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Deliverable 2.2. Typical farming systems and trends in crop and soil management in Europe

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Report describing and map illustrating typical European farming systems

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Executive summary

This Deliverable 2.2 is framed into Work Package (WP) 2 titled “Current and future crop and soil management systems in Europe”. Main objectives followed by this WP2 are these:

- Identify key management practices affecting SOC flows and stocks and their applicability in various farming systems and agro-ecological zones in Europe.
- Define typical farming systems in Europe (geographical zones, management practices, residue management) and their effects on SOC flows and stocks.
- Develop scenarios of future crop and soil management systems in Europe for improved productivity and enhanced soil SOC sequestration.
- Identify farm and management systems at risk of low SOC flow and stocks under current and future climate.
- Evaluate scenarios of changed soil and crop management systems for a range of ecosystem services using the model tools under current and future climate in Europe.

Task 2.1 hopes to define key crops and soil management practices among the different European countries. Over the past decades agricultural practices in Europe have changed considerably from, for instance, a mixed, low productivity farming system with animals and crops towards systems with varying productivity of either animals or crops. These changes are driven by various economic, social and demographic factors and changes in consumer preferences and demand. Numerous technical improvements and agricultural extension services have facilitated the development of more intensive forms of agricultural production.

More recently, concerns regarding environmental sustainability and consumer health have lead to the resurgence of less intensive, forms of agriculture (including organic farming). It is to be expected that these changes in agricultural practices will continue into the future. Based on historical records of crop and soil management practices in Europe, trends have been developed and the appropriateness of extrapolating these trends into the future has been explored. In doing this, attention has also be given to European policies aiming at restructuring the European agricultural sector. Statistical data on historical and current agricultural land use have been applied to gain an overall European picture.

Deliverable 2.2 “Report describing and mapping typical European farming systems with the key crop and soil management practices and trends” addresses the different farming systems with specific and targeted crops and soil management that can be distinguished in Europe. These farming systems are changing, and will continue to change in the future. Therefore, it is necessary to identify and characterize a relatively limited number of typical

European farming systems with relevant crop and soil management building on work from previous projects.

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1. Introduction

This SmartSOIL report presents the typical farming systems. We first present a general analytical method and then develop the database and apply it over the EU-27 territory. Elements of the characterization of these typical farming systems include production systems and resources at the EU-27 level. In each agricultural region there may be a very large number of farming systems. This report could not cover all of them. Therefore, in our methodology, we provide a balance between the maximum number of farming systems that can be distinguished and the minimal number of systems that should be considered in order to obtain a representative view.

The farming systems characterized provide a broad overview of the different types of systems that are common in Europe. The characterization includes: geographical zones, spatial extent, productivity level and intensity of land and resource (fertilizer and manure) use, management practices, and residue management.

Farming systems play an important role in the global carbon (C) cycle (Hall et al., 1995). Crops and grasslands are key elements in mitigation. Here we consider only crop and grassland systems. Although livestock systems are not considered explicitly, they are included in this study since: (a) we consider mixed systems and (b) we consider grasslands that support animal production. In the EU about 20% of the agricultural surface is covered by grasslands.

Many aspects and data have been mainly collected from different SmartSOIL partners, official databases (as Eurostat) and also from MITERRA-Europe model for all EU-27 member states at regional (NUTS2) level (deeply explained before). Collected information includes, at NUT2 level, main farming system (largest occupied area), total farming area (UUA), farm profits – standard output, main soil management practices of the main farming system, use of management practices (%) based on areas relative to arable land, main cultivated crops, area of main farming system (ha and %), irrigated area, main crop yield in the main farming system, main limiting factor to attain potential production, nitrogen fertilizer use, climate classification, area of organic farming (% of total) and main soil type. Furthermore, some information about each secondary farming system (second occupied area) has also been collected. It includes the main crop in the secondary farming system, area of second farming system (ha), area of second farming system (% of agricultural area), main crop yield (kg/ha) of secondary farming system and farmer's formation level about soil management and GHG emissions.

We collected additional information from the 7 countries represented by the SmartSOIL partners that contributed to this Deliverable 2.2 (Netherlands, Denmark, Italy, United Kingdom, Poland and Hungary). A large effort was made in collecting data from the countries not included in the D2.2 team in order to cover the EU-27. This is a limitation of the data presented that is out of our scope of the work.

Following this introduction, Section 2 presents the methods, Section 3 presents the results, and Section 4 presents the analysis of all these variables with the aim of describing the most important farming system in the European Union. Special attention must be given to the variables about crops (main and secondary), standard output, soil management, yields and main limiting factor to attain potential production.

2. Methodology

2.1. Framework: the Miterra model

We collected data from the current farming systems in the EU-27. Part of the data is obtained from the case study teams in SmartSOIL. Other data were obtained from the MITERRA-Europe model for all EU-27 member states at regional (NUTS2) level (Figure 1). A further description of MITERRA-Europe can be found in Velthof et al. (2009) and Lesschen et al. (2011). In this document a description is provided for the indicators that are derived from MITERRA-Europe. Most of the activity data (e.g. crop areas) are based on Eurostat data from 2008. Part of the management data was derived from the Survey on Agricultural Production Methods (SAPM); see also Council regulation (EC) No 1166/2008, which was held together with the FSS in 2010.

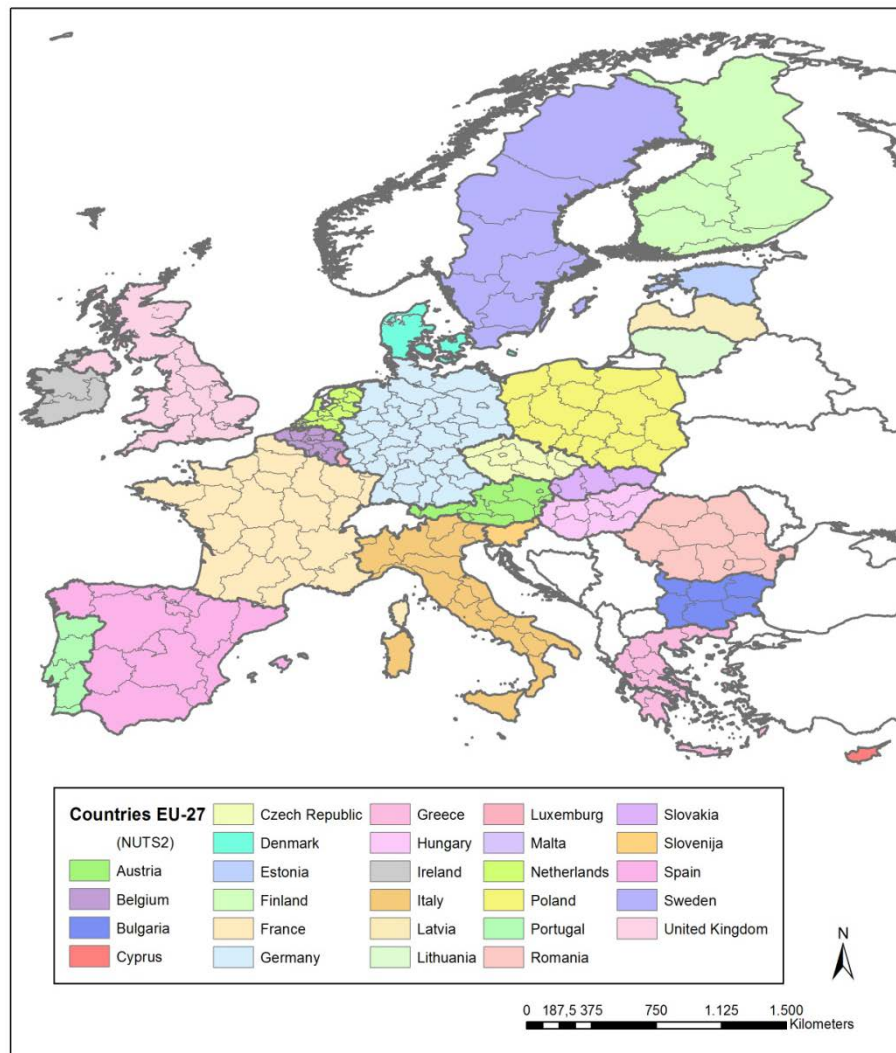


Figure 1. EU -27 member countries

The analysis has been done at the EU wide scale. However, the resolution of the data is not uniform, and some of the data are only available at the case study countries level. We cover in case studies countries at nuts 2 level Hungary, Poland, Denmark, Italy, Spain, United Kingdom, and Netherlands. The main limitations of the case studies are that some of the relevant agricultural regions of Central Europe (such as France and Germany) are not included in the project.

2.2. Steps

Here is a summary of the methodology with a total of 5 Actions identified in the text below:

- **Step 1:** A revised methodology was incorporated: responses of the case study region managers in the project about the potential data where possible, provided the source information and identified estimates where appropriate.
- **Step 2:** An approach was identified to analyse and assess how well our case study regions represent EU27 agriculture and present possible extensions in terms of regions that improve representativeness of EU27. Case study partners delivered information about their case study countries, which may be extrapolated to EU level.
- **Step 3:** Different teams were engaged to provide the EU-wide databases.
- **Step 4:** UPM engaged the case study managers in SmartSOIL to fill the Questions in the revised excel database and explained below from what they know about the case, from interviews with farm advisors or otherwise.
- **Step 5:** UPM proposed a possible indicator and the sources of data. What do we need to know on farming income, viability, what is key here and will be helpful to decide on measures to be taken up likely.

2.3. Data sources

The database was collected by means to completing the excel table prepared by UPM by each of the responsible partners for the case study regions and selected other regions where we think data would be available (included in the Annex).

Table 1 summarises the databases that were discussed during the meeting and the responsible partners for providing the data.

Table 1. Sources of information

Source of information	Responsible
UK - Farm Survey - From UK, the farmer practice survey is available at national level: http://www.defra.gov.uk/statistics/foodfarm/enviro/farmpractice/	SAC
EU - Farm Systems Survey - FSS (Farm Systems Survey EU)	UNIABERDEEN
EU - CCAT survey results, as policies/subsidies are drivers for farmers to uptake the measures	Alterra
EU - From LUCAS soil survey - Information about tillage and residues (what is seen on the field), however data are not yet available at point level, as there is discussion with the MS on the location availability at point level. DG Eurostat is the owner of this survey, and they should be asked for permission to use data.	JRC
EU – model - Alterra provided the data on the questions at EU level, based on MITERRA and other data sources (Eurostat, FAOSTAT, JRC)	Alterra
EU modelled – Calculation of data on farms and farm and soil management at EU27 NUTS-2 level. Alterra identified missing data and how to face filling.	Alterra
EU - Measures to climate change mitigation in agriculture Information on measures and activities across EU27 on basis of Smith et al. studies and IPCC AR4.	UNIVABER
EU - Farm Accountancy Data Network (FADN)	SAC

3. Results

3.1. Overview

The indicators in the database were presented as research questions (Q1 to Q21) regarding to typical farming systems and soil management practices. The results are described and mapped below and summarised in the following table.

