ENVIEVAL

Development and application of new methodological frameworks for the evaluation of environmental impacts of rural development programmes in the EU

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Report D6.1

Report on the selection of case study areas

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SEVENTH FRAMEWORK PROGRAMME

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List of Acronyms

AE	Agri-Environment
AEM	Agri-Environment Measure
BEF	Baltic Environmental Forum
CAP	Common Agricultural Policy
CF	Carbon Footprint
CLC	Corine Land Cover
EAFRD	European Agricultural Fund for Rural Development
EEA	European Environment Agency
ENRD	European Network for Rural Development
FADN	Farm Accountancy Data Network
GAP	Good Agricultural Practice
GDP	Gross Domestic Product
GHG	GreenHouse Gas
GNB	Gross Nutrient Balance
GVA	Gross Value Added
HNV	High Nature Value
HNVA	High Nature Value Area
IACS	Integrated Administration and Control System
JRC	Joint Research Council
LCM	Land Cover Map
LFA	Less Favoured Area
LFASS	Less Favoured Area Support Scheme
NGO	Non-Governmental Organisation
NUTS	Nomenclature of Territorial Units for Statistics
NVZ	Nitrate Vulnerable Zone

RD	Rural Development
RDP	Rural Development Programme
RPAC	Regional Proposal Assessment Committee
SCI	Sites of Community Importance
SPA	Special Protection Area
SRDP	Scottish Rural Development Programme
SRG	Stakeholder Reference Group
UAA	Utilised Agricultural Area
WFD	Water Framework Directive

Executive Summary

The main aim of this report is to summarise the common framework for the selection of case study areas and to discuss the selected case study areas across the different partner countries. The report summarises the common framework for the selection of the case study areas highlighting the key criteria of the selection process followed by short presentation of the selected case study areas. Emphasis is given to the examination of parameters that are significantly relevant for the selection procedure, e.g. key policy measures, available data types and sources and evaluation challenges which can be addressed in each selected case study area. Finally the report summarises the main policy measures and available data types and sources across the different public good case studies and discusses the scope of the selected case study areas to address the main evaluation challenges identified during the reviews and first stakeholder consultation carried out in the first phase of the ENVIEVAL project.

Rural development (RD) measures were selected mainly based on the causal relations between the public good and the respective RD measure. The amount of the area under contracts for each of the pre-selected key RD measures also played a particular role in the selection procedure. As to our initial assumptions area based measures are expected to have the most significant environmental impact in most cases. In the case of some public goods (e.g. water quality, animal welfare and climate change stability) 1st axis RD measures might also have significant effects (e.g. Measure 121 Modernization of agricultural holdings).

Data availability of the relevant environmental and other circumstances, in general, is the most crucial point of case study area selection. Targeted data collections for the environmental monitoring of RD programmes are in many cases not available. Therefore data collection from other monitoring systems and projects are of high importance across the different case study areas. Regarding data availability, partners considered the degree of detail and representativeness of the datasets beyond the requirements for counterfactual examinations. Available data types and RD measures selected for the evaluation are summarised by public goods in the following Table.

Summary table of public goods-case study areas - shortlist of key policy measures and available data sources

Public good	Country	Case study areas	Shortlist of key policy measures	Available types of data
Animal welfare	Germany	North-Rhine Westphalia	121, 215	IACS, Census, FADN, animal registration data, primary data on animal welfare indicators
Biodiversity HNV	Lithuania	Lithuania (whole country)	212, 213, 214, 221, 223, 224, 225, 226, 227	IACS, HNV assessment GIS data, National landscape management plan, Farm data on land use, LPIS-GIS data, CORINE, Farmland bird index data, National EU protected habitat inventory, Abandoned land register
	Italy	Emilia Romagna	214	IACS, LPIS, Agricultural Census, FSS 2007 and 2013, FADN, Land cover maps, Bird census data
Biodiversity Wildlife	Hungary	Heves-plain	212, 213, 214, 216, 221, 224, 225	IACS, FADN, LPIS data, Monitoring data of common bird species, Monitoring data for biodiversity, Spatial map of crop rotation, Soil quality data (TERRADEGRA), Agri-environment monitoring data
	Lithuania	Šilutė region/ Dovinė river basin	212, 213, 214, 221, 223, 224, 225, 226, 227	IACS, HNV assessment GIS data, National landscape management plan, Farm data on land use, LPIS-GIS data, CORINE, Vegetation maps, Aquatic warbler, and great snipe monitoring data, Hydrological monitoring data, Contact information to farmers, Annual biodiversity monitoring program, Farmland bird index data, National EU protected habitat inventory, Abandoned land register, Cattle register
Climate stability	Finland	Finland (whole country)	121, 123, 124, 211, 212, 214, 216	FADN, IACS, Data needed in Dremfia sector model, Data on ex-post period 1995-2012, Farm statistics data, CAP payment data, Use of inputs in agricultural production, Activity based cost models, acivity based unit cost calculations, Use of different feed stuffs per animal
	Italy	Veneto Region	214, 221, 222	IACS, LPIS, Agricultural Census, FSS 2007 and 2013, FADN, Land cover maps, National Greenhouse Gas Inventory
Landscape	Greece	Island of Santorini	125, 211, 212, 214, 216, 227, 321, 323	Number of beneficiaries, area under agreement and amount of support, IACS-Spatial data on land parcels, crop cover, Land use maps, Aerial photos, A survey at the local level for verification.
	Scotland	Grampian Region	212, 214, 221	IACS, Agricultural Census, Farm Structure Survey, FADN National Soil Inventory, Digital soil maps and soils characteristics, Landscape Character, Land Cover Map, Land Cover of Scotland (1988), Ordnance Survey digital height models, Ordnance Survey Mastermap
Soil functionality	Hungary	Heves-plain	212, 213, 214, 216, 221, 224, 225	IACS, FADN, LPIS data, Retrospective spatial map for crop rotation, Soil quality data (TERRADEGRA), Agri-environment monitoring data
	Scotland	Grampian Region	212, 214, 221	IACS, Agricultural Census, Farm Structure Survey, FADN National Soil Inventory, Digital soil maps and soils characteristics, Landscape Character, Land Cover Map, Land Cover of Scotland (1988), Ordnance Survey digital height models, Ordnance Survey Mastermap
Water quality	Finland	Southern Finland	211, 212, 214,	FADN including data on production inputs (nitrogen fertilizer + pesticide/herbicide expenses), IACS
	Germany	Lower Saxony	114, 121, 214, 323	IACS, Census, FADN, primary and secondary data on N and P indicators (farm and regional level)
	Greece	Thessaly	111, 114, 121, 125, 214, 216, 221, 226	Number of beneficiaries, area under agreement and amount of support, IACS-Spatial data on land parcels, crop cover, soil maps of the area, special action plans for Nitrate Vulnerable Zones, hydrographic maps, regional plan for water management in compliance to WFD

The coverage of RDP measures and available data inventory in the selected case study areas have the scope to contribute to the following specific methodological evaluation challenges:

1. Substitution effects in macro-level evaluations
2. Development of advanced counterfactual approaches with:
   a. consideration of external drivers to improve the assessment of net impacts
   b. carrying out alternative approaches to construct comparison groups where lack of data for non-participants is an obstacle
3. Development of suitable impact indicators to assess the impacts of RD measures on landscape and animal welfare

4. Improvement in the micro-macro linkage and net impact assessment
5. Examination of potential interactions and synergies of implementation of policy measures
6. Estimation and testing the usability of the relevant data originated from different sources and their consistent spatial integration
7. Underpinning of causal linkages between the RD measure and benefits to the public goods.

1 Introduction

This report provides a summary of the selected case study areas in the partner countries to inform the allocation of suitable method combinations for the public good case studies. The selected case study areas will provide a real ground for the testing of selected micro- and macro-level evaluation methods for capturing the environmental impacts of rural development measures.

Out of the main environmental public goods identified in ENRD (2011), the case studies focus on climate stability, biodiversity, water quality, soil functionality and cultural landscapes. The selected environmental public goods reflect the key environmental objectives of the CAP and are at the core of the needs of evaluations of environmental impacts of the rural development programmes in the Member States. Additionally, the provision of animal welfare is included in the public good case studies.

The public good case study approach allows for the testing of the counterfactual development and the evaluation methods at micro level and macro level.

The main aim of this report is to summarise the common framework for the selection of case study areas and to discuss the selected case study areas across the different partner countries. Section 2 summarises the common framework for the selection of the case study areas highlighting the key criteria of the selection process followed by short presentation of the selected case study areas. Emphasis is given to the examination of parameters that are significantly relevant for the selection procedure, e.g. key policy measures, available data types and sources and evaluation challenges which can be addressed in each selected case study area. Finally Section 4 summarises the main policy measures and available data types and sources across the different public good case studies and discusses the scope of the selected case study areas to address the main evaluation challenges identified during the reviews and first stakeholder consultation carried out in the first phase of the ENVIEVAL project.

2 Guidelines to the Case Study Area Selection

2.1 Selection of Key Policy Measures

As the main aim of the project is to provide methodological background for the analyses of the environmental impacts of the rural development measures, a clear linkage between case study area selection and the key policy measures is a basic requirement. Rural development measures aim at a wide range of activities and generate several kinds of economic, social and environmental impacts. For this reason the selection of relevant key policy measures is a crucial step in the case study area selection.

The proper selection of the key policy measures ensures that methodological evaluation challenges, thus also stakeholder needs, are addressed in the public good case studies, and helps to avoid the biasing side effects of the non-relevant measures. To this end partners carried out in-depth analyses of the relevant policy measures and defined the most important measures per partner countries with regard to the public goods concerned. The starting point for the analyses was the policy measures listed in the Description of Work for the different public goods.

Table 1 Overview of the public goods and their policy relevance

Public good case study	Case study country	Rural development measures (measure codes)
Climate stability	All partner countries	111, 114, 121, 123, 124, 125, 141, 211, 212, 213, 214, 216, 221, 222, 223, 224, 225, 226, 227, 321, 322, 323, 411, 412, 413
Biodiversity – wildlife	Lithuania and Hungary	111, 114, 121, 123, 124, 125, 141, 211, 212, 213, 214, 216, 221, 222, 223, 224, 225, 227, 313, 321, 322, 323, 411, 412, 413
Biodiversity – HNV	Italy and Lithuania	111, 114, 121, 123, 124, 125, 141, 211, 212, 213, 214, 216, 221, 222, 223, 224, 225, 227, 313, 321, 322, 323, 411, 412, 413
Water quality – diffuse pollution	Finland, Germany, Greece and Italy	111, 114, 121, 123, 125, 141, 211, 212, 213, 214, 216, 221, 222, 223, 224, 225, 226, 227, 322, 323, 411, 412, 413
Soil functionality – soil health	Scotland and Hungary	111, 114, 121, 123, 125, 141, 211, 212, 213, 214, 216, 221, 222, 223, 224, 225, 226, 227, 322, 323, 411, 412, 413
Landscapes – landscape character	Greece and Scotland	111, 114, 121, 123, 125,141, 211, 212, 213, 214, 216, 221, 222, 223, 224, 225, 226, 227, 313, 321, 322, 323, 411, 412, 413
Animal welfare	Finland and Germany	111, 114, 121, 141, 214, 215, 222, 313, 323

The results were presented and discussed with the national stakeholder reference groups. The result of the in-depth analyses of the measures clearly showed the dominance of the area-based measures in terms of the expected results regarding environmental impact (see Table 2).

Table 2 Measures with the highest expected significance related to different public goods (indicates only the measures ranked with the 10 highest scores)

RD Measures	Summary							
	Climate stability	Biodiv. wildlife	Biodiv. HNV	Water quality	Soil funct.	Land-scapes	Animal welfare	Sum of values
214 Agri-environmental payments	7	6	7	7	6	6	1	40
212 Payments to farmers in areas with handicaps other than mountain areas	4	4	6	4	5	4	1	28
216 Assistance provided to non-productive investments	3	3	5	5	4	3	0	23
221 First afforestation of agricultural lands	5	4	3	4	3	3	0	22
227 Non productive investments	4	4	3	3	2	2	0	18
121 Modernization of agricultural holdings	5	1	0	4	3	0	3	16
125 Infrastructure related to the development and adaptation of AGR & FOR	4	2	1	4	2	3	0	16
225 Forest-environment payments	2	3	2	2	3	3	0	15
114 Use of farm advisory services	2	1	1	3	4	1	2	14
223 First afforestation of non-agricultural land	3	2	1	2	2	2	0	12

While considering the most frequently mentioned measures with possible environmental impacts, there is a clear significance of locally important measures (e.g. regionally implemented RD measures). Consequently, there is a limited possibility to develop a common procedure of the selection of key policy measures for all partner countries. The selection of the measures shall be carried out with taking into account local/regional circumstances.

2.2 Selection of the shortlist of key policy measures

The net environmental impacts of the different measures depend on several attributes. While designating the case study areas, where micro- and macro-level evaluation methods will be tested, it is also important to take into consideration different aspects, such as:

1. Causal linkages between the measures and targeted public goods.

It is important to develop and consider the intervention logic and theoretical linkages between the measure and the public good under examination to be able to estimate the impact. This intervention logic shall take into consideration the impacts originated from the lowest level of the measures (e.g. at the level of the prescriptions of the AE measures).

2. The aim of the measure focuses on the different public goods as written in the RDP document.
3. Environmental indicator value is set for the targeted public good in the RDP document.

