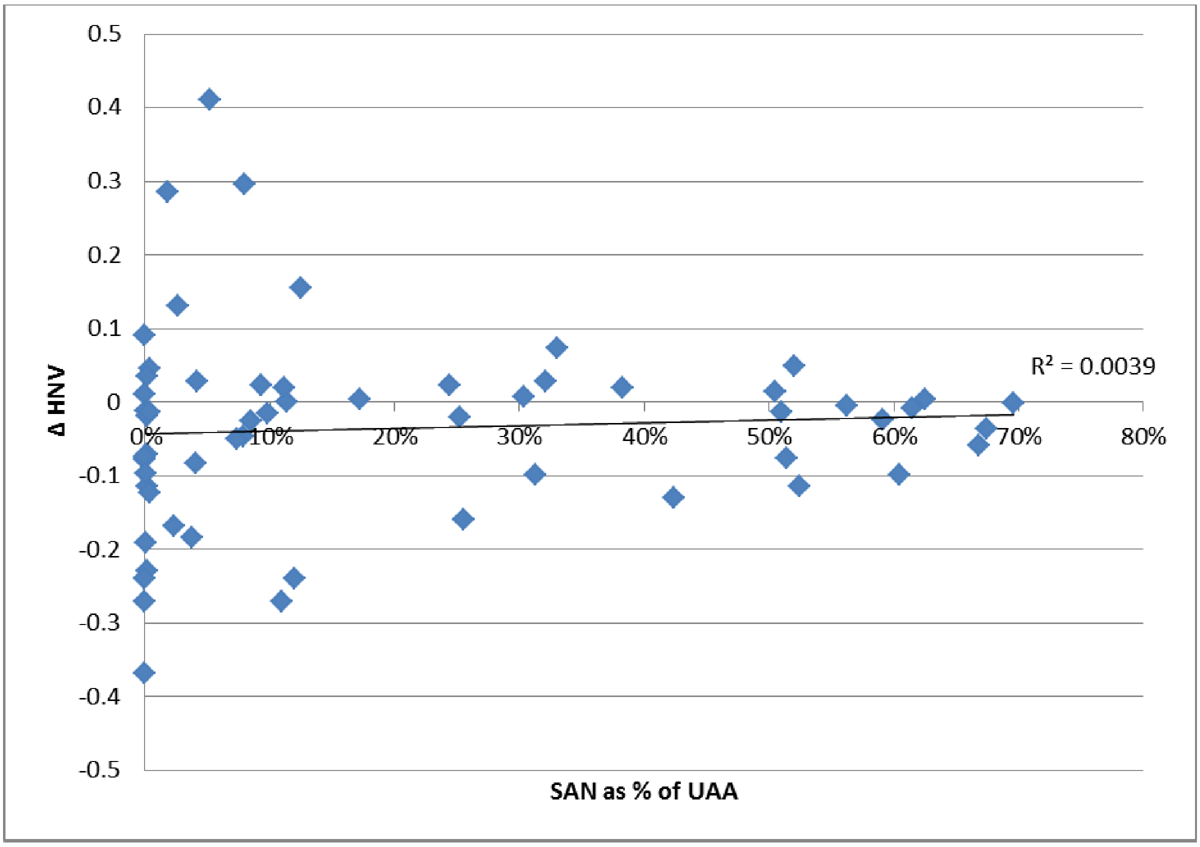

Figure 28. effect of AES as percentage of UAA on change in HNV (linear)

We must conclude that there is no evidence of any significant effect of agri-environment efforts on the nature value of farmland in general. The only aspect of this nature value where AES does have an impact – and a positive one – is on the nutrient load.

5.3. Measure 313 – promotion of tourism

The objective of measure 313 is to promote tourism to rural areas. Noord-Holland is by far the largest host of tourists in the country, with 9.4 million overnight visitors in 2011 (the next largest host province being Zuid-Holland, with 3.6 million). This is primarily due to the attraction of Amsterdam and its international airport, rather than the rural areas of the province, as Table 38 makes clear. Even without Amsterdam, however, the province is still a very important destination, partly due to the beach resorts on the coast.

From the table we also see that tourism nights in the province (outside Amsterdam) have declined in recent years. The province as a whole does show growth above the national average, not only in tourism nights but also in bed capacity and employment. In number of jobs, the tourism sector is of similar importance to agriculture.