Table 2. Indicators summary

Indicators	Description / Comment
Main farming systems.	We aggregate into six main farming systems: Field crops, Permanent crops, Pasture and grasslands, Industrial crops, Horticulture and Mixed farms.
Total utilized agricultural area (UAA).	Area is expressed in 1000 ha and is based on the sum of all crop areas, including rough grazing.
Farm profits – standard output.	SO is the average monetary value of the agricultural output at farm-gate price, in euro per hectare or per head of livestock.
Main soil management practices of the main farming system.	Main combinations of soil management practices relevant for soil carbon for the main farming system provided by partners for regions of case study countries.
Use of soil management practices based on areas relative to arable land.	Agricultural management practices relevant for soil carbon. The implementation level is expressed as the percentage of land under a certain management practice, compared to the total area of arable land.
Main crops in the main farming system.	The crop classification is based on the CAPRI crop types. These crops have been linked to the main farming systems.
Area of main farming system.	The area of main farming system is expressed in 1000 ha of the total utilized agricultural area (UAA).
Main farming system percentage of the total agricultural area.	The area of main farming system as percentage of the total utilized agricultural area (UAA).
Irrigated area.	The total irrigated area (in 1000 ha) was derived from the SAPM 2010 survey from Eurostat. The area that was irrigated at least once per year was used.
Crop yield in the main farming system.	The average crop yield, in kg of dry matter (DM) per ha, is provided for the main farming systems.
Main limiting factor to attain potential production.	The combinations of main limiting factors which attain potential production in the main farming system provided by partners for regions of case study countries.
Nitrogen fertilizer use.	The average nitrogen fertiliser use (kg N /ha), consisting of both animal manure and mineral fertilizer.
Climate classification.	We aggregate into five main climate zones: Boreal, Atlantic, Alpine, Continental and Mediterranean.

Organic farming percentage of the agricultural area.	The area of organic farming is expressed as percentage of the utilized agricultural area (UAA), and it excludes the farms in conversion to organic farming.
Main soil type.	Soil types from European soil database.
Secondary farming systems.	We aggregate into six secondary farming systems: Field crops, Permanent crops, Pasture and grasslands, Industrial crops, Horticulture and Mixed farms.
Main crops in the secondary farming system.	The crop classification is based on the CAPRI crop types. These crops have been linked to the secondary farming systems.
Area of secondary farming system.	The area of secondary farming system is expressed in 1000 ha of the total utilized agricultural area (UAA).
Secondary farming system percentage of agricultural area.	The area of secondary farming system as percentage of the total utilized agricultural area (UAA).
Crop yield of secondary farming system.	The average crop yield, in kg of dry matter (DM) per ha, is provided for the secondary farming systems.
Farmer's formation level about soil management and GHG emissions.	Identification of the average level of farmer's formation about soil management and GHG emissions using 5 categories: No knowledge; Low; Medium; High; Very high

3.2. Main farming systems

The farming systems have been derived from the SEAMLESS project (<http://www.seamless-ip.org>). In that project a classification was developed which distinguished 21 farm types, which could be further characterised by intensity (3 classes) and size (3 classes). A detailed description can be found in Andersen (2010). For SmartSoil we aggregated these 21 farm types into the following six main farming systems: Field crops, Permanent crops, Pasture and grasslands, Industrial crops, Horticulture and Mixed farms (Table 3).

Table 3. SEAMLESS farm types and grouping to main farming system

Code	SEAMLESS farm type	Main farming system
1	Arable/Cereal	Field crops
2	Arable/Fallow	Field crops
3	Arable/Specialised crops	Industrial crops
4	Arable/Others	Field crops
5	Dairy cattle/Permanent grass	Pasture and grasslands
6	Dairy cattle/Temporary grass	Pasture and grasslands
7	Dairy cattle/Land independent	Mixed farms
8	Dairy cattle/Others	Mixed farms
9	Beef and mixed cattle/Permanent grass	Pasture and grasslands
10	Beef and mixed cattle/Temporary grass	Pasture and grasslands
11	Beef and mixed cattle/Land independent	Mixed farms
12	Beef and mixed cattle/Others	Mixed farms
13	Sheep and goats/Land independent	Mixed farms
14	Sheep and goats/Others	Mixed farms
15	Pigs/Land independent	Mixed farms
16	Pigs/Others	Mixed farms
17	Poultry and mixed pigs/poultry	Mixed farms
18	Mixed farms	Mixed farms
19	Mixed livestock	Mixed farms
20	Horticulture	Horticulture
21	Permanent crops	Permanent crops

The farm types and farming systems can be expressed in number of farms or number of hectares. Data for Romania, Bulgaria, Cyprus and Malta is missing. Figure 2 shows the predominant farming systems in EU-27, they are field crops, mixed farms and pasture and grasslands. Some exceptions are found in regions of Netherlands with industrial crops or in regions of Spain and Italy with permanent crops. In Mediterranean regions, the most recent data provided by partners for regions of case study countries showed some differences

with the data used based on Eurostat regional and national statistics from 2008. Data provided by partners reflect a higher amount of permanent crops than Eurostat data, especially in Italy and Spain regions. The rest of countries of case study regions do not show changes in their typical farming system between sources of data.

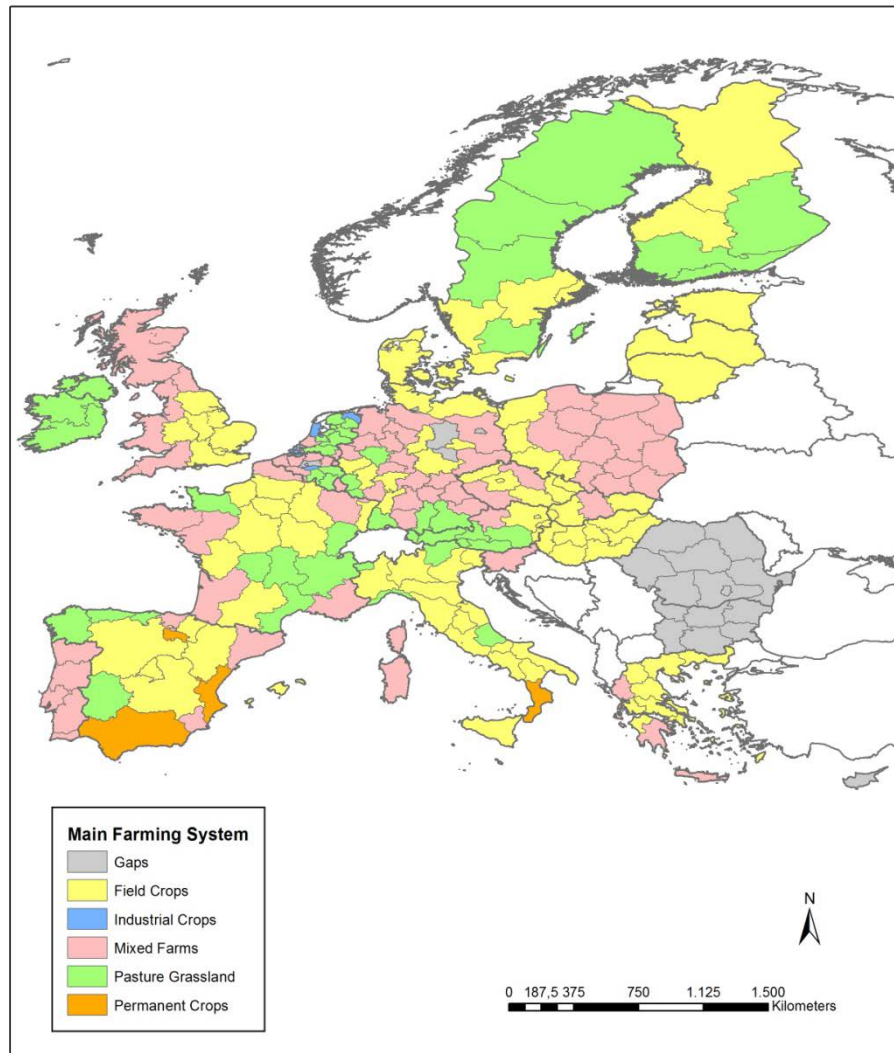


Figure 2. Main farming systems

3.3. Total utilized agricultural area (UAA)

Total utilized agricultural area (UAA) is expressed in 1000 ha and is based on the sum of all crop areas, including rough grazing. Data are derived from Eurostat (2008) regional and national statistics at the NUT2 level. Spain, Denmark, United Kingdom and Lithuania show the regions of largest agricultural extension in terms of hectares, followed by France, Ireland, Romania and Poland (Figure 3).