The estimation of the environmental impacts of the RDPs is always highly dependent on the actual content of the distinct RDP, as the aim of the procedure is to underpin or to contradict

the effects of rural development payments. In this respect the creation of a shortlist of the measures shall take into consideration the aims and the target values of the rural development document under examination.

4. The uptake of the measures.

The selection of the shortlist of the measures shall be based on the evaluation of the uptake of different key policy measures. In this phase of the procedure, measures with a certain number of supported farms/coverage of areas under contract of under a predefined threshold will fall out of focus, as the estimated impacts are not significant. This phase is highly relevant for the whole procedure, as nearly all of the RD measures are voluntary for farmers hence the uptake of the measures is depending on various circumstances.

2.3 Creating the Spatial Focus of the Case Study Area Selection

During the evaluation of measures procedure, three different types can be identified: area based (AE, LFA, Natura 2000 payment, Forest environment measures), infrastructural development measures (121, 125, non-productive investments), and other measures (114 Use of farm advisory services). For the evaluation of the environmental impacts, these types of measures may require different approaches in methodology.

After selecting the shortlist of measures, the next phase of the case study area designation is to develop the spatial focus of the case study. The spatial focus is highly dependent on several attributes, such as:

1. The spatial coverage of contracted areas/farms under the shortlisted measures
2. Characteristics relating to public goods under examination (landscape, biodiversity)
3. Characteristics relating to agricultural production
4. Data availability (e.g. overlap with ongoing environmental monitoring networks)
5. Specific data needs of counterfactual scenario (e.g. availability of long-term data for with-without and before-after comparisons, formulating of comparison groups based on different types of socio-economic and other relevant attributes)
6. Methodological requirements of the micro- and macro-level approach

In this phase of the selection procedure, emphasis shall be given to the expertise regarding the areas concerned. As several kinds of information may not be evaluated through common and pre-defined methodologies (e.g. ongoing local monitoring programmes, network of experts possibly involved in the evaluation procedures, former results from other surveys/projects), the final selection of the spatial focus shall rely on the suggestions by the different partners.

The process of the selection of the case study areas is summarised in the flowchart below.

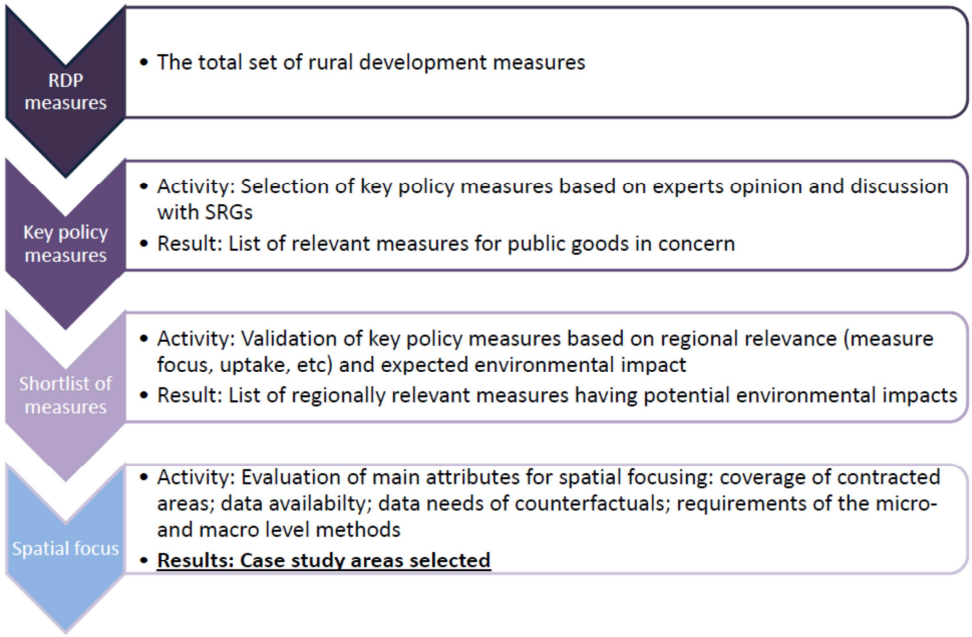

Figure 1 The summary of the case study selection process

The following section presents the selected case study area including a short description of the case study area, applied key criteria for the selection, most relevant policy measures identified, main policy measures in the case study area and an overview of in principle available data types and sources.

3 Presentation of Selected Case Study Areas

3.1 Finland

3.1.1 Climate stability

Case study area

The climate stability case study will use an agriculture-specific sectoral model to predict the impacts from natural handicap payments in mountain (and other) areas (measures 211 and 212) and agri-environment payments.

The model estimates outcomes with a nation-wide and regional focus on the GHG emissions in a CO_2 equivalent metric. The sectoral model, DREMFIA, takes into account the effects from changes in land use, livestock and the use of inputs.

The model enables both ex-post and ex-ante analysis of multiple scenarios, including a baseline (counterfactual) scenario. The model does not require difficult modifications for the purposes of the case study, as long as the analysis covers only natural handicap payments and agri-environment payments

This case study will be conducted within MTT.

Case	**Climate stability**
Counterfactual method	Sectoral model: DREMFIA
Evaluation period	Ex-post ’07-’13
Area	Whole country (divisible into 18 regions)
Justification for case study area	RDP’s support the national goals GHG-emission reduction
Environmental outcome indicator	CO_2 equivalent measure (it is also possible to separate CO_2, N_2O and NH_4 emissions)

Applied key criteria for the selection

The case study builds on earlier expertise on sectoral economic modelling (DREMFIA) of the Finnish agriculture. The case study area covers the Finland as a whole, with possibilities to divide the country into 18 sub-regions. The DREMFIA model has been used and tested earlier to project agricultural policy and climate effects among other issues. The model can also be inverted to provide a counterfactual case. This is the prime reason for selecting the model as the tool for this case study.

- Scope and implementation of key policy measure(s): The sectoral model takes into account all the major policy measures affecting national agriculture. These measures include the CAP pillar I measures, natural handicap payments, agri-environment

payments and national payments. As the natural handicap payments and agri-environment payments form the majority of RDP payments in Finland, we study their effects to GHG emissions from agriculture.

- Data availability: The sectoral model builds on a large set of existing national price and consumption data of agricultural inputs and products. No further data needs to be collected.
- Methodological considerations did not play a significant role in the selection of the case study area, because the examined measures 214 and 215 are applied throughout Finland and the data is readily available in the databank of the DREMFIA sector model. The DREMFIA sector model also allows analyses on various regional scales.
- Special challenges to be addressed: The environmental impacts of additional RDP measures besides the examined measures 214 and 215 cannot be evaluated by the DREMFIA sector model. Furthermore, the DREMFIA sector model cannot address farm-level effects because of its orientation of regional scales. However, in the case of GHG emissions, this restriction is less relevant, because the estimation of GHG emissions is based on land use, number of livestock and production input use, which can easily be reduced to farm level when necessary. The case study will contribute to the consideration of substitution effects in macro level evaluations.

Most relevant policy measures identified

Key policy measure: Natural handicap payments and agri-environment payments (make together some 77% of the total RDP funds)

Other targeting measures during ’07 – ’13: Axis 1: 121, 123, 124

Axis 2: 216

Natural handicap payments and agri-environment payments (make together some 71% of the total RDP funds).

Main measures	**Planned spending 2007-2013 pillar II (in million Euro of the EU share of payments)**	**Share on total spending in pillar II (in %)[1]**
214	677	32%
211 and 212	829	39%
Axis 1	245	11%

[1] http://www.maaseutu.fi/attachments/maaseutu/maaseudunkehittamisohjelmat/6HMiUGJzy/Manner-Suomen_maaseudun_kehittamisohjelman_2007-2013_vuoden_2012_vuosikertomus.pdf (p17)

Axis 2 (other measures)	35	2%
Axis 3	214	10%
Axis 4, Leader	114	5%

Main policy measures in case study area (in terms of budget and uptake)

In 2012, 90% of Finnish farmers had taken up and 94% of the arable land was under agri-environmental payment schemes (214). All of Finland is eligible for natural handicap payments.

Overview of available data sources

FADN, IACS

Data needed in DREMFIA sector model (Heikki Lehtonen 12.9.2013)

Data on ex-post period 1995-2012, annually

From official statistics:

- Prices of agricultural inputs (annual averages – annual price indices)
- Prices of agricultural commodities – annual prices in Finland and in the EU (average)
- Prices of dairy products – annual prices in Finland and in the EU (average) (18 dairy products in the model)
- Consumption of agricultural commodities, Finland, annual
- Consumption of dairy products, Finland, annual
- Exports of agricultural commodities, Finland, annual
- Exports of dairy products, Finland, annual
- Imports of agricultural commodities, Finland, annual
- Imports of dairy products, Finland, annual
- Use of crops as fodder at farms and in fodder industry
- Yields per hectare (kg/ha) and per animal (milk per cow, slaughter weights of animals)
- Agricultural total calculations on the value of different inputs in agriculture (similar to EEA) – a validation basis for DREMFIA
- (land use under different crops and number of animals at different regions and in the whole country are used in model validation)

– (Farm structure statistics is used in the validation of the model – distribution of dairy cows in different farm size categories is endogenous in the DREMFIA model)

Data partially (not always completely due to farm specific definitions) but not completely available in official statistics:

– Agricultural subsidies (according to support regions and specific rules and definitions)

– CAP pillar 1

– LFA

– Agri-environmental

– National subsidies

– Investment subsidies – specific to various kind of investments in livestock and crop production

Other data (with sources):

– Use of inputs in agricultural production - per ha, per head per year

  - mainly from activity-based cost models maintained and published by agricultural extension services (www.proagria.fi)
  - partly from FADN – activity-based unit cost calculations

– Use of different feed stuffs per animal, from dairy farm recording system, and other livestock specific data systems of agricultural extension services, www.proagria.fi

Other data related issues:

– Specific needs of energy and protein content as well as roughage needs of different animals – MTT feeding norms (published)

– Nutrient contents of manure of different livestock

– MTT internal calculations maintained in animal nutrition research and/or specific tables retrieved and summarised in different research projects

– Nitrogen response function parameters from various studies, reports and articles

– Milk yield response function parameters estimated from earlier and recent data material

– Other technical parameters related to use of inputs per ha and head

The data used in the Finnish case study do not allow any other methods to be used. However, in Finland the existing data allows us to test at micro level carbon footprint, emissions from agriculture and the production of renewable energy.

3.1.2 Water quality and diffuse pollution

Case study area

The water quality case study uses a before-and-after counterfactual approach to assess the impacts of measures 211, 212, and 214 to nitrogen run-offs. The econometric model employs existing FADN data, while addressing problems encountered in naïve before-and-after estimation methods. The model results will focus on Southern Finland.

This case study will be conducted in collaboration with MTT and VATT Government Institute for Economic Research.

Case	**Water quality and diffuse pollution**
Counterfactual method	Structural economic model with statistical estimation on effects
Evaluation period	Ex-post ’07-’13
Area	Southern Finland (crop production farms)
Justification for case study area	Diffuse water pollution has a major effect especially on the ecosystems of Gulf of Finland and the connected waterways
Environmental outcome indicator	Nitrogen fertiliser use modelled to environmental outcome Pesticide/herbicide use as an intermediary measure

Applied key criteria for the selection

The case study builds on an earlier structural econometric model assessing farm-level use of nitrogen fertiliser and pesticides/herbicides in Southern Finland. This model provides a sound basis to study agri-environmental payment effects on nitrogen fertiliser use. Southern Finland and especially its coastal area have heavily eutrophied areas to which the use of nitrogen fertiliser.

- Data availability: The structural model builds on an existing set of farm-level data (FADN), thus requiring no new data collection.
- Methodological considerations played some role in the selection of the case study area (Southern Finland), because the FADN data-based structural econometric model can be applied in its current form only to crop production farms, which are most common in Southern Finland. Furthermore, the structural econometric model can be used at the moment only in the analysis of the examined measures 214 and 215.
- Special challenges to be addressed: The selected approach does not include an indicator which would be based on actual measurement of nitrogen loading to

waterways. The structural econometric model estimates how the examined measures 214 and 215 change production decisions of farmers and the water quality impact is induced from these changes. The case study will contribute to the development of counterfactual approaches testing the applicability of structural models in situations where either limited data availability for non-participants or large scale uptake of policy measures constrain the development of control groups.

Most relevant policy measures identified

Key policy measures: Natural handicap payments and agri-environment payments (a total of 55% of the total agricultural payments in Southern Finland)

Other targeting measures during ’07 – ’13: Axis 2: 216

Main policy measures in case study area (in terms of budget and uptake)

Natural handicap payments and agri-environment payments (make together some 71% of the total RDP funds).

Main measures at A+B areas (Southern Finland)	**Spending 2011 (in million Euro) pillar II**	**Share on total spending in pillars I and II, 625 mil. eur. [2](in %)**
214	161.1	25.8%
211 and 212 (LFA)	189.6	30.3%
CAP	274.3	43.9%
National payments: LFA	43.5	
National payments for Southern Finland (article 141)	84.0	
National payments: other	12.5	

Overview of available data sources

FADN including data on production inputs (nitrogen fertiliser + pesticide/herbicide expenses)

FADN, IACS

The case study is based on FADN data so all the methods that utilise FADN data are possible to test. The existing data in Finland should also allow testing of the following methods at micro level: water footprint and nitrates in freshwater. From macro-level methods spatial econometrics applications could be tested.