Table 38. The tourist economy in Noord-Holland and the Netherlands

region	2006	2010	growth
	tourist nights ('000)		
Netherlands	83,943	84,873	1.1%
Groningen	1,402	1,183	-15.6%
Friesland	4,625	4,749	2.7%
Drenthe	5,666	5,724	1.0%
Overijssel	5,062	5,252	3.8%
Flevoland	1,669	1,622	-2.8%
Gelderland	9,440	9,501	0.6%
Utrecht	2,407	2,185	-9.2%
Noord-Holland	19,195	20,197	5.2%
Noord-Holland excl. Amsterdam	10,608	10,474	-1.3%
Zuid-Holland	7,942	8,213	3.4%
Zeeland	8,183	8,034	-1.8%
Noord-Brabant	8,217	8,774	6.8%
Limburg	10,136	9,438	-6.9%
coast (all coastal provinces)	18,970	19,092	0.6%
	number of beds/sleeping places		
Noord-Holland	164,788	168,631	2.3%
Netherlands	1,186,280	1,200,887	1.2%
	employment in tourism		
Noord-Holland	98,336	107,240	9.1%
as % of total	1.4%	1.4%	

Sources: Central Bureau of Statistics (http://statline.cbs.nl/StatWeb/dome/?LA=NL) , Province of Noord-Holland (http://www.noord-holland.nl/web/Over-de-provincie/NoordHolland-in-Cijfers.htm)

The CMEF mentions several indicators which are relevant here: employment development of the non-agricultural sector; economic development of the non-agricultural sector (which may be expressed as value added); development of the services sector (which is part of the previous one); and tourism infrastructure in rural areas (expressed as the number of bed-places). All of these are in the category of objective-oriented baseline indicators. Also, all of them are related to gainful economic activities.

However, an objective of Axis 3 is also the improvement of the quality of life in rural areas, and this means that the improvement of leisure facilities for both visitors (from outside the province or from urban areas within it) and for local residents would meet this objective. Other possible indicators, therefore, are the number of visitors, the number of nights spent, and the number of day-trips made.

Once again, the difficulty is obtaining the necessary data for these indicators. Tourist nights spent or number of tourists spending nights would be useful, but these figures are not made available at municipal level by the Central Bureau of Statistics. Those municipalities which raise a tourist tax naturally do collect figures on nights spent, but only 46 out of 60 municipalities have a tourist tax, and we considered it not worthwhile to go through the time and expense of collecting incomplete data from 46 different agencies – which undoubtedly have these data in different formats. There exists also a dataset on leisure activities of Dutch citizens, which is collected regularly through a fairly large sample survey (350 respondents weekly, 5,000 annually). It contains data on day trips to recreation areas, hiking and cycling activities – precisely the sorts of activities at which the projects under M313 are aimed. Unfortunately, the most detailed spatial level at which the data are available is for 7 sub-regions of the province – too coarse for quantitative analysis. Moreover, even those figures are available only for 2010 (for which the province purchased them), not for previous years.

5.3.1. Indicator: employment in tourism-related sectors

One indicator which the province has available at municipal level is employment in the tourism and leisure sector; this sector is taken to include accommodation, catering, culture and entertainment, sports and some jobs in transport and trade closely related to recreation and tourism. We have used the changes in this indicator between 2006 and 2010 as our dependent variables. The independent variable is the amount of money spent under M313 until 2011 per municipality, as listed in Table 16. The analysis has been carried out on the 58 municipalities which existed in 2011 (two less than in 2010, due to merging of municipalities), in 26 of which investments under M313 had taken place.

The hypothesis for the number of jobs is as follows: the municipalities where investments for measure 313 have happened have seen more jobs created in tourism and recreation than municipalities where no such investments have taken place.

H_0: $\beta_1 = 0$, there is no relationship between municipalities with and without investments in the number of jobs in tourism and recreation;

H_a: $\beta_1 > 0$, there is a relationship between municipalities with investments and without investments in the number of jobs in tourism and recreation, municipalities with investments has a higher increase of the number of such jobs.

The output of the analysis is presented in Table 39.