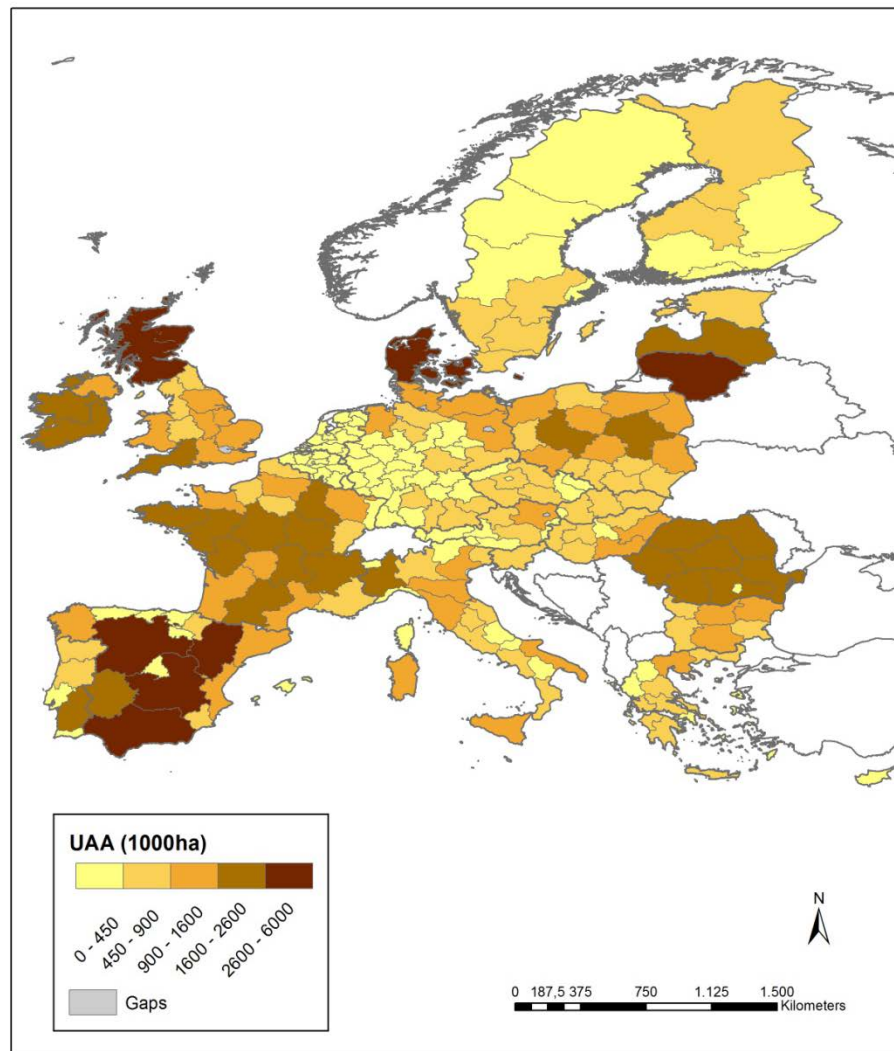


Figure 3. Total utilized agricultural area (UAA) in 1000 ha

3.4. Farm profits

Standard output is the indicator of the economy of farming business (€) from Eurostat regional and national statistics 2010. The standard output of an agricultural product (crop or livestock), abbreviated as SO, is the average monetary value of the agricultural output at farm-gate price, in euro per hectare or per head of livestock (Eurostat 2013).

As the Eurostat glossary (2013) explains the standard output is:

“There is a regional SO coefficient for each product, as an average value over a reference period (5 years). The sum of all the SOs per hectare of crop and per head of livestock in a farm is a measure of its overall economic size, expressed in euro.

Until 2007 the Farm structure survey (FSS) and the Farm accountancy data network (FADN) have used standard gross margin (SGM) to classify agricultural holdings by type of farming and by economic size (Commission Decision 85/377/EEC). In the FSS 2010 and onward this classification uses standard output (SO) instead. The principle of both concepts is the same; only the way they are calculated differs.

The main differences between SO and SGM are:

- *SO excludes direct payments;*
- *The fodder requirement in the case of some livestock characteristics is included in the calculation of the SO;*
- *The unit used to measure SO is the euro and not ESU (1,200 Euro) as in the SGM classification.*

Standard output coefficients used for typology are available in Eurostat database (code ef_tso|ef_tso ef_tso). The SO 2004 was calculated using the average of 2002, 2004 and 2005 prices. It is applied in 2007 Farm structure survey data and to earlier Farm structure surveys to allow comparability over the different time periods. The SO 2007 was calculated using the average of 2005, 2006, 2007, 2008 and 2009 prices. It is applied in the 2010 Farm structure survey data.”

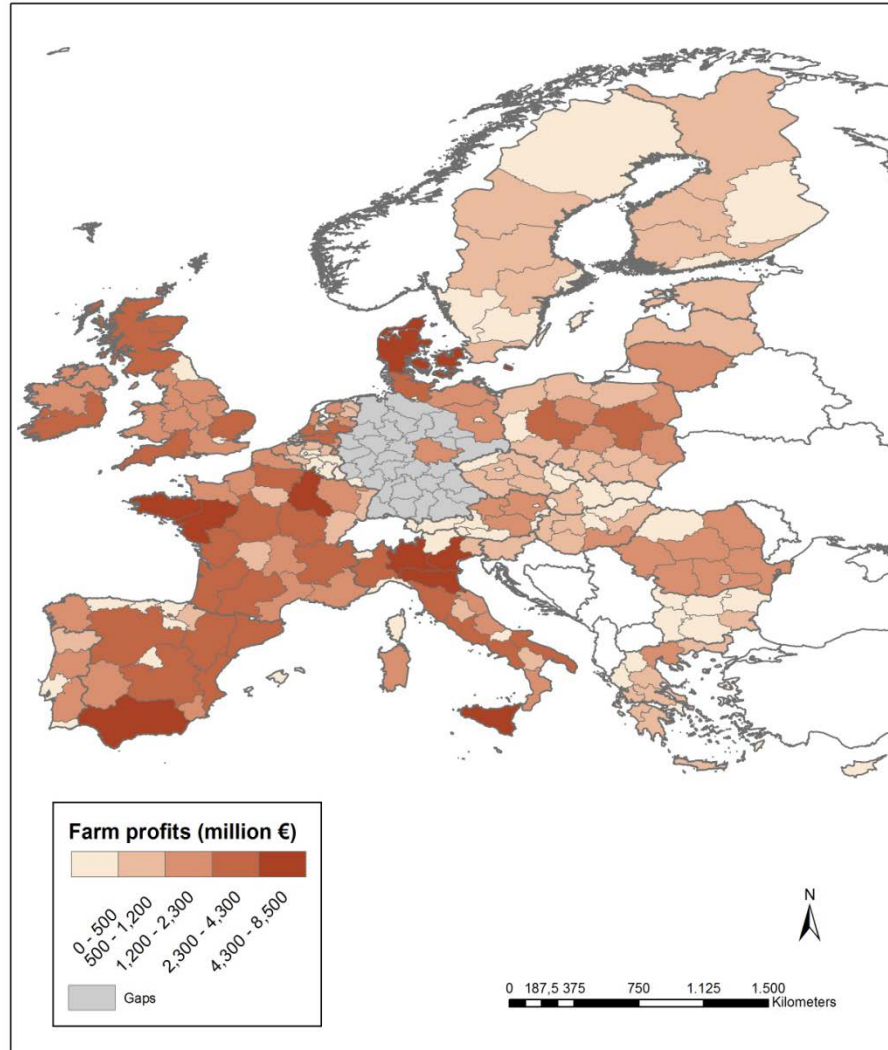


Figure 4. Farm profits: Standard output (SO) in million €

Most of standard output data for Germany regions are missing. The regions illustrating the greatest farm profits belong to Spain, Denmark, France and Italy. Others regions showing high farm profits are found in United Kingdom, Netherlands and Poland (Figure 4).

3.5. Main soil management practices of the main farming system

The following options represent the main management practices at the Nuts2 level.

- **Reduced tillage (RT) or Reduced tillage + Direct planting (RT+DP)**
Reduced tillage differs from zero tillage in that the soil is still tilled, but is disturbed less. Reduced / conservation tillage can take many forms including ridge tillage (in which ridges are made in the field), shallow ploughing and rotovation or scarification of the soil surface. All cause less soil disturbance than conventional deep tillage with a mouldboard plough (e.g. Smith et al., 1998). The mechanisms for GHG reduction are the same as those for zero tillage. The timing of tillage can also be taken into account as part of this measure. Autumn ploughing leaves fields bare over the winter, increasing the impact in terms of soil erosion, and in colder climates, N₂O emissions from freeze-thaw cycles (Kaiser et al, 1998; van Bochove et al, 2000). Spring ploughing may therefore reduce soil C losses and GHG emissions from tillage.
- **Conventional tillage (CT)**
Tillage labours made by traditional way.
- **Spontaneous catch crops (CC1) / Cultivated catch crops (CC2) / Cover or intermediate crop (CI)**
The provision of temporary vegetative cover between agricultural crops, which is then ploughed into the soil, is termed green manure / a catch crop. These 'catch' or 'cover' crops add C to soils (Barthès et al. 2004; Freibauer et al. 2004) and may also extract plant-available N unused by the preceding crop, thereby reducing N₂O emissions and reducing amount of fertilizer N that needs to be added.
- **Residue Management (RM)**
Residue management usually goes hand-in-hand with reduced / zero tillage. Residue incorporation, where stubble, straw or other crop debris is left on the field, and then incorporated when the field is tilled, is used in some areas for water conservation, but also enhances carbon returns to the soil, thereby encouraging carbon sequestration. However, as the tillage data shows, incorporation can increase N₂O emissions and therefore net benefits in terms of climate mitigation may be highest when residues with high N content are removed. Composting these residues and then returning them to the soil may reduce N₂O emissions in relation to incorporation untreated, while retaining benefits in terms of reduced requirements for mineral fertiliser (Velthof & Kuikman, 2000).

- Normal winter crop (WC).

The use is particularly referred to normal winter crop cover (e.g. winter wheat)

- Rotation and adding legumes (RA)

This measure consists in inclusion of different crop types in crop rotations (growing various crops on the same piece of land in a planned sequence) can considerably increase carbon sequestration. This includes (i) use of more forage crops in rotations (e.g. forage maize as an intermediate crop, in 4-course rotation at irrigation conditions, where maize occupies 3 consecutive fields); (ii) replacement of continuous two-course rotations of row crops with crop rotations of winter cereals; (iii) elimination of summer fallow; (iv) use of more winter crops; (v) winter cover crops (e.g. mixture of 50 % triticale + 50 % winter peas included in maize-wheat rotation; rye included in continuous maize; peas-oats mixture included in continuous potato; winter rye as a fore-crop winter cover in continuous tobacco; rye and triticale as forecrops in continuous tobacco; growing of a ryegrass catch crop in the autumn and winter after a cereal crop and before a spring cereal, etc). The measure is widely applicable for broad soil and climate conditions.

Adding nitrogen-fixing crops, such as beans, peas, soya, Lucerne, etc. to rotations of cereals reduces N fertiliser requirements and therefore related emissions, and increases SOC. Legumes can be included into cereal rotations as a separate crop, as a second crop (when the land would otherwise be bare fallow) or under the major crop.

- Spontaneous / Spontaneous Managed (cultivated by farmer)

Growing grass primarily for seasonal protection and soil improvement on orchards and vineyards where seasonal benefits of a cover crop are needed. Grass usually is plowed under or desiccated to accommodate the primary crop being produced on the site. This practice is used to control erosion, add fertility and organic material to the soil, improve soil texture, and increase infiltration and aeration of the soil. In orchards, this practice is also used to increase populations of bees for pollination purposes. Growing grass with fruit and vines can minimize erosion and non-point pollution and increase sequestration on cropland (Lal et al., 1999).

Figure 5 shows the main combinations of soil management practices for the main farming system. These data were only available and provided by partners for regions of the case study countries. These regions show how they are implementing different combinations of practices for their main farming systems, nevertheless conventional tillage remains as a common feature for all of them.