3.2 Germany

3.2.1 Animal welfare

Case study area:

[2] http://www.mtt.fi/mttraportti/pdf/mttraportti57.pdf (page 35)

- Federal State of North-Rhine Westphalia

In North-Rhine Westphalia more than half (15,000 km^2) of the area is used for agriculture, mostly as farmland (10603 km^2). According to the data of the 2010 agricultural census, there are about 27,700 livestock farms with 1.77 million LU (20 million animals mainly cattle, pigs and poultry). With about 200 livestock units per 100 ha of agricultural land, North-Rhine Westphalia has the highest density of livestock units in Germany (119 livestock units per 100 ha). Furthermore nearly 25% of all German pigs are kept in North-Rhine Westphalia (LANUV NRW 2013a, 2013b). Animal welfare issues targeted by rural development measures include, for example, the size and design of pig stables and access of pastures for dairy cattle.

Applied key criteria for the selection:

- Experience and expertise in project team and evaluators: It is mandatory for the feasibility of the case studies that these will take place in areas which are included in the ex-post evaluations carried out by TI.
- Scope and implementation of key policy measure(s): Measure 215 is the key measure for animal welfare and the case study area needs to cover this measure. Measure 215 is implemented in Mecklenburg Western Pomerania and North-Rhine Westphalia. The measure is particular targeted towards certain production systems and farm types. The number of farms which have taken up the measure is not big enough to have sufficient data for a specific case study area within the Federal States. Thus, the Federal State as a whole is proposed as case study area.
- Data availability: Primary data are available on beneficiaries (farm visits, interviews and surveys) and access to a set of relevant secondary policy and farm databases (see below for an overview of available data sources).
- Methodological considerations: The case study area has been selected to utilise synergies with other projects carried out in the same area developing and testing new indicators and evaluation methods. Thus the case study area provides the option to build on these on-going projects.
- Specific challenges to be addressed: The lack of suitable impact indicators to assess the effects of RD measures of different aspects of animal welfare and improvements in the assessment of net-impacts are expected to be addressed

Most relevant policy measures identified for animal welfare (based on a relevance assessment with the evaluators):

- Measure 215
- Measure 121

Main policy measures in case study area (in terms of actual spending):

North-Rhine Westphalia:

Measure	Spending 2007 – 2011 (in million Euro)	Share on total spending (in %)
214	230	49
121	**80**	**17**
212	47	10
322	37	8
125	14	3
213	14	3
215 (implemented in 2010!)	**3**	**1**

Overview of in principle available data types and sources:

Type of data	Data origin	Geographical scale
IACS	Payment Agency	Farm level (universe)
Agricultural Census	National Statistical Institute	Farm level (universe)
FADN	TI	Farm level (sample)
HIT database (Identification and Information System for Animals)	• Landeskontrollverband Nordrhein-Westfalen e.V. • MQD Qualitätsprüfungs- und Dienstleistungs-gesellschaft Mecklenburg Vorpommern mbH (Quality control organisations)	Farm level (registered animals)
Animal welfare indicator data	Empirical data from farm surveys and visits of evaluators	Farm level (sample)

The case study area provides a wide range of secondary data including data from the Identification and Information System for Animals. In addition, primary data from farm surveys and visits are available. The primary data focus on dairy farms and currently consist mainly of participating farms. Those two aspects can potentially constrain the testing of advanced evaluation methods with high data requirements such as propensity score matching or spatial econometrics. Efforts to link the data from the Identification and Information System for Animals with IACS data and the primary data on animal welfare indicator will be undertaken to further increase the methodological scope of the case study testing. However, the available data provide sufficient scope to test different problem-related animal welfare indicators. The testing of new indicators is an important contribution to address the current gaps in RDP evaluations of animal welfare impacts.

3.2.2 Water quality

Case study area:

Federal State of Lower Saxony (and neighbouring Federal States, if appropriate)

With 2.62 million ha utilised agricultural area (UAA) accounting for 55 % of the state's area, agriculture is an important sector in Lower Saxony. It is highly regionalised and characterised by intensive arable (cereals, maize, potato, sugar beet) and intensive livestock production (poultry, laying hens, pigs, dairy cattle and beef production). Further, Lower Saxony is the state with the highest energy production from biogas in Germany (Flessa et al., 2012. According to the initial characterisation of the Water Framework Directive nearly 70% of groundwater in Lower Saxony is affected by diffuse pollution from agriculture (Kunkel et al., 2008).

Applied key criteria for the selection:

- Experience and expertise in project team and evaluators: It is mandatory for the feasibility of the case studies that these will take place in areas which are included in the ex-post evaluations carried out by TI.
- Scope and implementation of key policy measure(s): Water protection measures are a key policy objective for agri-environmental policies in Lower Saxony. Agricultural water pollution, especially nitrogen, is a major obstacle for reaching the objectives of the Water Framework Directive.
- Data availability: Primary data on Gross Nutrient Balance (GNB, esp. for nitrogen) of 150 model farms at farm gate level is available and access to a set of relevant secondary policy and farm databases (see below for an overview of available data sources).
- Methodological considerations: In the case study area, several studies on water quality were carried out in the past in cooperation with the monitoring organisation and the managing authority. Therefore, it is possible to build on these experiences and supplement on-going activities in the case study area.
- Specific challenges to be addressed: Lack of data on non-participants is an obstacle to use the counterfactual approach; micro-macro linkage and net impact assessment can be improved.
- Some of the data sets can be tested in order to assess the impact of sample sizes.

Most relevant policy measures identified for water quality (based on a relevance assessment with the evaluators):

214 Agri-environment measures

323 Rural heritage (support of technical advice in drinking water protection areas)

114 Use by farmers and forest holders of advisory services (farm management: focus on nutrient management). Although the measure has, with 0.7 %, a relatively low share of the total budget (i.e. 17 million Euro), it will be considered in the assessment due to its importance for the public good water quality.

[121 Farm Investment Aid: in some cases used to support slurry storage capacity etc., but availability of specific data is limited]

Voluntary Agreement for the protection of drinking water (applied according to EAFRD art. 89, as 'top-up' payments)

Main policy measures in case study area (in terms of budget and uptake):

Measure	Spending 2007 – 2011 (in million Euro)	Share on total spending (in %)
126	491	21.1
214	**415**	**17.8**
121	353	15.2
125	327	14.1
322	204	8.8
323	**169**	**7.3**

Overview of available data sources:

Type of data	Data origin	Geographical scale
IACS	Payment Agency	Farm level (universe)
Agricultural Census	National Statistical Institute	Farm level (universe)
FADN	TI	Farm level (sample)
N balance data, Gross Nutrient Balance(GNB)	Farm accounting data (until 2000) After 2000: data from controls of the fertilisation audience (Düngeverordnung)	Farm level
Mineral N content in autumn	soil samples, NLWKN (water protection authority)	parcel level
GNB at farm gate level in WFD areas	Empirical data from farm surveys of managing authorities	Farm level (sample of 150 model farms)
N surplus, run-off and leaching P run-off	TI, AGRUM Weser / WAgriCo (regional model data)	State level

In the case study area a wide range of primary and secondary data is available and access to this data is facilitated by the close cooperation with the evaluators, the monitoring organisation and the managing authority. Primary data on gross nutrient balances at farm-gate level as well as data on advisory services are available for 150 model farms in drinking water

protection areas. Thus, the focus is on farms that have easy access to advisory services. Monitoring data for drinking water protection areas is currently extended by a control group to enable the comparison with farms outside of protective areas. The data constraint is that information on AEM participation is only available for 2012, and is lacking the information if AEMs were applied before that year. Further, soil samples at parcel level are available for the analysis of the mineral N content in autumn. Based on this data, counterfactuals as well as different approaches of upscaling and hierarchical sampling could be applied and tested, e.g. to address the challenge of gaps between micro and macro level evaluations. Statistical tests should be carried out to complement the recent impact assessment of the monitoring agency on N balances.

3.3 Greece

3.3.1 Landscape

Case study area

There is a long tradition of winemaking on the volcanic island of Santorini, at the Southern part of the Aegean archipelago. Although tourism has been the main industry for the last 30 years, a considerable part of the island is still covered by vineyards i.e. approximately 1.500 ha or 50 % of the total area.

Farmers in Santorini (Thira) and Thirasia, a smaller island nearby, are pruning their vine stocks low, very close to the ground, in a circular-reversed conical way, in order to protect the grapes from the wind and, taking advantage of the volcanic soils, gather the nocturnal dew. Furthermore vines are self-propagated through layering in a disorderly manner in space. It is obviously a system adapted to the climatic and soil conditions (dry and hot summers, strong winds and volcanic soil) that resulted in the specific landscape currently being at risk. Historically, this took place in times of abundant, relatively low-cost skilled labour supply. These practices, today, not only increase pruning cost, since a greater amount of skilled labour is required, but also make mechanisation impossible.

The crucial points, i.e. the relation between quality of the grape and consequently of the wine, and the specific traditional technique for pruning, have not yet been adequately explored. Producers and wine makers trying the linear system argue that, in their experience, the quality is better. The pioneers of that shift towards a market and tourism oriented vine cultivation and wine making were also the first to use modern techniques in farming, including changing the pruning system. There are arguments suggesting that ‘raising’ the vines and supporting them on linear systems would enable farmers to lower the costs through mechanisation and also improve wine quality, since plant protection interventions would be far more effective. Hence Santorini wine and winemakers would be more competitive in the global wine market.

The second pressure exerted on the vineyard landscape of Santorini was that of urbanisation. Years of tourism development have left indelible traces on the landscape. Construction along the main roads and beaches and the expansion of urban construction around the main settlements, much of which is illegal, has created an urban continuum on a large part of the island. Dispersed construction outside this continuum has also contributed to a degradation of the landscape.

For land owners, farmers included, the perceived opportunity cost of using the land for agriculture is extremely high. Hence, all previous attempts to control construction for tourism and leisure have been in vain. During the interviews conducted, wine producers and some local authorities have asked for state regulatory intervention, so far without success.

Despite all pressures against it, there are several factors contributing to the resistance of wine making, hence landscape protection: product quality and fame, linkages to tourism. To these one should add the agri-environmental measure for landscape protection that offered the maximum per hectare amount permitted for the specific crop under Reg. EC/1257/99. An AE scheme was specifically designed for landscape protection on the two adjacent islands, Santorini (Thira) and Thirasia. It would compensate farmers for increased costs due to the maintenance of the specific pruning system and the terraces, as well as for revenues foregone due to decreased productivity, together with the protection of bushes and trees at the field margins. The scheme had considerable success in terms of uptake and, during the first two years of implementation, almost half of the vineyards were under the scheme. According to the mid-term evaluation document, there were a total of 655 beneficiaries and 709 ha of vineyards were supported.

Apart from this, special aid for the maintenance of traditional vineyards, within the framework of special aid to the small islands of the Aegean, has been running for several years, with considerable success. An average of over 80% of the vineyard received the support during the period 2002-2006. The overall available amount of aid (1,525 € per ha), if the two schemes were to be adopted, could compensate for the increased costs of cultivation in the traditional way, but it is rather doubtful whether this amount could be enough to compensate farming households for the opportunity cost of agricultural land use.

- **Applied key criteria for the selection**
  - Production system (Extensive crop, non-irrigated, island)
  - One of the two areas of measure implementation
  - Established contacts
  - Data availability
- **Methodological considerations**
  - The simultaneous implementation of at least two RD measures could give us the opportunity to try some of the methods in order to disentangle the impacts of measures

- The macro level is clearly defined in spatial terms since the agri-environmental measure implemented is clearly defined.

- **Specific challenges to be addressed:**
  - Examination of potential interactions and synergies of implementation of two different policy measures.
  - A multiple objective RD measure, not directly focusing on landscape protection but rather on maintaining the rural society is going to be examined.
  - The driving forces exerting pressure on the environment are external to the agroecosystem. An assessment of the effectiveness of rural policies would be an interesting challenge.

Most relevant policy measures identified

125 Improving and developing infrastructure related to the development and adaptation of agriculture and forestry

The forest road network plays a key role in rational management and efficient exploitation of forest resources. The measure supports investments in infrastructure such as the creation and improvement of forest road network ensuring the sustainable development of forest areas and access to aesthetic landscapes increasing the ecotourism development.

211 Natural handicap payments to farmers in mountainous areas

212 Payments to farmers in areas with handicaps, other than mountainous areas

Avoiding land abandonment in disadvantaged areas contributes to the maintenance of agricultural landscape.

214 Agri-environment payments

- Action Protection of traditional olive grove of Amfissa
- Action Conservation of cultivation practices in vineyard of Thira

These actions are targeted at the preservation of an agricultural landscape that was formed by specific agricultural activities.

Farmers under action ‘Protection of traditional olive grove of Amfissa’ should maintain the olive trees in their current form, avoiding renewal actions and destruction of the distinctive dykes using mechanical means.

Farmers under action ‘Conservation of cultivation practices in vineyard of Thira’ should maintain the traditional pruning and create ecological compensation areas avoiding the mechanical or chemical weed control methods.

216 Support for non-productive investments

The only non-productive investment that is funded is the restoration of terraces, which concerns commitments from the previous programming period. The restoration of terraces aims to maintain the environmental and aesthetic value of the agricultural landscape.

227 Support for non-productive investments

Since forests have become attractive areas for social and ecological tourism, various forest recreation activities are supported. The measure contributes indirectly to protecting landscape and preserving cultural and natural heritage of forests.

321 Basic services for the economy and rural population

Small-scale infrastructures are supported in order to address problems, caused by seasonal flooding of rivers or streams, which degrade agricultural land and natural environment. Also, the local rural road network, especially in winter, has mobility problems and makes unsafe the access to farmlands. Therefore such investments may affect agricultural landscape.