Table 39. Regression analysis for impact of M313 on employment in tourism & leisure

SUMMARY OUTPUT 1

Input X: amount of money

Input Y: Relative difference in jobs

Regression Statistics	
Multiple R	0.094119803

R Square	0.008858537
Adjusted R Square	-0.00884042
Standard Error	0.61410457
Observations	58

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.188755	0.188755	0.500512	0.482209
Residual	56	21.11897	0.377124		
Total	57	21.30772			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.03585657	0.093314	-0.38426	0.702243	-0.22279	0.151074	-0.22279	0.151074
X Variable 1	5.27493E-07	7.46E-07	0.707469	0.482209	-9.7E-07	2.02E-06	-9.7E-07	2.02E-06

We arrive at a very low value for R-square, the coefficient of determination: 0.0089. A correlation so close to zero indicates no predictive value in using the equation. In other words, less than 1% of the variation in the response variable can be explained by the explanatory variable, the remainder being due to unknown or inherent variability.

Moreover, the significance value is large, meaning there is no proof that measure 313 has an impact on the number of jobs. The last possible check can be the t-statistic. This has a value of 0.707469, wich is very low. The t-statistic usually indicates how far the data will deviate from H_0 and in this case there is almost no difference.

There is still a possibility that not the amount of money affects the growth in tourism jobs, but the mere fact that there is an investment. This means we can take a dummy variable for the explanatory one: 0 for no investments, and 1 for municipalities where investments in tourism promotion under M313 have taken place.

With the dummy variable there is a small difference in the output but not a difference in the conclusion. The R Square is now 0.0026 (so even lower) and the t-statistic is 1.22. This is a small increase compared with the t-statistic in the previous output but still too low to deviate from H_0. Similarly, the P-value has decreased slightly, to 0.227, but still too high for the result to be significant.

5.3.2. Indicator: number of tourism-related business establishments

There is another indicator for the impact of M313 available at municipal level – not from official statistics but from data which the province has made available. This is the number of companies (or local branches of companies) in the field of tourism and leisure. The hypothesis is: in municipalities where measure 313 has been active there will be more growth in the number of business establishments in the field of tourism and leisure than in municipalities where no investments under measure 313 have taken place.

H_0: $\beta_1 = 0$, there is no relationship between municipalities with and without M313 investments in the number of business establishments in tourism and recreation;

H_a: $\beta_1 > 0$, Municipalities with M313 investments have a higher increase (or a lower decline, as the case may be) in the number of business establishments in tourism and recreation.

In the next output the relative change in the number of establishments in tourism and recreation is taken as the dependent (response) variable. The relative change is from 2006 to 2010. The investment (amount of money) is taken as the independent (explanatory) variable. The amount of money for municipalities where no investment has taken place is zero. The result is presented in Table 40.

Table 40. Regression analysis for impact of M313 on number of establishments in tourism & leisure

SUMMARY OUTPUT 2

Input X: amount of money
Input Y: Relative difference in number of establishments

Regression Statistics	
Multiple R	0.137237
R Square	0.018834
Adjusted R Square	0.001313
Standard Error	0.140295
Observations	58

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.021158	0.021158	1.074953	0.304286
Residual	56	1.102238	0.019683		
Total	57	1.123396			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.093062	0.021318	4.365384	5.52E-05	0.050356	0.135767	0.050356	0.135767
X Variable 1	1.77E-07	1.7E-07	1.036799	0.304286	-1.6E-07	5.18E-07	-1.6E-07	5.18E-07

Once again, R-square is very low, namely 0.018834, signifying that only 1.8% of the increase in establishments can be explained by the investments under measure 313. As with the employment indicator, the p-value is high (0.304), and the t-statistic is low (1.04). The null hypothesis is not rejected.

As with the previous indicator, we have carried out an alternative linear regression with a dummy variable: municipalities where M313 investments have taken place have the value 1, and those without such investments have the value 0. There is a small difference in the output but not in the conclusion: the R Square is 0.039, and the P-value is 0.13. Still there is no proof of the alternate hypothesis.

We must conclude that we have been unable to discern any impact of measure 313 on the tourist economy, at least on those indicators for which we were able to find data. This is not to say that such impact does not exist. However, in order to measure it (assuming there is an impact), we would need a longer period for that impact to materialize. After all, there is bound to be a time lag between investments in leisure facilities, their completion, and their utilization. The particular facilities are likely to attract primarily day-trippers and only secondarily more overnight stays. An increased number of day-trippers will also have an effect on local expenditure in the tourist sector, but a smaller one. There will be another time lag before that effect is translated into more tourism businesses and more jobs.

Getting better data may seem to be another answer, but this is easier said than done. Data from sample surveys simply do not lend themselves to assessing values for small spatial units such as municipalities. Data on bed capacity and overnights, covering an entire population rather than a sample, might in principle be obtained – but they will not solve the time-lag problem.