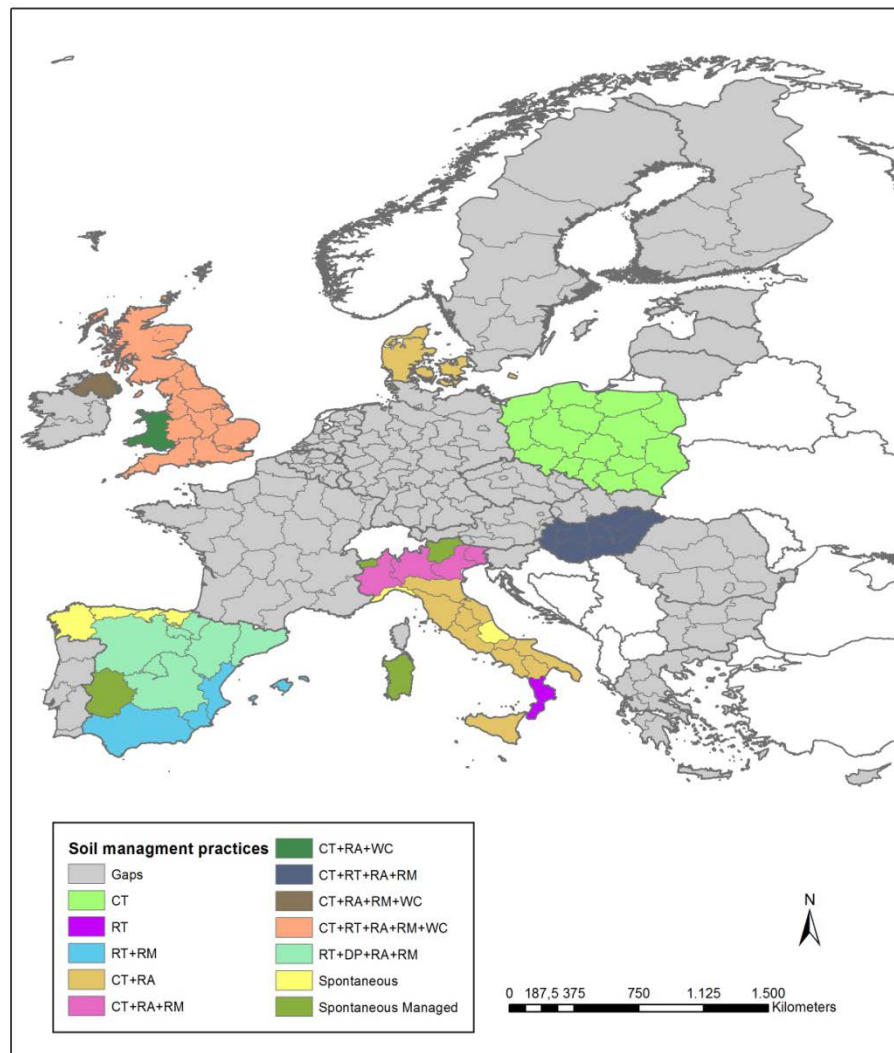


Figure 5. Main soil management practices of the main farming system

3.6. Use of soil management practices based on areas relative to arable land

From the Survey on Agricultural Production Methods, which was held in 2010, data on agricultural management practices relevant for soil carbon can be derived. The implementation level is expressed as the percentage of land under a certain management of practices, compared to the total area of arable land. Many of the soil management practices data for Germany regions are missing. We derived the use for the following measures at NUTS2 level:

- Conventional tillage as percentage of arable land (CT)
As mentioned before, conventional tillage is found to be the most common practice for all the regions. Many of the regions represented in Figure 6 show that they are implementing more than 60% of conventional tillage out of total arable land.

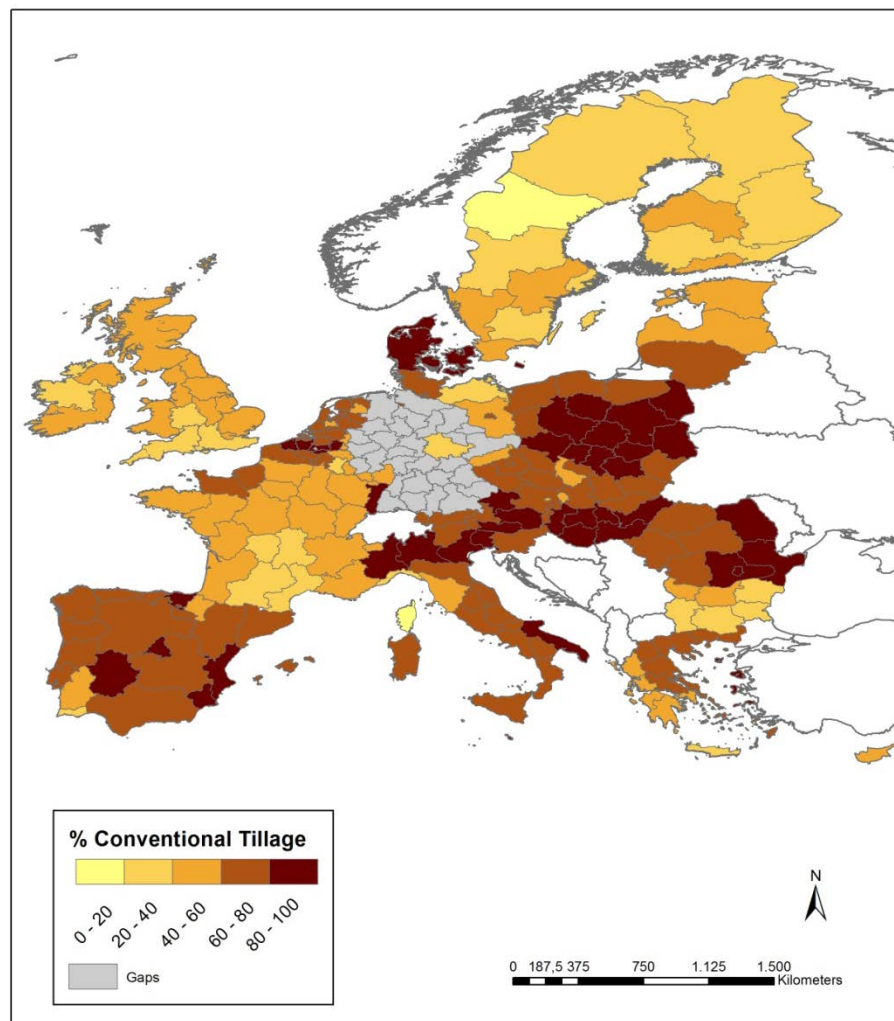


Figure 6. Main soil management practices: Conventional tillage as percentage of arable land

- Reduced tillage as percentage of arable land (RT)

Unlike conventional tillage, the soil management practice of reduced tillage is not extensively undertaken. Only Cyprus, Halle region in Germany and Severoiztochen region in Bulgaria are implementing approximately 60-80% of reduced tillage and no region is implementing more than 80% of reduced tillage out of total arable land (Figure 7).

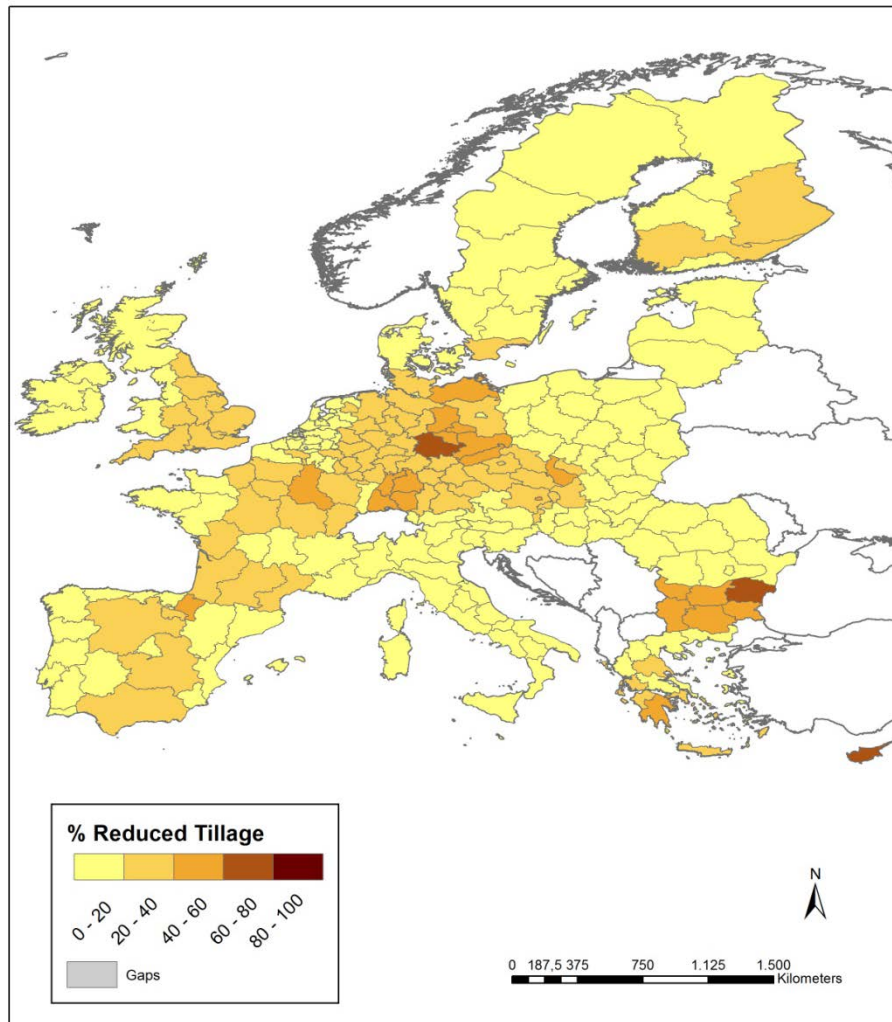


Figure 7. Main soil management practices: Reduced tillage as percentage of arable land

- Zero tillage as percentage of arable land (ZT)

In the same way that the implementation of the reduced tillage practice is limited, the agricultural practice of zero tillage is barely undertaken in most of the EU-27 regions. The EU-27 average of reduced tillage implementation out of total arable land is approximately 18% and for zero tillage is 3%. None of the regions overcomes the 20% of zero tillage out of total arable land and only a few regions of Spain, Finland, Romania or Poland overcome the 10% of zero tillage out of total arable land.