323 Conservation and upgrading of the rural heritage

The measure supports actions related to the conservation, restoration and enhancement of areas of natural beauty and cultural value. Important elements related to the traditional rural life such as mills, bridges, oil presses are part of the landscape upgrading its natural and cultural heritage.

Main policy measures in case study area (in terms of budget and uptake)

The agri-environmental measure for landscape protection that offered the maximum per hectare amount permitted for the specific crop under Reg. EC/1257/99. An AE scheme was specifically designed for landscape protection on the two adjacent islands, Santorini (Thira) and Thirasia. It would compensate farmers for increased costs due to the maintenance of the specific pruning system and the terraces as well as for revenues foregone due to decreased productivity, together with the protection of bushes and trees at the field margins. The scheme had considerable success in terms of uptake; during the first two years of implementation almost half of the vineyards were under the scheme. According to the mid-term evaluation document, there were a total of 655 beneficiaries and 709 ha of vineyards supported.

Moreover, a special aid for the maintenance of traditional vineyards, within the framework of special aid to the small islands of the Aegean, has been running for several years, with considerable success. An average of over 80% of the vineyard received the support during the period 2002-2006. The overall available amount of aid (1,525 € per ha) if the two schemes were to be adopted, could compensate for the increased costs of cultivation in the traditional way, but it is rather doubtful whether this amount could be enough to compensate farming households for the opportunity cost of agricultural land use.

Overview of available data sources

- Number of beneficiaries, area under agreement and amount of support (Source: RD Management Authority and payment authority, Annual data)
- Spatial data on land parcels both under the measure and not, as well as their crop cover (Source: IACS , Annual data).
- Land use maps (Corine based, 1997-2007)
- Aerial photos (Different time points)
- A survey at the local level for verification.

The landscape conservation measure is applied since 2005 and an adequate database has been established. Moreover the previous working experience from the project team in the area is considered significant. According to the available data, one option considered at this stage is the application of a biophysical method at micro level combined with scaling methods to evaluate macro level impacts. As far as the counterfactual analysis is concerned, a before and after comparison will be applied.

3.3.2 Water quality

Case study area

Cotton cultivation is a leading example of intensive production in Greece. Furthermore, the Nitrate Reduction Scheme is one of the first Agri-environmental Schemes (AES) implemented in Greece, targeted initially at Thessaly (a Nitrate Vulnerable Zone (NVZ) under the Nitrates Directive (EEC/91/676)), and then expanded to other areas.

According to the mid-term evaluation document, a total of 10,347 beneficiaries remain and 109,900 ha of UAA are supported. In the prefecture of Larissa alone, there are approximately 50,000 ha under agreement, predominantly cotton farms.

The scheme for reducing nitrate reduction from agricultural sources was implemented in three areas for the period 2000-2006. These were the plains of Thessaly, the Lake Kopais area and the Pineios river area in the prefecture of Ileia. The scheme was designed to introduce or maintain nitrate-reducing farming practices concerning irrigated arable crops in areas with high concentrations of nitrates in their groundwater or in NVZs under Directive EEC/91/676. Payments were made to farmers in order to apply nitrate reducing farming practices described in the scheme methodologies found in the Greek Rural Development Programme, and in a special set of (Agri-environmental) Codes of Good Agricultural Practices (GAP). The stated objectives for the Nitrate Reduction Scheme are protection of water resources from exhaustion, restoration of quality of ground water and improvement in soil fertility.

Larissa is one of the four prefectures of Thessaly. It is mostly a plain area, where agriculture has been traditionally the main economic activity. The previous 'coupled' CAP commodity support schemes led the farmers to shift towards highly intensive cropping patterns, in which cotton predominated.

In Greece, the prefecture of Larissa is second (out of 52) in size and first in Utilized Agricultural Area (UAA). Larissa retains 164,000 ha of UAA out of which 28% is under agreement within the Nitrate Reduction Scheme.

- **Applied key criteria for the selection**

– Production system (Intensive crop, irrigated in the plains)
– Long term implementation of measures (since 1995)
– Established Contacts
– Data availability

- **Methodological considerations:**

– A great variety of data exists, coming from different sources, with varying spatial reference and frequency. An attempt to utilise this relative data abundance in a consistent and operational way will be made. Particular emphasis will be placed on ensuring the possibility of spatial mapping of IACS data to better integrate policy, economic and environmental data for spatial analysis.

- **Specific challenges to be addressed:**

– Lack of data for non-participants is an obstacle to the construction of a counterfactual. However, since the area is a Nitrate Vulnerable Zone, the cross-compliance provisions could be used as a reliable baseline scenario.

- Alternatively, old data of non-participants from previous farm surveys could be used.
- Three different variations of the same measure, including similar but not identical agricultural practices, are applied. Fine tuning of the evaluation methods and indicator system is going to be a particular challenge.

Most relevant policy measures identified

111 Vocational training and information actions including diffusion of scientific knowledge and innovative practises for persons engaged in the agricultural, food and forestry sectors

Beneficiaries under Axis 2 can only participate in vocational training and information actions; thus these actions are expected to focus on environmental issues and contribute positively to the sustainable management of natural resources.

114 Use of advisory services by farmers and forest holders

Cross-compliance requirements should be respected by all farmers and forest holders. The complexity of these standards implies the use of advisory system, including advice on statutory management requirements and good agricultural and environmental conditions.

121 Modernisation of agricultural holdings

The modernisation of agricultural holdings supports investments that expand or replace the existing production sectors or introduce innovations and new technologies in order to improve their competitiveness focusing on water quality.

125 Improving and developing infrastructure related to the development and adaptation of agriculture and forestry

Investments in infrastructure related to land reclamation actions, dam and reservoir constructions are important in order to address water scarcity issues. Therefore the measure contributes to the rational management of water resources.

214 Agri-environment payments

- Action Organic farming
- Action Organic livestock farming
- Action Extensification of livestock farming
- Action Protection of Nitrate Vulnerable Zones (NVZs)
- Action Protection of wetland systems

Evaluators do not examine each action of AEMs separately. Reducing pressures on natural resources (soil, water, air) from intensive agricultural activities by supporting sustainable farming systems contributes to protecting the environment.

216 Support for non-productive investments

The only non-productive investment that is funded is the restoration of terraces, which concerns commitments from the previous programming period. The restoration of terraces aims to improve the environment, biodiversity, soil and water quality.

221 First afforestation of agricultural land

The expansion of forest resources aims to prevent polluted runoff into water bodies, encouraging aquifer recharge and improving water quality.

226 Restoring forestry potential and introducing prevention actions

Forest fires can have disastrous consequences for the environment such as causing increased soil erosion and therefore degradation of water quality. For this reason suitable projects targeting flood and erosion control must be planned in order to protect and improve water quality.

Main policy measures in case study area (in terms of budget and uptake)

The scheme for reducing nitrate reduction from agricultural sources was implemented in three areas for the 2000-2006 period. These were the plains of Thessaly, the Lake Kopais area and the Pineios river area in the prefecture of Ileia. The scheme was designed to introduce or maintain nitrate-reducing farming practices concerning irrigated arable crops in areas with high concentration of nitrates in their groundwater or in NVZs under Directive EEC/91/676. Payments were made to farmers in order to apply nitrate-reducing farming practices described in the scheme methodologies found in the Greek Rural Development Programme, and in a special set of (Agri-environmental) Codes of Good Agricultural Practices (GAP). The stated objectives for the Nitrate Reduction Scheme are protection of water resources from exhaustion, restoration of quality of ground water and improvement in soil fertility.

Larissa is one of the four prefectures of Thessaly. It is mostly a plain area, where agriculture has been traditionally the main economic activity. The previous ‘coupled’ CAP commodity support schemes led the farmers to shift towards highly intensive cropping patterns, in which cotton predominated.

In Greece, the prefecture of Larissa is second (out of 52) in size and first in Utilized Agricultural Area (UAA). Larissa retains 164,000 ha of UAA out of which 28% is under agreement within the Nitrate Reduction Scheme.

Overview of available data sources

- Number of beneficiaries, area under agreement and amount of support (Source: RD Management Authority and payment authority, Annual data).
- Spatial information on land parcels both under the measure and not, as well as their crop cover (Source: IACS , Annual data).
- Soil maps of the area.
- Special action plans for Nitrate Vulnerable Zones.
- Hydrographic maps.
- Regional plan for water management in compliance to Water Framework Directive (WFD) (not approved yet).

The plain of Thessaly is one of the three most significant areas in terms of budget and uptake where the agri-environmental action for the improvement of water quality is implemented. Since primary water quality data at catchment level originate from a multiplicity of sources, various data mining methods will be used and tested. A simple biophysical and scaling-up method will be applied for the micro- and macro-level assessment respectively, comparing participants and non-participants before and after measure implementation in terms of counterfactual analysis.

3.4 Hungary

3.4.1 Soil functionality and Biodiversity / Wildlife

Case study area

Heves-Plain is a 61,000 ha area in the North of Hungary, of importance for nature conservation supporting bird species such as the great bustard (Otis tarda) and Imperial Eagle (Aquila heliaca). Due to its importance for nature, it was included in the NRDP agricultural scheme system for High Nature Value Areas (HNVA) in 2004, and it includes some Natura 2000 sites, specifically four Sites of Community Importance (SCI) and one Special Protection Area (SPA). Most of the area is under intensive agricultural use.

Applied key criteria for the selection

- Scope and implementation of the selected measures: Heves-Plan is considered as one of the most successful HNVA areas in Hungary. The farmers participate in high-level AE measures aiming the protection of the great bustard. The total coverage of AE measures is 23,489 ha. The agri-environmental schemes have been available for the farmers in the case study area since 2002, while other measures mainly started in 2004 and in 2007. The long-term implementation of the measures also played a significant reason for selecting this particular case study area.
- Data availability: Data collection in terms of biodiversity started shortly after CAP measures were implemented in Heves-Plain. Data is available on common bird species, rare and colony nesting bird species, target species of HNV measures (great bustard, red-footed falcon, imperial eagle, etc.). Yearly crop rotation maps are also available for the territory. Soil sample results and the results of the TERRADEGRA project is planned to be analysed.
- Expert knowledge and previous experience: The available expert knowledge and the human capacity in the case study area shall be also taken into consideration during the selection procedure.
- Methodological considerations: The coverage of the relevant measures and the set of available data ensure the feasibility of the testing of the selected methods, and form a basis for the counterfactual analyses.
- Specific challenges to be addressed: The quality of the different types of data may require further investigation. In the case of agri-environmental monitoring data, some of the descriptive attributes are based on the farmers own estimation/sampling.

Monitoring data is mainly available from AE contracted areas, and further clarification is needed to use these data for evaluating other measures (spatial representativeness).

Selection of the relevant measures

Coverage of data is the most relevant attribute regarding the selection of the case study area. Relevant rural development measures for biodiversity in Hungary were defined based on:

- the aim of the measure
- the relevance of the measure details (eg. management prescriptions) for the public good concerned
- indicators related to biodiversity set in the Rural Development Plan

The results of the overview of the measures are the following:

Measures related to Soil and Biodiversity in Hungary	Soil	Biodiv.-Wildlife
114 Use of farm advisory services	x	x
121 Modernization of agricultural holdings	x	
125 Infrastructure related to the development and adaptation of	x	
212 Payments to farmers in areas with handicaps other than mountain	x	X
213 Natura 2000 and WFD payments on agricultural areas	x	X
214 Agri-environmental payments	x	X
216 Assistance provided to non-productive investments	x	X
221 First afforestation of agricultural lands	x	X
222 First establishment of agro forestry systems	x	X
224 Natura 2000 payments (forest)	x	X
225 Forest-environment payments	x	X
226 Restoring forestry potential and preventive actions		X
227 Non-productive investments	x	X
323 Conservation and upgrading of the rural heritage		X

Short description of the measures

114 Use of farm advisory services

The general objective of the measure is to enhance the competitiveness and performance of agricultural enterprises and forest holders, promote the sustainability of agricultural developments, and to provide advisory services on farm management. The measure also focuses on advisory activities linked to the elements of the cross compliance for the protection habitats and species. General environmental advisory activities and informational supports for AE measures are also available under this measure.

Total number of beneficiaries: 13,291

Number of supported farms with environmental related advisory activities: 3,021

121 Modernisation of agricultural holdings

The objectives of the measure can be grouped in line with the three main reasons of introducing the measure.

1. Modernisation of the agricultural production, upgrading the technological level of animal husbandry, horticulture and arable farming. The improvement of the efficiency and competitiveness of animal husbandry, the introduction of new technologies in order to improve product quality, the promotion of the use of information and communication technologies are also among the objectives of the measure.
2. The measure aims to contribute to the diversification of the arable sector based agriculture by promoting investments in horticulture and the production of biomass by the plantation of short rotation coppice for energy production. The current imbalance of the Hungarian agriculture, heavily weighted towards arable farming, can be mitigated this way.
3. The measure aims to ensure the compliance with the relevant requirements of the EU in the field of environmental standards, especially the requirements of the Nitrate Directive, animal welfare, food hygiene, manure storage. The focus is on the fulfillment of the requirements of the Nitrate Directive. Farms have been obliged to meet these requirements from the 1st of May, 2008.