6. Conclusions

When designing the SPARD project, it was believed that the analysis at case-study level should yield much more detailed information than the analysis for the EU-27 as a whole. After all, for each variable the member state with the poorest data determines what the quality of the data overall will be. At case-study level, we could vary the indicators according to data availability within the region. Familiarity of the researcher with the region would also help in understanding the specific context and in prying loose such data as might exist.

This has turned out to be true for some data, but not for all. One problem which we did not fully realize at the time is that some of the data we need are based on sample surveys. By their nature they can be extrapolated to larger geographical units (such as NUTS2), but not to higher spatial resolutions (such as municipalities). We have techniques for assigning values to these smaller units, but we are then using model predictions instead of actual observations. Some of these sample data are among the most important ones needed for impact assessment: agricultural production, for instance, or nutrient loads. This necessarily limits the scope for detailed assessment within a NUTS2 region.

Even where we do have complete data (for instance on the number of projects implemented under a particular measure), the numbers may be too small to be statistically significant. This was the case with the impact analysis of measure 125.

Another lesson we learned was that while detailed data exist, they may not be readily available; or, where they are available, processing them may be time-consuming. An example is the data on individual RDP projects and subsidies. These are published on the internet. For the projects under provincial responsibility, they are presented on a map with some details on each project. To assign them to municipalities, however, one must search each project on the map and locate it in relation to municipal boundaries. For projects under national administration, it is not the projects that are published, but the names and addresses of beneficiaries with the payments received by them. These beneficiaries must also be located in order to assign them to municipalities. In neither case are they identified by the registration numbers with which they can be linked to the FSS database.

The fact that a particular indicator is listed in the CMEF does not necessarily mean that it is available with the national or provincial RDP authorities. Many indicators are published in monitoring and evaluation reports at national level only. Nominally, the RDP in the Netherlands is a provincial responsibility, but this does not mean that all decisions on it are made by the provinces, nor that the province have all the necessary information about them.

A problem that plagues all evaluation efforts is the gap between the time when evaluation is needed (namely, at the time when planning for the next period is being undertaken) and the time when the intended impact of a project, programme or policy is likely to materialize. This gap is also very much in evidence in the analysis presented in this report. In the case of Axis 1, the effect of a particular project on the labour productivity of individual beneficiaries may be fairly rapid; but on the competitiveness of the farming sector as a whole it is likely to be much slower. The same is true for measures in Axis 3, such as 311.

This problem is particularly in evidence for Axis 2. Impacts on the quality of nature are difficult to measure and often take many years to materialize. Therefore, we cannot conclude from the lack of evidence found in section 5.2.2 that measure 214 has no impact on the natural value of farmland. Rather, the time needed for the effect to materialize is longer than the four years we have used. And moreover, the HNV indicator may not adequately measure the particular aspects of nature quality that are targeted by the particular agri-environment schemes implemented in our province.

Thus, impact analysis has its limitations. This is why, at an early stage, our work package decided to focus on uptake analysis instead: if we could not say what the impact of an RDP is, at least we could say something about how successful the programme has been in attracting participants from among the farming community (and other rural players for some measures), and what factors may have influenced that success – or lack of it, as the case may be.

In this uptake analysis, in the case of Noord-Holland, we were hampered by the fact that for two of the selected measures (M121 and M311) the numbers of projects were quite small and we could not relate the participants to our FSS database. So we had to work at municipal level, which severely limited the number of cases to analyze.

For measure 214, the situation is rather better, as we do have detailed data both on the implementation of the programme and on the characteristics of the beneficiaries. Yet the correlation we found were not that high, although we did succeed in identifying some variables that are associated with the propensity to engage in agri-environment schemes. Overall participation, by the way, remains fairly low and moreover appears to be in decline. Apart from being somewhat alarming to programme managers, this also affects our data, because the database contains a vast majority of non-participants.

The climax of our work was supposed to be the spatial-econometric analysis of the associations we would find, in order to assess to what extent they might be due to spatial autocorrelation, and also to identify possible hidden factors of a spatial nature. This was done only for the uptake analysis of measure 214. The main result we found was that, although age does not affect the degree of participation, areas with older farmers have a higher uptake rate. This is because those are the less favoured areas of grassland on peat soils, where bird protection in particular is often practised; these areas also have fairly large number of retired dairy farmers who have changed from dairying to less intensive forms of grassland farming.

7. References

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