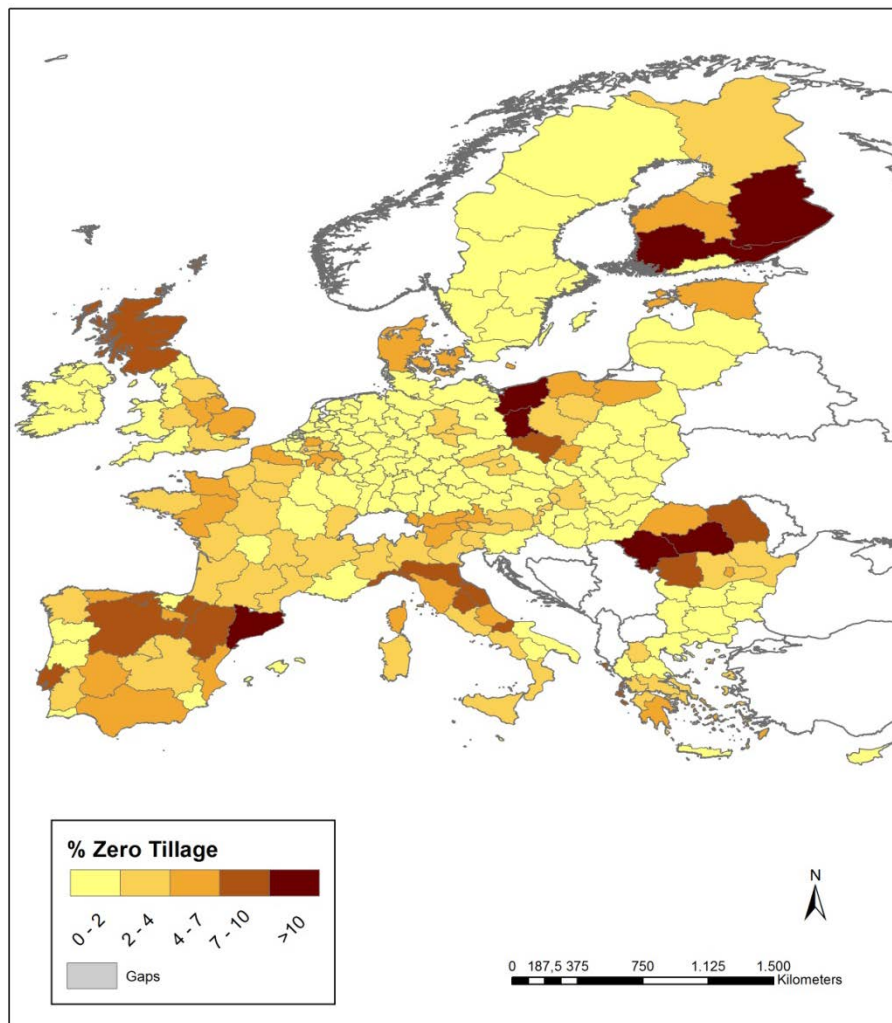


Figure 8. Main soil management practices: Zero tillage as percentage of arable land

- Normal winter crop cover as percentage of arable land (WC)
Normal winter crop cover is more extensively undertaken between ranges of 40-60% out of total arable land. A few regions from United Kingdom, France, Germany, Czech Republic, Poland, Greece, Italy or Spain are implementing between ranges of 60-80% out of total arable land. Only Cyprus is implementing more than 80% of normal winter crop cover (Figure 9).

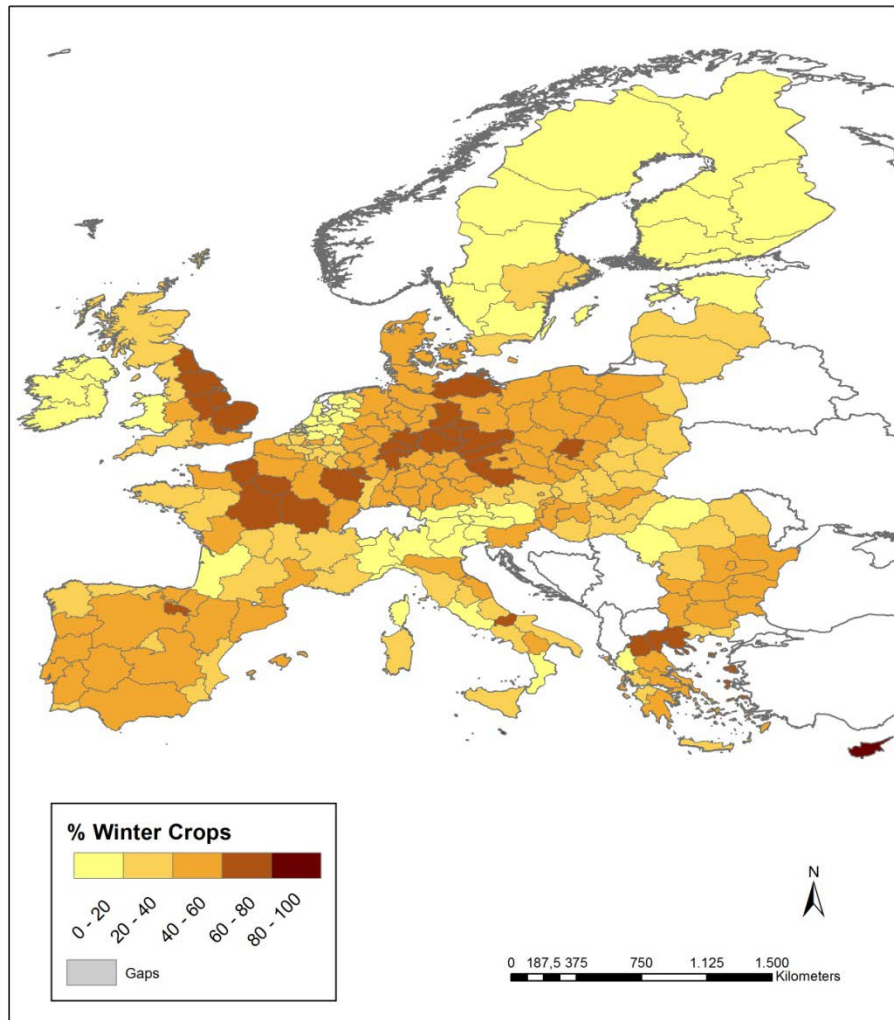


Figure 9. Main soil management practices: Normal winter crop cover as percentage of arable land

- Bare soil as percentage of arable land (BS)

Figure 10 shows lower percentages than 60% of bare soil for the most of regions, except Limousin region in France and Valle D'aosta in Italy showing percentages between 60-80% out of total arable land and Corse from France showing more than 80% of bare soil out of total arable land.

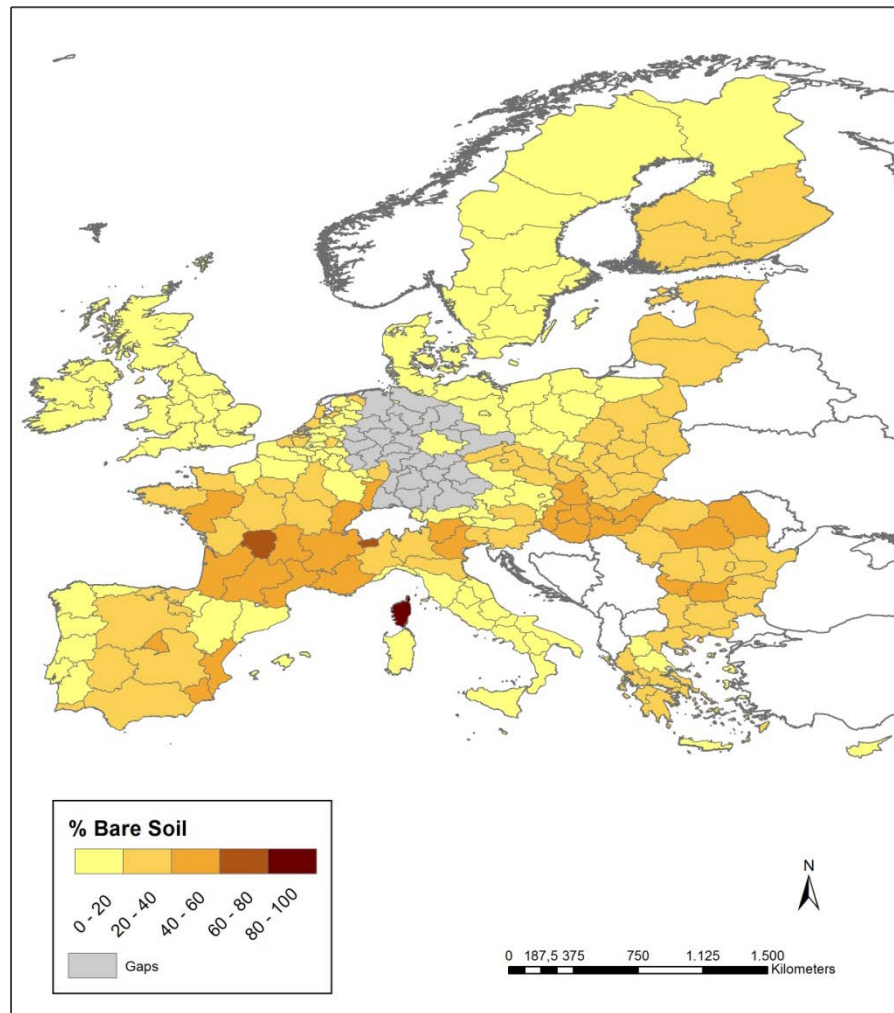


Figure 10. Main soil management practices: Bare Soil as percentage of arable land

- Crop rotation as percentage of arable land (RA)

Crop rotation is widely undertaken in most of the EU-27 regions (Figure 11). The EU-27 average of crop rotation implementation out of total arable land is approximately 86%. All regions are implementing percentages greater than 20% of crop rotation out of total arable land.