Number of beneficiary farms: 9,432

125 Infrastructure related to the development and adaptation of agriculture and forestry

The objective of the measure is to improve the conditions and capacity utilisation of the facilities required for the provision of irrigation water in order to develop water and energy-saving irrigation management whereby farmers can reduce the harmful impact of the climate change. A further objective of the measure is to protect agricultural land by means of ameliorative interventions, to improve the efficiency of damage elimination and the retaining and storing potential of water reserves. An additional objective of the measure is to promote the use of biomass generated in agricultural holdings and biodegradable municipal waste for high efficient energy as well as to increase the exploitation of renewable energy resources, modernise heating systems, harness geothermic energy in greenhouses and establish the energy supply of farm-steads. The establishment of paved agricultural roads contributes to the development of agricultural logistics, historical wine-growing areas, and allowing better accessibility of farmsteads. The improvement of forestry infrastructure by the application of facilities made up of biological components make it possible to protect the forest soils against soil erosion, establish mountain entrapments, drain harmful waters and establish small

reservoirs in the forest if necessary. The basic condition of professional forest management is to ensure the accessibility of isolated forests by establishing forestry exploration roads.

212 Payments to farmers in areas with handicaps other than mountain areas

The main purposes of the measure are: development of a production pattern in accordance with the specific requirements of the production area, promoting extensive cultures (grassland and forage crops) on environmentally sensitive areas, enhancing environmentally conscious farming and sustainable landscape use. Furthermore, it includes the expansion and improvement of rural employment and income generation opportunities, development of a new, alternative rural economic environment, complying with the requirements of environmental protection, and ensuring the continuation of agricultural activities and the maintenance of agricultural land use on less favoured areas, as well as contribution to the preservation of viable rural communities are the main objectives of the measure.

Total area covered: 413,031 ha

213 Natura 2000 and WFD payments on agricultural areas

The main objectives of the measure are to preserve and sustain, by way of upkeeping environmentally sound land use methods, the favourable conservation status of the species and habitats listed in the respective EU legislation; ensuring the settings for the natural condition and for a management of creating and sustaining such a condition, protection of the species and of habitats in the designated areas (with particular regard to grasslands with high levels of biodiversity), as well as the enforcement of compliance with the rules of land use, in line with the provisions.

Total area covered: 267,067 ha

214 Agri-environmental payments

In a significant part of the country it is necessary to restructure land use and to take new, nationwide directions in terms of land use as well as to determine area priorities (e.g.: the restructuring of land use of areas threatened by floods and internal waters, the restoration of semi-natural management systems). Land is still at risk due to processes impairing the quality of soil and its production potential (erosion, acidification, alkalisation, soil compaction, negative nutrient balance), the low rate of environmentally friendly livestock management based on rough grazing, the lack of environmentally-conscious nutrient management, all of which impede the validation of sustainability.

In terms of nature conservation in all areas of agricultural land use (arable farming, grassland management, plantations), the target of the agri-environment payments is the development of an active nature conservation system by the establishment and preservation of diverse, semi-natural habitats, by the provision of adequate feeding, reproduction and resting places for animal and plant species which are valuable from a nature conservation aspect. The above-mentioned instruments for the preservation and enhancement of biodiversity primarily serve the protection and development of Natura 2000 areas.

Total area covered: 1,100,000 ha

216 Assistance provided to non-productive investments

The main objective of the measure is to conserve the rural landscape, to promote the sustenance of the individual value of the landscape, increase the richness in species of fauna and flora, improve the environmental condition, facilitate the fulfillment of the commitments made on a voluntary basis and increase public welfare in the areas of high natural value, specified in Natura 2000 and in the programme.

Number of beneficiary farms: 623

221 First afforestation of agricultural lands

The main aims of the measure are to increase the forest cover of the country, increase the environmental protection, social, public welfare and economic role of forests, improve the level of employment in rural areas by developing the forestry sector, enable the agricultural restructuring by alternative use of areas. Objectives of forestry also include the establishment of high biodiversity natural forests, through a substantial increase in the ratio of indigenous tree species, particularly in protected areas. An environmental development objective is to enrich biodiversity by establishing close-to-nature forests, to preserve the natural components of the rural landscape, and to facilitate appealing landscape appearance. The whole area of afforestation contributes to protection against erosion (water or wind) and climate change mitigation. The approval procedure of the afforestation plan ensures that no afforestation can be implemented which has a negative effect on the environment.

Total area covered: 19,050 ha

222 First establishment of agro forestry systems

The agro-forestry systems are extensive land use systems where forest and agricultural activities are pursued simultaneously; thus a mosaic of agricultural and forestry systems is

created. Agro-forestry systems are of great ecological, landscape and social value since they combine extensive agricultural and forestry systems aimed at the production of excellent quality wood and other forestry products. Grazing forests have a long tradition in Hungary. This measure provides the opportunity to introduce new land-use systems. From a farming point of view, introducing agro-forestry systems in certain special regions of Hungary (floodplains, regions of threat to wind and water erosion) is expected to achieve major positive environmental effects.

Total area covered: 594 ha

224 Natura 2000 payments (forest)

The support under this measure is to be granted to foresters who suffer from particular disadvantages in the areas concerned as a result of the implementation of Birds and Habitats Directives, when compared to the advantageous position of foresters in other areas.

The compensation under this measure is to help address the specific disadvantages and to contribute to the effective management of Natura 2000 sites and to ensure the minimum of protection of those sites.

Total area covered: N.A.

225 Forest-environment payments

The measure contributes to the fulfillment of the obligation undertaken in Göteborg in relation to the reversal of the decrease of biodiversity until 2010, to the aims of the Water Framework Directive and to the aims related to the mitigation of climate change defined in the Kyoto Protocol.

Total area covered: 14,289 ha

226 Restoring forestry potential and preventive actions

The objective of the measure is to mitigate and terminate the factors threatening the fulfillment of society's welfare, leisure time and environmental needs, and to prevent and abolish abiotic and biotic damage, thus contributing to the conservation and increase of biodiversity. Another objective is to decrease the risks related to forest management, to prevent and stop the damage that threatens the ecological and welfare functions of the forests. The forests' multifunctional existence has to be safeguarded for society. Another important objective is to reduce the risk of private forest holders, short of capital, increasing levels of

production from forests and thus diminishing the public goods and services of the forests; equally it is very important to prevent and terminate forest damage.

Number of beneficiary forest holders: 413

227 Non productive investments

The aim of measure is the provide an appropriate rate of composition, the creation of multilevel stand structures in the forest, to improve the natural character, biodiversity and health of the forests. It is also very important to maximise profit for the people without damaging the forests and by utilising the given characteristics of the habitat. The investments ensuring the social welfare services of forests contribute to the deepening of the relationship between society and the forests. In the future where the distance between the people and forests will grow, these linkages will be even more important.

Number of beneficiary forest holders: 53

323 Conservation and upgrading of the rural heritage

323.2 Preparation of Natura 2000 management plans

The aim of the measure is to contribute to the conservation, development and the sustainable utilisation of natural values in rural areas.

Total area covered: N.A.

Most relevant policy measures identified

The shortlist of relevant measures were defined based on:

- the estimated causal linkages between the measure and soil/biodiversity issues
- the uptake of the measure
- estimated data availability
- possibility for detailed evaluation of impact

The shortlist of measures are:

Measures related to Soil and Biodiversity in Hungary	**Soil**	**Biodiv.-Wildlife**	**Area (ha)**
212 Payments to farmers in areas with handicaps other than mountain	x	x	8 898
213 Natura 2000 and WFD payments on agricultural areas	x	x	6 948
214 Agri-environmental payments	x	x	23 489
216 Assistance provided to non-productive investments	x	x	n.a.
221 First afforestation of agricultural lands	x	x	n.a.
224 Natura 2000 payments (forest)	x	x	n.a.
225 Forest-environment payments	x	x	n.a.

Spatial focusing

Case study area selection process is partly based on the spatial analyses of overlaps between the areas covered with the shortlisted measures and the coverage of monitoring systems providing environmental data. The map below shows the coverage of the relevant measures and the network of different environmental monitoring systems.

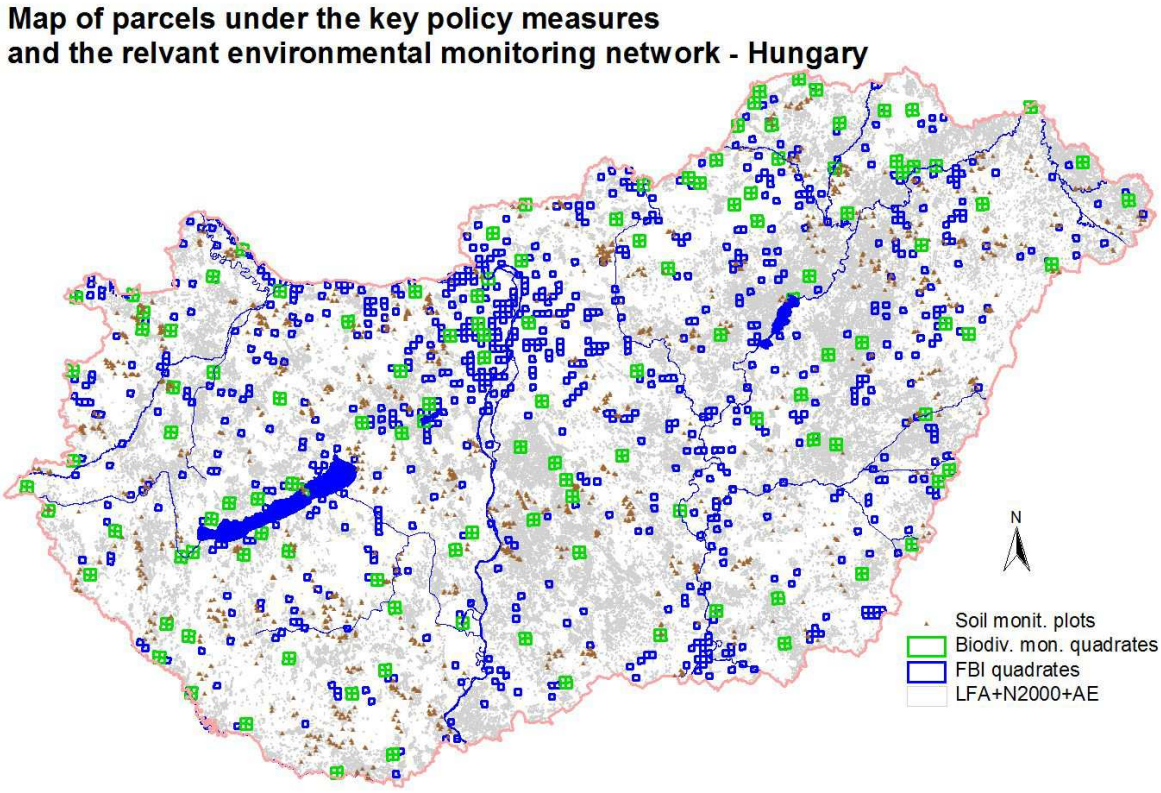

Figure 2 Map of parcels under the key policy measures and the relevant environmental monitoring network for Hungary

Case study area selection shall also take into consideration the additional information in candidate case study areas. In this regard SZIE focuses on those areas where detailed biodiversity monitoring was carried out in the last decades, and also provides a reasonable possibility for soil quality analyses. See also chapter "Applied key criteria for the selection".

Overview of available data sources

As one of the main determining factors for the impact evaluation of the environmental performance of the Rural Development Programmes is the data availability, an overview of the available data sources is evitable for the selection of the case study areas. The available data sources are:

Type of data	Data origin	Geographical scale
IACS	Paying Agency	Farm level (universe)
FADN	Research Institute for Agricultural Economincs	Farm level (sample)
LPIS data	Paying Agency	Parcel level
Monitoring data of common bird species	BirdLife Hungary/MME	2,5x2,5 km quadrates partially overlapping with case study area
Monitoring data for biodiversity	National park directorate/Local NGO	Representative sampling of case study area
Retrospective spatial map for crop rotation	National park directorate/Local NGO	Case study area
Soil quality data (TERRADEGRA)	Institute for Soil Sciences and Agricultural Chemistry	Representative sample for the case study area
Agri-environment monitoring data	National Food Chain Safety Office	Farm/parcel level

The overview map for the case study area is below.

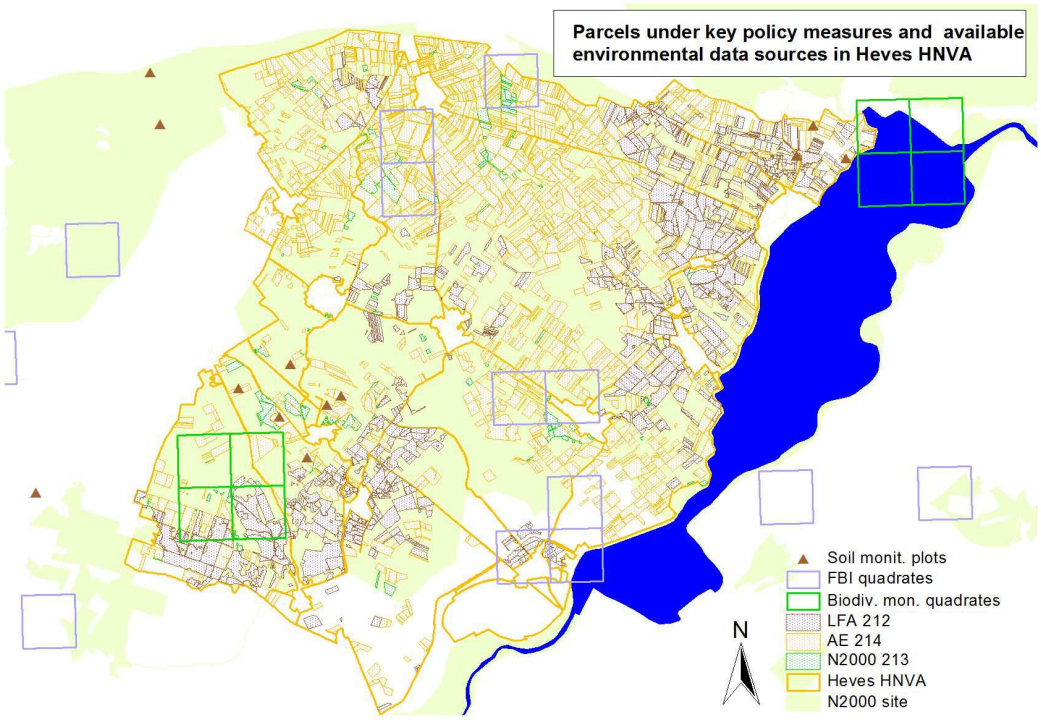

Figure 3 Overview map for the Hungarian case study area

3.5 Italy

3.5.1 Climate stability

Case study area: Veneto Region

Veneto Region is located in North East of Italy; it stretches from the Alps to the Adriatic sea, with a coastal strip of about 150 km in length and more than 5 million inhabitants. According to Corine Land Cover (CLC) data, the regional area is 1,841,440 ha (6% of Italian territory). The territory is 56% low-lying, 15% hilly and 29% mountainous. Veneto Region is located within the Po Valley, one of the most intensive agricultural areas of Italy. According to the last agricultural census data (provided by ISTAT, 2010), the regional UAA amounts to 811,440 ha. There are around 120,000 regional farms, with approximately 75,000 employed units (2012). The regional food industry pays an important role in the national context. There are more than 6,600 agro-industrial firms, which employ 49,300 units. Main agro-industrial sectors are dairy, meat processing and pasta making. Forestry is a relevant economic activity in mountains and in some areas along the Po valley (e.g. poplar production). Climate stability is a very challenging issue, due to the intensification of agricultural practices, leading to increasing emissions.

Veneto: 5.9% of national UAA; 11% of agricultural gross output

Figure 4 The Italian case study area – Veneto region

Applied key criteria for the selection

- Experience and expertise in project team and evaluators: The selection of the Region has been mainly based on the experience of the project team and stakeholders about climate stability and environmental issues in the region.

- Scope and implementation of key policy measure(s): Climate change is one of the environmental challenges of the new regional RDP 2014- 2020, due to the high level of emissions derived from farming activities. RDP pays serious attention to strategies to decrease GHG emissions.
- Data availability: Most of the available data will require information included in the on-going evaluation 2007-2013, in which data processing has been developed.
- Methodological considerations: the proposed methodology - Carbon Footprint (CF) - measures the environmental impact of human activities on climate at macro and micro scale, taking account of GHG expressed in carbon dioxide equivalent. CF evaluates the CO_2 emissions to specific 'systems' (e.g., single production process or a single product) and requires information about all products used in the production process.
- Specific challenges to be addressed: The current methodology adopted by the RDP evaluator is based on partial quantification that does not take into account the overall impact of the measures on climate stability.

Most relevant policy measures identified for climate stability

Specific goal of the RDP is the GHG emission reduction, mainly to be achieved through the maintenance or increase of the carbon stock in the soil and the reduction of input and energy demand. The main measures are the following:

- 214 contain the main sub-measures for climate change, particularly:
  - 214 A - Increase carbon storage in woody biomass
  - 214 B - Preservation and storage of carbon in soil
  - 214 E - GHG emissions reduction; nitrous oxide from chemical fertilisers
- 221 (Increased renewable energy production)
- 222 (First establishment of agro forestry systems on agricultural land)

Main policy measures in case study area

State of implementation of RDP in Veneto Region (2007-2013)

Measures	**Expenditure 2007–2013**	**Share on programmed expenditure (in %)**
111	7.041.491	49%
112	44.392.041	90%
121	181.952.370	63%
123	76.923.899	99%
211	88.256.031	92%

214	113.267.281	76%
216	12.961.171	63%
221	13.802.039	80%
222	9.797	31%
223	770.636	72%
225	214.834	71%
226	3.367.422	22%
227	4.878.404	39%
311	15.070.512	56%
321	4.376.928	57%
323	1.593.144	28%
331	53.182	6%

Available data types and sources and resulting scope for case study testing:

CF requires data about a) the energy demand (total energy demand, energy cost for production and allocation) and b) the coefficients to convert the energy demand in CO_2 emissions. The challenge is to infer the results on the whole study area to assess the RDP impacts in terms of CO_2 emissions.

Regarding climate change data, the detail of the analysis within the measure for Veneto Region is not sufficient to retrieve the necessary data. The main challenge is to propose a method to evaluate the impact at micro and macro scale through a carbon footprint approach. Available data sources are listed in the following table:

Type of data	Data origin	Geographical scale
IACS	Regional Payment Agency	Farm level (universe)
LPIS for 1st and 2nd pillar beneficiaries for single measure	Regional Payment Agency	Parcel level (universe)
Agricultural Census	National Statistical Institute	Farm level (universe)
FSS 2007 and 2013 (after summer 2014)	National Statistical Institute	Farm level (sample)
FADN	INEA	Farm level (sample)
Land cover maps	LPIS and other sources (CLC classification)	Parcel level – LPIS (universe) Regional level - CLC (universe)
National Greenhouse Gas Inventory	IPCC	Regional and province level

3.5.2 Biodiversity HNV (wildlife)

Case study area: Emilia-Romagna Region

Emilia-Romagna Region is located in north-east Italy; stretching from the Apennines to the Adriatic Sea and covers a big part of Po valley. The regional territory occupies about 2,245,278 ha, and it is about 48% low-lying, 27% hilly and 25% mountainous. Population is about 4,430,000 inhabitants. The Po Valley is one of the most intensive agricultural areas in

Italy. Emilia-Romagna is a leader region within the Italian agricultural sector. There are about 73,000 regional farms and UAA is around 1.1 million ha. The agricultural sector increased its competitiveness through a deep structural reorganisation in the last decades, leading to highly specialised and innovative production. The agriculture sector has both strictly territorial roots, oriented in typical and high quality production, and industrial production for large-scale trades.

Figure 5 The Italian case study area – Emilia-Romagna

Applied key criteria for the selection

- Experience and expertise in project team and evaluators: The Region has been mainly selected on the basis of the experience of the project team and stakeholders with biodiversity issues related to the regional agricultural sector.
- Scope and implementation of key policy measure(s): Biodiversity is a relevant task within the regional agricultural policies.
- Data availability: Most of the available data will require information included in the on-going evaluation 2007-2013, in which methodology and data processing have been developed.

- Methodological considerations: Several research projects have been recently carried out and their outputs are successfully developed in RDP evaluation. The evaluator used the JRC methodology, based on the integration of CLC and Natura 2000 data. HNV farmland has been identified on the basis of two land use variables: a) Non grassland: a Shannon index for crop diversity ('crop rotation index') multiplied for an indicator of farming intensity ('management intensity index'); b) Grassland: an indicator for livestock density ('stocking density index'). Spatial analysis is the most suitable method for identifying HNV areas, based on overlapping layers derived by the values of selected indices on each area.
- Specific challenges to be addressed: The current methodology adopted by the RDP evaluator is only partially based on the criteria established at EU level for the identification of HNV farmland. Farming intensification and actual presence wildlife are not wholly assessed yet. A more comprehensive methodology will be applied to better identify HNV at farm and regional level.

Most relevant policy measures identified for Biodiversity HNV

- 212 Payments to farmers in areas with handicaps other than mountain areas
- 214 Agri-environment measures - Actions 6, 9, 10
- 222 First establishment of agro forestry systems
- 224 Natura 2000 payments (forest)
- 225 Forest-environment payments
- 226 Restoring forestry potential and preventive actions

Main policy measures in case study area

State of implementation of RDP in Emilia-Romagna (2007-2013)

Measures	Expenditure 2007–2013	Share on programmed expenditure (in %)
211	49,348,477	76.7%
212	8,142,097	78.5%
214	339,786,803	83.2%
216	2,877,924	29.4%
221	35,028,903	83.2%
226	5.200.441	72,8%
227	10,769,091	100%

Available data types and sources and resulting scope for case study testing

The Guidance Document for the Application of the HNV Impact Indicator points out that low intensity farming is the most effective feature in preserving biodiversity. Semi-natural vegetation is also crucial; however its reduction can be compensated by crop diversity. HNV farmland aims to identify the agricultural systems in which animal and vegetal species are located, leading to a high value of biodiversity. Four elements of farmland have been identified:

- 1. High crop diversity
- 2. Low intensity farming
- 3. Presence of semi-natural vegetation
- 4. Presence of wildlife

Type of data	Data origin	Geographical scale
IACS	Regional Payment Agency	Farm level (universe)
LPIS for 1st and 2nd pillar beneficiaries for single measure	Regional Payment Agency	Parcel level (universe)
Agricultural Census	National Statistical Institute	Farm level (universe)
FSS 2007 and 2013 (after summer 2014)	National Statistical Institute	Farm level (sample)
FADN	INEA	Farm level (sample)
Land cover maps	LPIS and other sources (CLC classification)	Parcel level – LPIS (universe) Regional level - CLC (universe)
Bird census data for AE target species	National Rural Network & LIPU (Italian Association for the Protection of Birds)	Farm level (sample)

3.6 Lithuania

3.6.1 Biodiversity wildlife

Case study area (Option 1): Šilutė region municipality

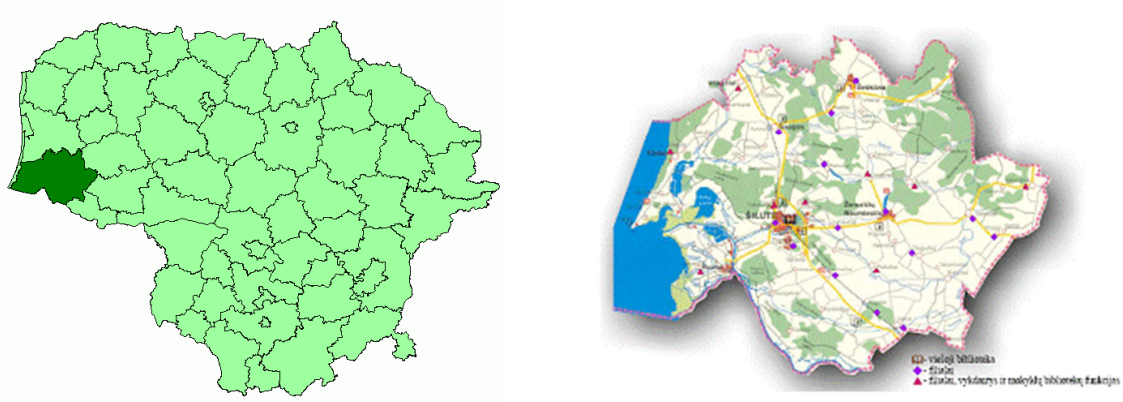

Figure 6 Location maps of Lithuanian case study area - Šilutė region municipality

The territory is located in the western part of Lithuania and overall covers 170600 ha. Half of the territory is covered by Utilized Agricultural Area (UAA), while the remaining area is covered by forest (22%), water bodies (20%), road and other infrastructure (3%), and other land use (5%). Grasslands cover 38% of UAA (which is comparatively high proportion; Lithuanian average is 21%). Since 2009 a clear trend has been observed of an increase in arable land caused by turning grasslands into arable land (impact of CAP support). However, a still relatively large proportion of grasslands could be explained by specifics of the region geographic location causing vast annual floods – it is located on the largest Lithuanian river (Nemunas) delta and bordering to the Curronian lagoon. Annual floods cover approximately 40 % of UAA; therefore the area is assigned as 'less favorable territory' and is eligible for 212 measure. Due to floods as well as being a specific location on the bird migration route, the area is recognised among the most important bird territories around the Baltic sea. Around 300 different bird species can be found here, 170 of them are breeding in the area. The area includes several Natura 2000 territories, where the most significant and agriculture landscape related is Nemunas Delta regional park (covering 28 870 ha).

The area does not represent "typical Lithuanian average" due to main following features:

- Relatively high density of grasslands (38% of UAA)
- Annual flooding of the area (40% of UAA)

- In the river might the area is specific by its high fertility of alluvial meadows and mild climate, which influences to specific features for farming (e.g. grasslands harvested 3 times in a year, mild climate cause early harvest of vegetables).

Due to specific features of the area, it does not reflect typical Lithuanian situation, therefore it might not qualify as good case study. However, if the objective of the case study is not evaluation result, but applicability of the methodology, the area could be a goo case study as it is one of the most researched areas in Lithuania (still systematic observations are lacking).

Applied key criteria for the selection:

- Working experience and expertise of the project team in the area;
- Available direct contacts with farmers, regional authorities;
- Available different type of data in some pilot areas (up to 700 ha territories), some biological data are very detailed on farm level;
- The area is exceptionally important from biodiversity conservation point of view, especially with regards to breeding and migratory birds.
- The area is inhabited in high density by Corncrake (Crex crex), which potentially could be a good new impact indicator for certain measures evaluation, therefore the area is good for testing such new methodologies;
- Specific challenges to be addressed: the assessment will face a big diversity of different data, however potentially data gathering locations will be very fragmented and thus could provide a challenge for evaluation on the bigger scale than individual farm level. It might also be a challenge to have appropriate number of sites where data availability and agri-envinmental measures application is matching.