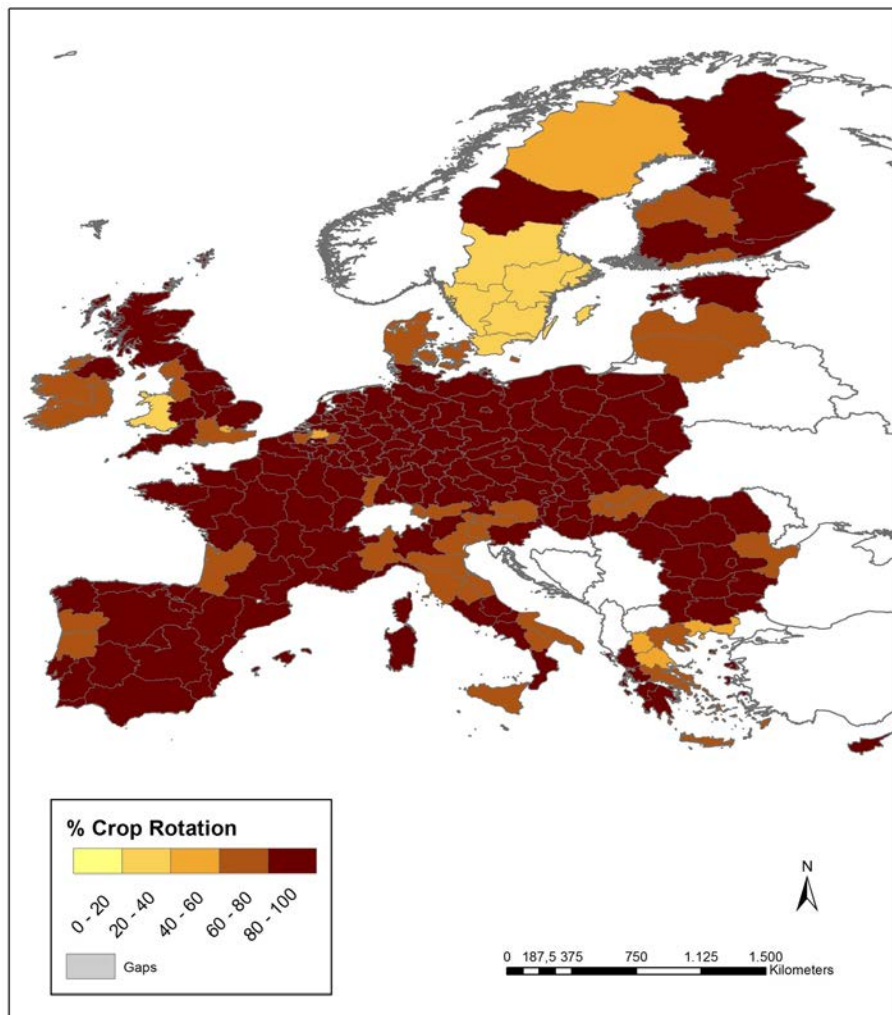


Figure 11. Main soil management practices: Crop rotation as percentage of arable land

- Residue Management as percentage of arable land (RM)

In Figure 12 is found that most of the regions are barely implementing residue management with percentages lower than 20% out of total arable land. There is no region with percentages higher than 60%.

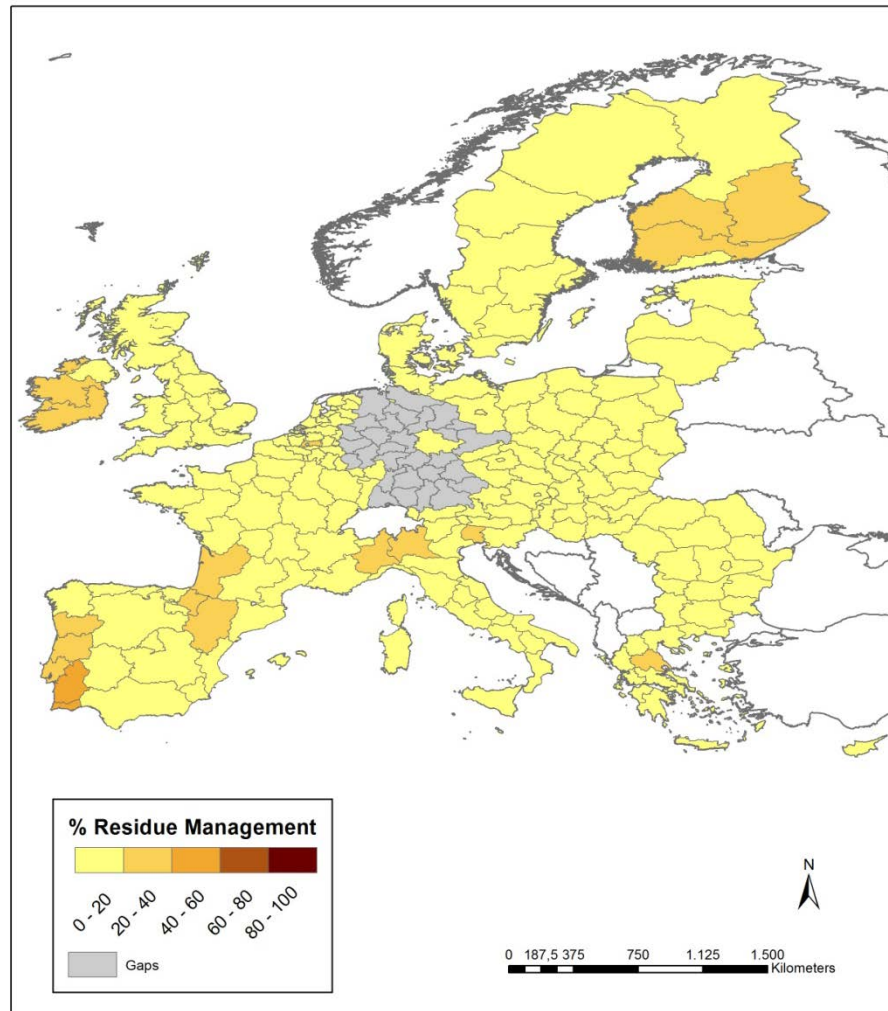


Figure 12. Main soil management practices: Residue management as percentage of arable land

- Cover or intermediate crop as percentage of arable land (CI)
Cover or intermediate crop is found to be the soil management practice less implemented due to most of the regions are showing very low percentages of this practice out of total arable land in Figure 13.

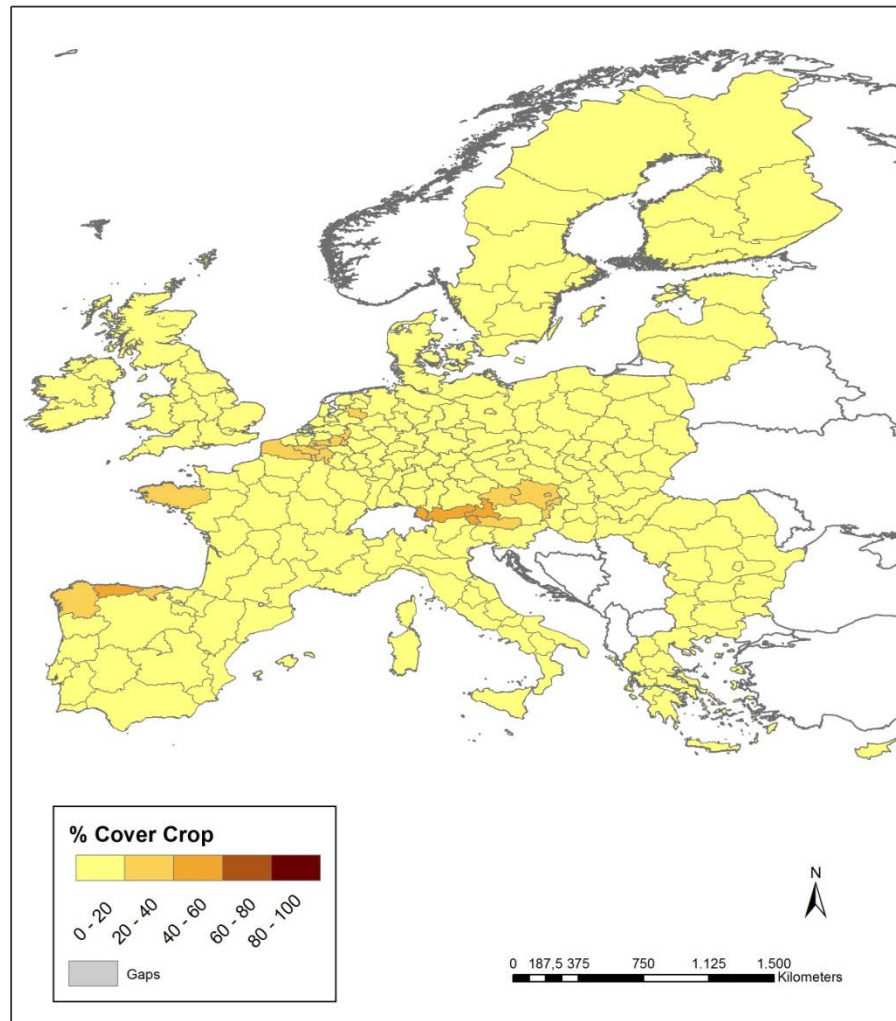


Figure 13. Main soil management practices: Cover or intermediate crop as percentage of arable land

3.7. Main crops in the main farming system

Based on Eurostat regional statistics the crop areas of 34 crops are listed (in 1000 ha) per NUTS2 region. The crop classification is based on the CAPRI crop types. These crops have been linked to the main farming systems (Table 4). However, the current output file does not include this linkage yet, as some of the crops can be related to more farming systems.

Table 4. Classification of MITERRA crop types to main farming systems

Field crops	Permanent crops	Mixed farms
Soft wheat (SWHE)	Olive for oil (OLIV)	Fodder maize (MAIF)
Durum wheat (DWHE)	Apples and pears (APPL)	Fodder on arable land (OFAR)
Rye and meslin (RYEM)	Other fruit (OFRU)	Fodder root crops (ROOF)
Barley (BARL)	Citrus (CITR)	Soft wheat (SWHE)
Oats (OATS)	Table grapes (TAGR)	Rye and meslin (RYEM)
Grain maize (MAIZ)	Table olives (TABO)	Barley (BARL)
Other cereals (OCER)	Wine (TWIN)	Oats (OATS)
Paddy rice (PARI)	Nurseries (NURS)	Grain maize (MAIZ)
Rapeseed (RAPE)		Other cereals (OCER)
Sunflower (SUNF)		
Soybean (SOYA)		
Other oil (OOIL)		
Pulses (PULS)		
Other crops (OCRO)		
Fallow land (FALL)		
Pasture and grasslands	Industrial crops	Horticulture
Fodder on arable land (OFAR)	Potato (POTA)	Tomatoes (TOMA)
Grassland (GRAS)	Sugar beet (SUGB)	Other vegetables (OVEG)
	Fibre crops (TEXT)	
	Tobacco (TOBA)	
	Other industrial crops (OIND)	
	Flowers (FLOW)	