Case study area (Option 2): Dovinė river basin

The area is located at the South-west of Lithuania in Alytus, Marijampolė and Lazdijai districts. The area is covering 58 870 ha and most of land-use is agriculture. The land use of the area is distributed as following: cultivated arable land (46%), meadows and pastures (18%), forest (14%), peat bogs and marshes (13%) and other land-use (5%).

Figure 7 Dovinė river basin

The area's land-use structure and farming practices are very typical to Lithuania. This area has special importance for biodiversity due to Žuvintas shallow lake and surrounding wetlands. Žuvintas biosphere reserve is established in the area in the begining of the 20th century – one of the first protected areas in Lithuania (holding RAMSAR, UNESCO status). Due to long conservation history the biosphere reserve area (where grazing and mowing activities are allowed) has good quality data on biodiversity and other environmental monitoring. However, large numbers of farmers are not expected (932 inhabitants lives in the territory of the reserve) in the sites where more solid data is gathered.

Applied key criteria for the selection:

- The area represents typical Lithuania agricultural landscape and farming practice.
- Good cooperation with biosphere reserve and scientists/experts worked in the area (potential of stakeholder advice and data sharing).
- The area is highly important for biodiversity; there is long research history and thus good data availability on biodiversity and its trends.
- A foreseen challenge is the mismatch of available environmental data with applied RDP measures at farm level.
- The case study will test different scaling and matching methods to contribute to the creation of a consistent database for environmental evaluations. In addition, long term impacts can be assessed.

Most relevant policy measures identified for biodiversity (wildlife and HNV) in all case study areas:

- 212 Payments to farmers in areas with handicaps other than mountain areas
- 213 Natura 2000 and WFD payments on agricultural areas
- 214 Agri-environment measures
- 221 First afforestation of agricultural land
- 223 First afforestation of agricultural and abandoned land
- 224 Natura 2000 payments (forest)
- 225 Forest-environment payments
- 226 Restoring forestry potential and preventive actions
- 227 Non-productive assessments

Main policy measures in case study area (in terms of budget and uptake)*:

Measure	Spending 2007 – 2013 (in million Euro) Šilutė case	Share on total spending (in %)
212	324	5.03%
213	1.7	26.47%
214	266	0.99%
221	48.9	4.01%
223	68.5	0.00%
224	2,2	0.05%
225	1.7	0.00%
226	6.7	4.33%
227	10	0.70%

***Note:** the data on spending for Dovinė river basin case study area (option 2) is not illustrated as the area is located in three administrative areas. Therefore illustrated data may not be calculated accurately for the selected area.

Available data types and sources resulting scope for case study testing:

Type of data	Data origin	Geographical scale
IACS	Paying Agency	Farm level (universe)
HNV assessment GIS data	Ministry of Agriculture	National level
National landscape management plan, baseline assessment of 2013 (GIS data)	Ministry of Environment	National level
Farm data on land use	Agriculture and rural business centre	Farm level (universe)
Land Parcel Information System (LPIS-GIS data)	Agriculture and rural business centre	Farm level (universe)
CORINE database	Environmental protection agency	National level
Vegetation community mapping 2011, 2013 (GIS)	BEF	Farm level (sample, areas size 100-700 ha)
Aquatic warbler monitoring data (several areas), GIS	BEF	Farm level (sample)
Great snipe inventory data	BEF	National scale, farm level
Hydrological monitoring data GIS	BEF	Sample area
Contact information to farmers	BEF	Farm level, sample area only in Šilutė case (option 1)
Annual biodiversity monitoring program	Environmental protection agency	National scale
Farmland bird index data (since 2006 annually gathered data)	Lithuanian ornithological society	Sample sites at farm level
National EU protected habitat inventory GIS database (to be at least partly available in end of 2014)	Nature Research Centre, Institute of Botany	National scale, farm level
Abandoned land register	Ministry of Agriculture	National scale, farm level
Cattle register	Ministry of Agriculture	National scale, farm level

We intend to examine the potential farmland bird index data to apply at farm level. A wide set of supplementary data will be used for cross-checking if initially used data sources and applied methods deliver objective results. In addition, methods will be closely linked to the

available regular data-gathering systems at national scale e.g. biodiversity monitoring. Analysing the potential of this data will consider using certain flagship species, such as Corncrake (Crex crex) to be used as an indicator.

3.6.2 Biodiversity HNV

Case study area:

Lithuania whole country territory (on macro level), with particular pilot areas on micro level, which will be selected in coordination with (a) case study area of Biodiversity (wildlife) as it is close related, and (b) depending on micro level data availability.

The contribution of the agriculture sector and its related services to the national economic development trends for 2006-2010 period was on average 2.83% of gross domestic product (GDP) in Lithuania.

Structure of agriculture by gross agriculture output illustrates that the sector is almost equally divided into crop (2006-2010 average – 53%) and animal (2006-2010 average – 47%) production. However trends illustrate that the animal production share is slightly decreasing. Such trend from a longer time perspective is also confirmed due to the fact that, between 1993 and 2010, the amount of cattle more than halved. Such trends impact not only on the economy sector, but also on environmental condition, particularly the decline in valuable grasslands. Concerning the future perspectives of the sector structure, agricultural policy will boost the increase of animal production due to its higher economic competiveness and better climate conditions in the country for such type of production.

With regard to the spatial dimension of the sector, agricultural land use covers 60.55% of land area in Lithuania; thus the sector is a major driving factor forming national landscape (forest covers 33%, inland water bodies – 4%).

Lithuania has quite an evenly distributed network of protected areas, which covers 10,230,000 ha (15.67% of the national territory). The majority of the protected areas (5 national parks and 30 regional parks) are operating as IUCN IV category, which means that agricultural activities are ongoing in most of the protected areas. Approximately 50% of the protected areas are overlapping with the Natura 2000 territories network.

Applied key criteria for the selection:

- The complexity of HNV and its quality is related not only to the individual sites, but also as networks having ecological connectivity and degree of habitat fragmentation; thus evaluation of HNV indicators in the larger area of network is more objective.
- The quality of HNV areas selection is not good. Therefore choosing individual sites might not provide favourable results.

- Taking the country as a whole gives the opportunity to evaluate how current nationally-collected data by different state monitoring programmes delivers information required for the evaluation of impact indicators.
- Data quality will be the main challenge considering following: missing HNV data at farm level; challenges of linking data among different databases (different coding systems, lack of GIS data); data relevance of pillar I.

Most relevant policy measures identified for biodiversity (wildlife and HNV) in all case study areas:

- 212 Payments to farmers in areas with handicaps other than mountain areas
- 213 Natura 2000 and WFD payments on agricultural areas
- 214 Agri-environment measures
- 221 First afforestation of agricultural land
- 223 First afforestation of agricultural and abandoned land
- 224 Natura 2000 payments (forest)
- 225 Forest-environment payments
- 226 Restoring forestry potential and preventive actions
- 227 Non-productive assessments

Main policy measures in case study area (in terms of budget and uptake):

Measure	Spending 2007 – 2013 (in million Euro)	Share on total spending (in %)
212	324	100
213	1,7	100
214	266	100
221	48,9	100
223	68,5	100
224	2,2	100
225	1,7	100
226	6,7	100
227	10	100

Available data types and sources resulting scope for case study testing:

Type of data	Data origin	Geographical scale
IACS	Payment Agency	Farm level (universe)
HNV assessment GIS data	Ministry of Agriculture	National level
National landscape management plan, baseline assessment of 2013 (GIS data)	Ministry of Environment	National level
Farm data on land use	Agriculture and rural business centre	Farm level (universe)

Land Parcel Information System (LPIS-GIS data)	Agriculture and rural business centre	Farm level (universe)
CORINE database	Environmental protection agency	National level
Farmland bird index data (since 2006 annually gathered data)	Lithuanian ornithological society	Sample sites at farm level
National EU protected habitat inventory GIS database (to be at least partly available in end of 2014)	Nature Research Centre, Institute of Botany	National scale, farm level
Abandoned land register	Ministry of Agriculture	National scale, farm level

The case study will test candidate methods proposed in ENVIEVAL deliverable D5.2. However, at the initial stage, we indicated the following potential challenges: assessment should be based on spatial data, but there is a lack of good quality, proper scale GIS data; GIS data on IACS are available only from the plots who participate in RDP, counterfactual can be determined only at large scale. The data on farm level does not necessary demonstrate impact to HNV; there are limited GIS data on forest clear-cuts.

3.7 Scotland

3.7.1 Soil quality and landscape

Case study area

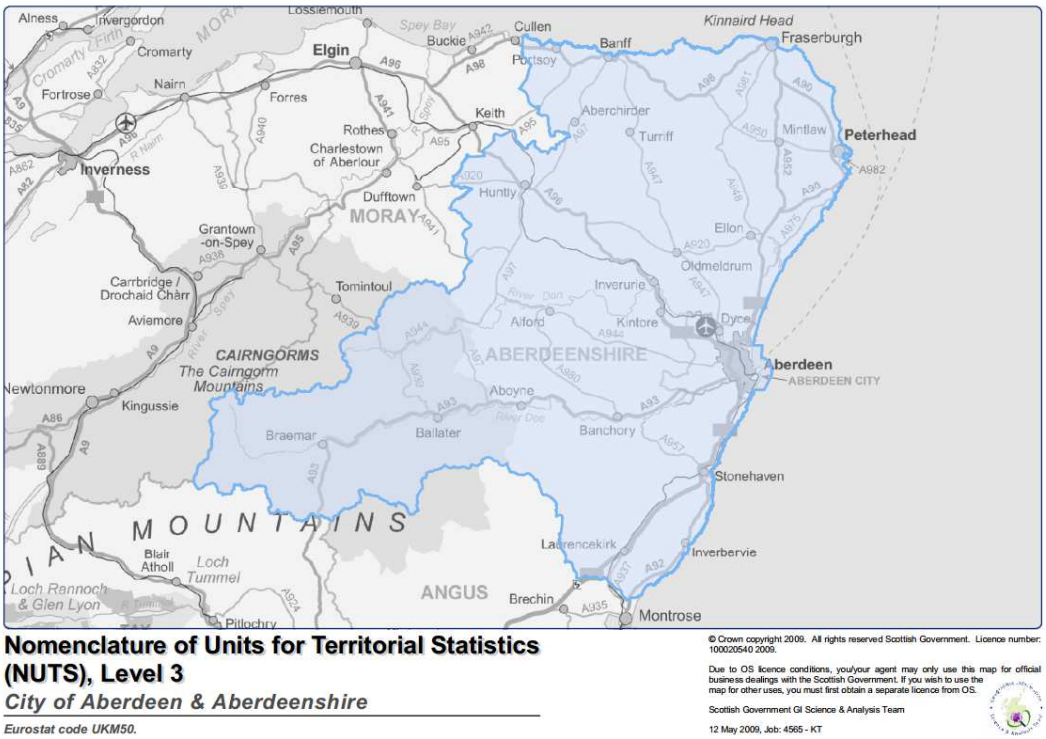

Figure 8 Scottish case study area Aberdeenshire

Grampian, the region of north-east Scotland broadly aligning with the NUTS 3 areas of Aberdeenshire and Aberdeen City (UKM50), has a total area of approximately 880,000 ha, and a population in 2012 of approximately 480,000. The principal land-cover types in the area (Eurostat, 2012) are grassland (30.2%), crop/arable land (24.3%), moorland/upland (23.2%), woodland (15.6%), artificial areas (3.2.%) and residential areas (3.5%).

The uplands to the west comprise areas with high conservation value (Cairngorms National Park), with High Nature Value Farming and land designated as LFASS, and good agricultural land in the central and eastern lowlands, and coastal areas. In 2010 the GDP per head was almost 40,000 Euros per annum, 17th highest of the 271 EU NUTS 3 areas. Agriculture, forestry and fishing contributed 0.8% of the GVA of the area between 2001 and 2010 (Aberdeen City Council, 2013).

There is evidence of farmed settlements for c. 8,000 years in this area, leading to evolutions in landscape character. The area has a diversity of soil types, from the Alpine soils of the mountain areas of the Cairngorms to the west, the peatlands of the uplands, to the alluvial

soils of the river valleys and coastal sandy soils. The agricultural lowlands of Aberdeenshire are predominantly Brown Forest Soils and Humus Iron Podzols, which are reflected in the Land Capability for Agriculture classes in these areas ranging from land capable of producing consistently high yields of a narrow range of crops to land suitable for grass or rotation with yields very variable and commonly below national average (Bibby et al., 1982).

The landscapes are diverse in their character (Environmental Resources Management, 1998; Cairngorms National Park Authority, 2009), with the principal lowland agricultural areas being referred to as the Agricultural Heartlands, which comprise intensive mixed farming with large and fertile fields. The Farmed Moorland Edge creates transition landscapes between the moorland plateaux and agricultural heartlands. The Moorland Plateaux are generally exposed mountainous areas, often with coniferous woodlands. In areas of Deeside (one of the two main river catchments), the landscapes are notable for their extensive cover of native woodland and mixed woodlands.

Grampian is one of the Scottish Government's Regional Proposal Assessment Committee regions (RPAC). These determine the Regional Priorities, which contribute to Rural Priorities and thus the Scottish Government's strategic objectives. Rural Priorities is an integrated funding mechanism to deliver targeted environmental, social and economic benefits and is part of the Scottish Rural Development programme (SRDP). Therefore, Government statistics will be available and reported at RPAC level.