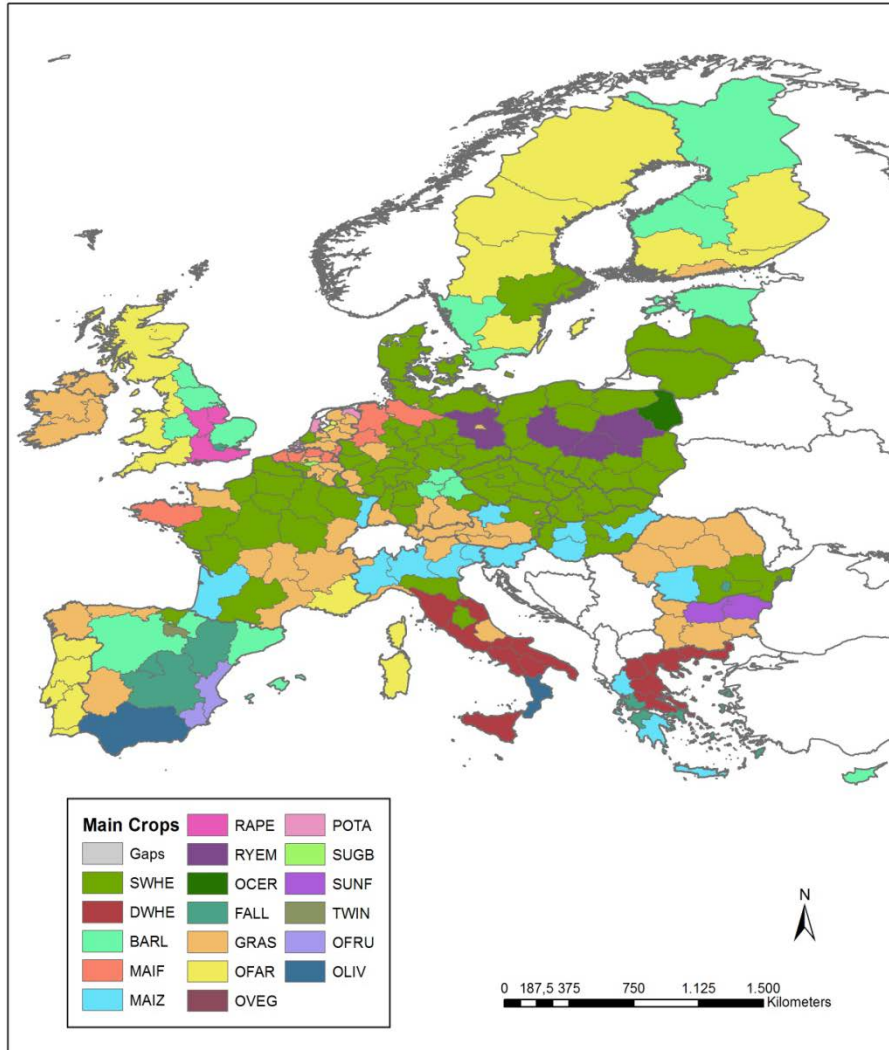


Figure 14. Main crops in the main farming system

Figure 14 shows the main crops in the main farming system, being soft wheat, fodder on arable land and grassland the most frequent crops.

3.8. Area of main farming system

The area of main farming system is expressed in 1000 ha of the total utilized agricultural area (UAA). Data for Romania, Bulgaria, Cyprus and Malta is missing. The biggest areas of main farming systems in terms of hectares are found in regions from Spain (Andalucía, Castilla La Mancha and Castilla León) and United Kingdom (Scotland), followed by regions of Denmark, Poland, France and Lithuania (Figure 15).

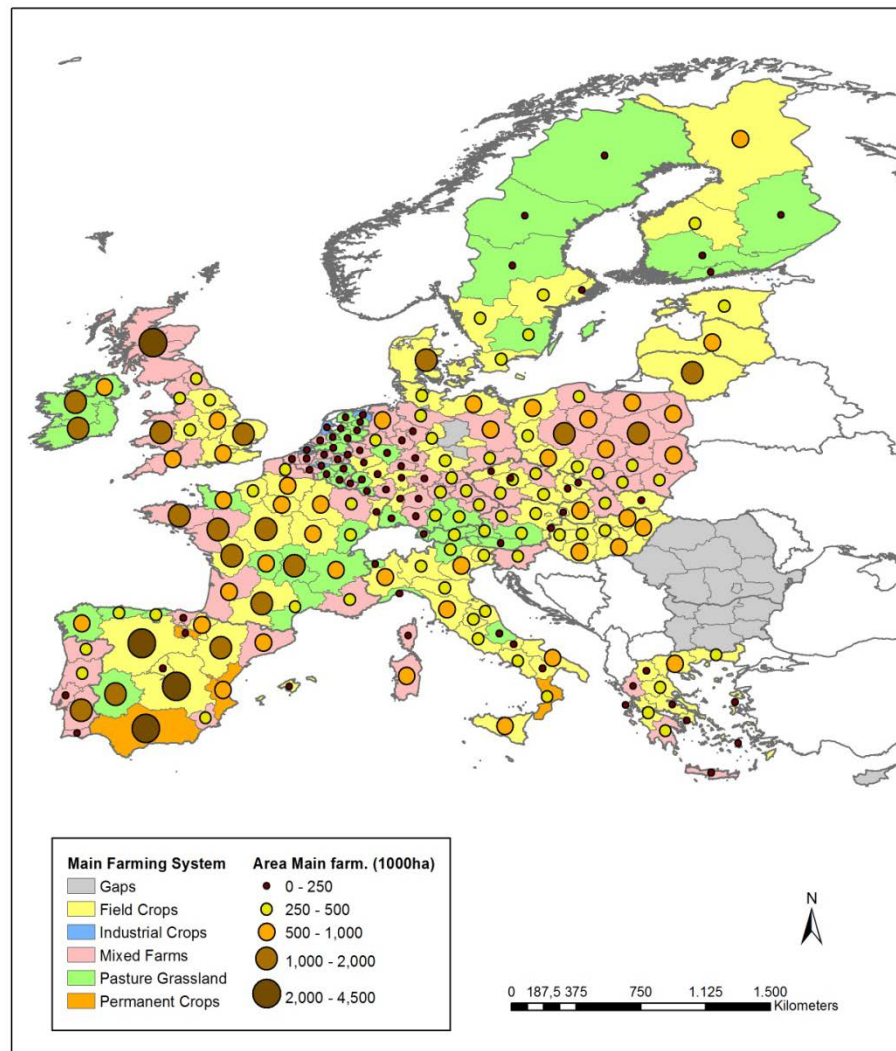


Figure 15. Area of main farming system in 1000 ha

3.9. Main farming system percentage of the total agricultural area

The area of main farming system as percentage of the total utilized agricultural area (UAA). Data for Romania, Bulgaria, Cyprus and Malta is missing. The percentage of main farming system out of the total agricultural area is not related to the area of the main farming system. For instance, Andalucía region in Spain showed a very large extension in hectares of the main farming system (Figure 15), however it is only showing a percentage around 40-60% out of the total agricultural area (Figure 16). In the same way, smallest areas in terms of hectares of main farming systems located in Sweden (Övre Norrland region) (Figure 15), are largely representing the main farming system with high percentages around 80-100% (Figure 16). The regions showing low percentages of main farming systems, are probably sharing the agricultural area with others relevant farming systems.

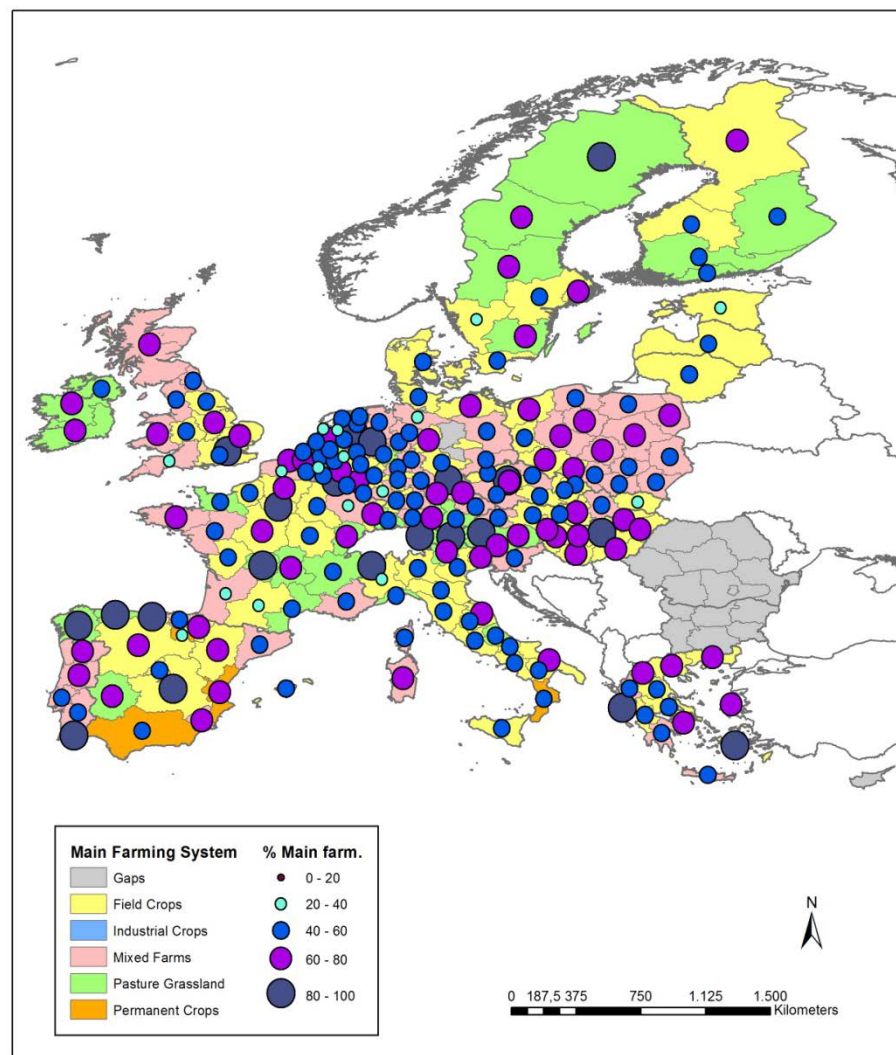


Figure 16. Area of main farming system as percentage of the total utilized agricultural area (UAA).

3.10. Irrigated area

The total irrigated area (in 1000 ha) was derived from the SAPM 2010 survey from Eurostat (ef_poirrig). The area that was irrigated at least once per year was used. It is also possible to use the potential area that can be irrigated or subdivide the area to the main crop (groups). Also the total volume of water used for irrigation is available. Figure 17 shows how Mediterranean regions are the most irrigated areas as well as Denmark. Data for Ireland is missing.