Applied key criteria for the selection

- Experience and expertise in project team and evaluators: The use of this study area will build on a significant body of in-house expertise regarding landscape and soil research as well as spatial and multi-criteria analysis. The study area will build on ongoing research in relation to land use, ecosystem services, and catchment management (River Dee).
- Scope and implementation of key policy measure(s): Key measures for soil and landscape are 212, 214 and 221. Both public goods are expected to benefit from the activities under these measures; however the difference between upland and lowland farming systems may mean that both the activities and the impact are different. It is therefore important that a case study area includes both upland and lowland areas.
- Data availability: Primary data may be available on beneficiaries (farm visits, interviews and surveys); this requires confirmation from the evaluators. Access is

available to a set of relevant secondary policy, soil, land cover and landscape and farm databases (see below for an overview of available data sources).

- Methodological considerations for selection of case study area: The diversity of landscape and soils in relation to RDP eligible areas make this area suitable for testing the methodology for the assessment of RPD impact on the public goods
- Specific challenges to be addressed: The lack of indicators for assessment of effect of measures on both soil quality and landscape. In addition to the absence of an appropriate measurement, there is also a lack of evidence for the causal link between the RD measure and benefits to the public good.

Most relevant policy measures identified

Measure 212 Payments to farmers in areas with handicaps other than mountain areas

Measure 214 Agri-environmental payments

Measure 221/223 First afforestation of agricultural/non-agricultural lands

Main policy measures in case study area (in terms of budget and uptake)

Measure	***National* Budget (in €)**	**Share of total spending (in %)**	**No of supported holdings/ beneficiaries**	**Agricultural/forested land area supported (ha) (achieved at mid-term)**
212	393,269,046		13,000 (13,050)	3,370,000 (3,243,006)
214	232,613,670			2,020,000 (41,415)
221/223	217,182,616		500 (73)	6,000 (1,344.4)

Available data types and sources, and resulting scope for case study testing

Type of data	**Data origin**	**Geographical scale**
IACS	Payment Agency	Farm
Agricultural Census	National Statistical Institute	Farm Universe
Farm Structure Survey	National Statistical Institute	Farm Sample
FADN	DG Agri / National Institute in charge for data collection	Farm Sample
National Soil Inventory Scotland	The James Hutton Institute	Point observations at 10 km grid
Digital soil maps and soils characteristics for Scotland	The James Hutton Institute	1:25,000; 1:50,000; 1:63,360; 1:250,000
Countryside Survey	Centre of Ecology and Hydrology	National
Landscape Character	Scottish Natural Heritage; Cairngorms National Park Authority	National and Regional
Land Cover Map (LCM)	Centre of Ecology and Hydrology	National
Land Cover of Scotland (1988)	The James Hutton Institute	1:25,000
Ordnance Survey digital height models	Ordnance Survey	Spatial resolution: 10 m x 10 m; 50 m x 50 m
Ordnance Survey Mastermap (field boundaries and features)	Ordnance Survey	1:,1,250 to 1:10,000

Data for the case study area are comprehensive, using commonly available data sources. There is the opportunity to draw on data from research activities not available to the same extent in other areas of Scotland.

The data are predominantly spatial in nature, usable within a Geographic information System (GIS) and compatible with each other for certain types of analysis (e.g. overlays, summary tables) and presentation (e.g. maps). A summary of key strengths and weaknesses of each type of data is presented in Table 3. Of these strengths, the farm-level data are all collected as part of national or European requirements, and most of the available environmental data are available for entire case study area, in-house, and there is considerable experience of the use within the research team. Principle weaknesses relate to some datasets being samples rather than a census, and the range of geographic scales of data for some data types (e.g. soils), inconsistency between consultants compiling data (e.g. landscape character), and the dates of data collection or errors in classifications (e.g. land cover).

Summary of strengths and weaknesses for each dataset for case study area.

Type of data	Strength	Weakness
IACS	National requirement for data capture	Potential constraints on access
Agricultural Census	National requirement for data capture	Aggregation by administrative areas
Farm Structure Survey	National requirement for data capture	Sample
FADN	Requirement for data capture	Aggregation by post code/administrative area
National Soil Inventory Scotland	Data available and expertise in use	Sample point data
Digital soil maps and soils characteristics for Scotland	Complete coverage, data available and expertise in use	Scales of data available not consistent across case study area
Countryside Survey	Data available and expertise in use	Sample data
Landscape Character	Data available and expertise in use	Multiple consultants for character mapping across case study area
Land Cover Map (LCM)	Data available and expertise in use	Reliability of data classification
Land Cover of Scotland (1988)	Data available and expertise in use	Date of data collection
Ordnance Survey digital height models	Data available and expertise in use	
Ordnance Survey Mastermap (field boundaries and features)	Data available and expertise in use	

4 Summary and Discussion

Firstly, this section summarises the main policy measures and available data sources (across the different public good case studies). The main policy measures and available data sources in the case study areas inform the design of the public good case studies and the selection of the candidate methods to be tested in the case studies. Building on the summary and the information provided in the description of the main aspects of the case study areas, this section then discusses the scope of the selected case study areas to address the main evaluation challenges highlighting their strengths and potential constraint for the case study testing. The table below summarises the results of the selection of case study areas, with special regard to key policy measures identified and the available data sources.

Summary of the case study area selection

In each case the pre-defined parameters were studied which we consider highly important at the beginning of the case study process. With regard to the selection procedure the following summary for these parameters can be given.

Selection of the most important rural development measures

Rural development (RD) measures were selected mainly based on the causal relations between the public good and the respective RD measure. The amount of the area under contracts for each of the pre-selected key RD measures also played a particular role in the selection procedure.

As to our initial assumptions area based measures are expected to have the most significant environmental impact in most cases. In the case of some public goods (e.g. water quality, animal welfare and climate change stability) 1st axis RD measures might also have significant effects, such as Measure 121 (Modernization of agricultural holdings) in most cases.

Table 3 Summary table of public goods-case study areas - shortlist of key policy measures and available data sources

Public good	Country	Case study areas	Shortlist of key policy measures	Available types of data
Animal welfare	Germany	North-Rhine Westphalia	121, 215	IACS, Census, FADN, animal registration data, primary data on animal welfare indicators
Biodiversity HNV	Lithuania	Lithuania (whole country)	212, 213, 214, 221, 223, 224, 225, 226, 227	IACS, HNV assessment GIS data, National landscape management plan, Farm data on land use, LPIS-GIS data, CORINE, Farmland bird index data, National EU protected habitat inventory, Abandoned land register
	Italy	Emilia Romagna	214	IACS, LPIS, Agricultural Census, FSS 2007 and 2013, FADN, Land cover maps, Bird census data
Biodiversity Wildlife	Hungary	Heves-plain	212, 213, 214, 216, 221, 224, 225	IACS, FADN, LPIS data, Monitoring data of common bird species, Monitoring data for biodiversity, Spatial map of crop rotation, Soil quality data (TERRADEGRA), Agri-environment monitoring data
	Lithuania	Šilutė region/ Dovinė river basin	212, 213, 214, 221, 223, 224, 225, 226, 227	IACS, HNV assessment GIS data, National landscape management plan, Farm data on land use, LPIS-GIS data, CORINE, Vegetation maps, Aquatic warbler, and great snipe monitoring data, Hydrological monitoring data, Contact information to farmers, Annual biodiversity monitoring program, Farmland bird index data, National EU protected habitat inventory, Abandoned land register, Cattle register
Climate stability	Finland	Finland (whole country)	121, 123, 124, 211, 212, 214, 216	FADN, IACS, Data needed in Dremfia sector model, Data on ex-post period 1995-2012, Farm statistics data, CAP payment data, Use of inputs in agricultural production, Activity based cost models, acivity based unit cost calculations, Use of different feed stuffs per animal
	Italy	Veneto Region	214, 221, 222	IACS, LPIS, Agricultural Census, FSS 2007 and 2013, FADN, Land cover maps, National Greenhouse Gas Inventory
Landscape	Greece	Island of Santorini	125, 211, 212, 214, 216, 227, 321, 323	Number of beneficiaries, area under agreement and amount of support, IACS-Spatial data on land parcels, crop cover, Land use maps, Aerial photos, A survey at the local level for verification.
	Scotland	Grampian Region	212, 214, 221	IACS, Agricultural Census, Farm Structure Survey, FADN National Soil Inventory, Digital soil maps and soils characteristics, Landscape Character, Land Cover Map, Land Cover of Scotland (1988), Ordnance Survey digital height models, Ordnance Survey Mastermap
Soil functionality	Hungary	Heves-plain	212, 213, 214, 216, 221, 224, 225	IACS, FADN, LPIS data, Retrospective spatial map for crop rotation, Soil quality data (TERRADEGRA), Agri-environment monitoring data
	Scotland	Grampian Region	212, 214, 221	IACS, Agricultural Census, Farm Structure Survey, FADN National Soil Inventory, Digital soil maps and soils characteristics, Landscape Character, Land Cover Map, Land Cover of Scotland (1988), Ordnance Survey digital height models, Ordnance Survey Mastermap
Water quality	Finland	Southern Finland	211, 212, 214,	FADN including data on production inputs (nitrogen fertilizer + pesticide/herbicide expenses), IACS
	Germany	Lower Saxony	114, 121, 214, 323	IACS, Census, FADN, primary and secondary data on N and P indicators (farm and regional level)
	Greece	Thessaly	111, 114, 121, 125, 214, 216, 221, 226	Number of beneficiaries, area under agreement and amount of support, IACS-Spatial data on land parcels, crop cover, soil maps of the area, special action plans for Nitrate Vulnerable Zones, hydrographic maps, regional plan for water management in compliance to WFD

Data availability

Data availability of the relevant environmental and other circumstances, in general, is the most crucial point of case study area selection. Targeted data collections for the environmental monitoring of RD programmes, in most cases, cannot be considered complete. Therefore data collection from other monitoring systems and projects are of high importance across the different case study areas. Regarding data availability, partners considered the degree of detail and representativeness of the datasets beyond the requirements for

counterfactual examinations. Potential datasets to be used for the evaluations were presented in detail during the area selection process. Available data types and RD measures selected for the evaluation are summarised by public goods in Table 3.

Environmental and other parameters of the selected areas

Studying the environmental parameters had an important role in the selection process. Environmental assessment of the public goods with respect to the selected RD measures was undertaken. For example in the case of water quality diffuse pollution and intensive agricultural production sites in the selected study area, or the presence of valuable bird species in the area selected for examining biodiversity were assessed.

Beyond environmental parameters, the length of time from which RD measures are available in the area was also considered an important selection parameter by partners, as environmental impacts, in most cases, are perceivable after a certain amount of time, on the long run.

Scope of selected case study areas to address evaluation challenges

During the selection process partners focused on innovative approaches which contribute to existing challenges in RDP evaluations. In this context the selection of the case study areas also paid particular attention to data requirements of candidate methods for case study testing and existing indicator and data gaps and issues in RDP evaluations.

Overall, the coverage of RDP measures and available data inventory in the selected case study areas have the scope to contribute to the following specific methodological evaluation challenges:

1. Substitution effects in macro-level evaluations
2. Development of advanced counterfactual approaches with:
    a. consideration of external drivers to improve the assessment of net impacts
    b. carrying out alternative approaches to construct comparison groups where lack of data for non-participants is an obstacle
3. Development of suitable impact indicators to assess the impacts of RD measures on landscape and animal welfare
4. Improvement in the micro-macro linkage and net impact assessment
5. Examination of potential interactions and synergies of implementation of policy measures
6. Estimation and testing the usability of the relevant data originated from different sources and their consistent spatial integration

7. Underpinning of causal linkages between the RD measure and benefits to the public goods.

The selected case study areas with the set of their environmental circumstances, policy relevance in terms of RDP measures and the necessary descriptive data will provide suitable solutions for testing the new indicators and methodologies. For example, the case study areas provide a wide range of secondary data including data sets relevant for specific public goods such as landscape character data in Scotland and the Identification and Information System for Animals in Germany. In addition, data from farm surveys and environmental monitoring programmes are available. The available data provide sufficient scope for the testing of new impact indicators for the public goods landscape and animal welfare where currently indicators gaps constrain the evaluation.

In addition, the available data are also expected to provide sufficient scope to test innovative approaches for more complex designs of counterfactuals with multiple comparison groups, thus contributing to improvements in counterfactual development and the assessment of net-impacts. In cases where the data availability for comparison groups is limited or in cases where RD measures are taken up across most of the programme area, the applicability of alternative advanced methodological approaches (e.g. structural models) will be tested.

However, during the selection process partners have identified several parameters which might pose feasibility challenges in conducting the case study examinations. Among the methodological issues the problem of scale emerges in several cases. Previous methods and models are not capable in all cases of handling the spatial levels (parcel or farm level) of the measures under examination. Therefore new solutions are to be explored in some cases. These scaling constraints are predicted both in terms of methodological (indicator) issues and data availability. As a consequence, a particular emphasis will be placed on testing a range of different scaling methods and approaches (see for example also Deliverables D5.1 and D5.2).

A recurring problem during the assessment of data availability was the issue of lacking data or of inappropriate quality. A typical problem to be solved is lack of detailed and spatially representative patterns of data which pose a challenge to running counterfactual approaches (e.g. lack of control, non-measure areas or lack of appropriate data on environmental parameters) and also require a thorough expert assessment to the suitability of existing datasets to be used for such purposes.

With the proper selection of case study areas, however, we consider that most of these constraints can be handled. During the area selection procedure, all available parameters relevant for our purposes were considered; therefore in the selected areas the testing of the indicators and evaluation methods reviewed and identified in the methodological workpackages are expected to be deliver insights into the cost-effective application of new evaluation methods.

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