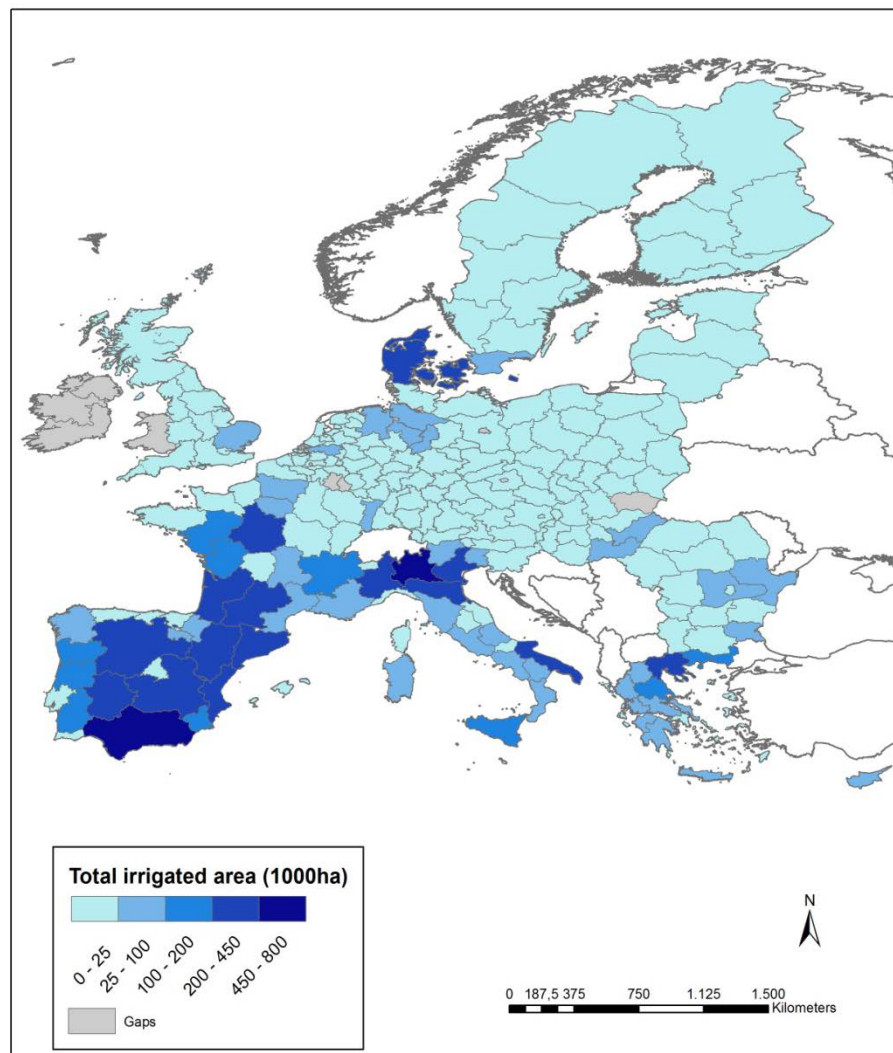


Figure 17. Total irrigated area in 1000 ha

3.11. Crop yield in the main farming system

The average crop yield, in kg of dry matter (DM) per ha, is provided for the main farming systems. This average crop yield is the weighted average of the crops mentioned in Table 4. Crop yields are based on Eurostat statistics, for 17 main crops the data is available at NUTS2 level, while for the other crops national crop yields are used. The highest crop yields in the main farming system are found in Netherlands and Ireland regions as well as northwest regions of Spain. In the other hand, the lowest crop yields in the main farming system are found in some regions of Spain, Italy, Finland, Lithuania and Estonia. Data for Romania, Bulgaria, Cyprus and Malta is missing (Figure 18).

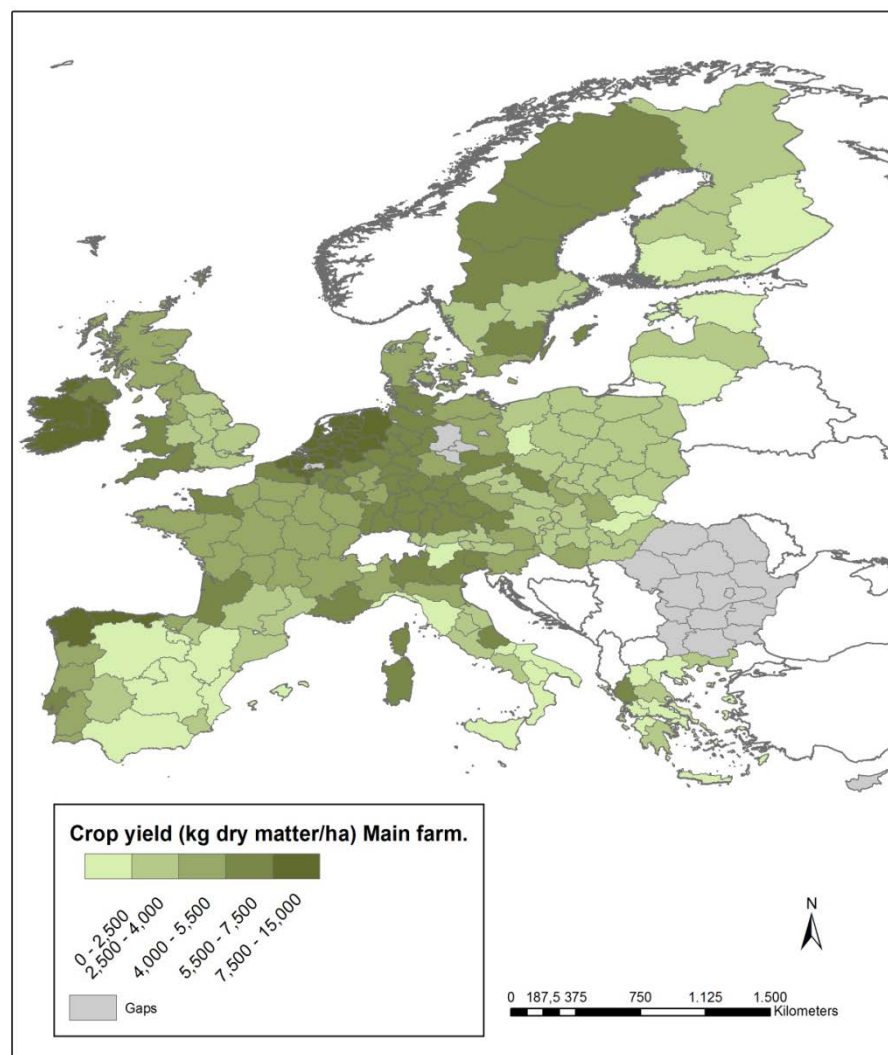


Figure 18. Average crop yield in kg dry matter/ha of the main farming system

3.12. Main limiting factor to attain potential production

Figure 19 shows the possible combinations of main limiting factors which attain potential production in the main farming system (water availability, rain, temperature, altitude and gradient, leaching, erosion, salt intrusion, pest and diseases, soil compaction, farm size, farmer knowledge, wet peat soils). These data were only available and provided by partners for regions of the case study countries. These regions show what factors are limiting the production for their main farming systems, and water availability remains as a common feature for most of them, especially in Mediterranean regions.

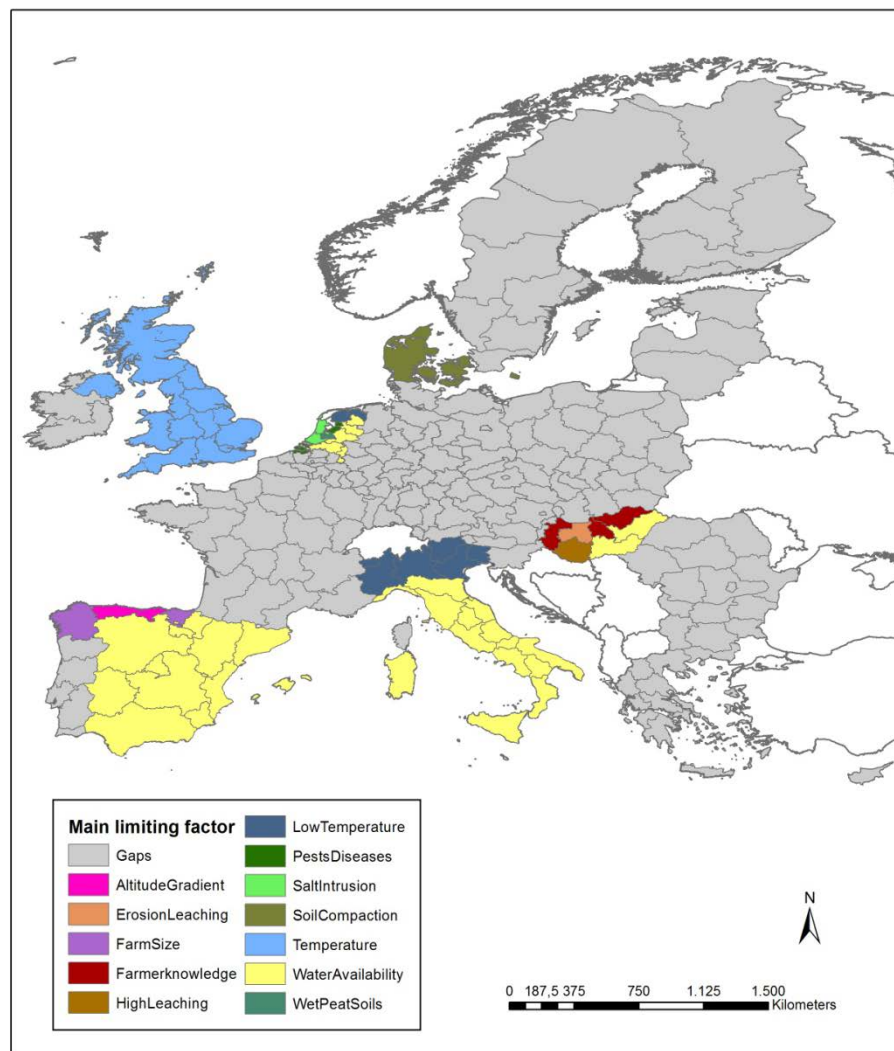


Figure 19. Main limiting factor to attain potential production

3.13. Nitrogen fertilizer use

The average nitrogen fertiliser use (kg N /ha), consisting of both animal manure and mineral fertilizer, was calculated for each NUTS2 region. The average of all crops has been calculated, but if needed it could be specified to farming system, although this is rather uncertain. The total mineral fertilizer consumption was derived from FAO statistics at national level. The amount of animal manure has been calculated based on the total number of livestock, derived from Eurostat at NUTS2 level, multiplied with the N excretion rates, derived from the GAINS model, and corrected for the N losses. The procedure for the allocation of animal manure and mineral fertilizer is described in detail in Velthof et al. (2009). Netherlands and Belgium regions are applying the higher amount of nitrogen fertilization (Figure 20).

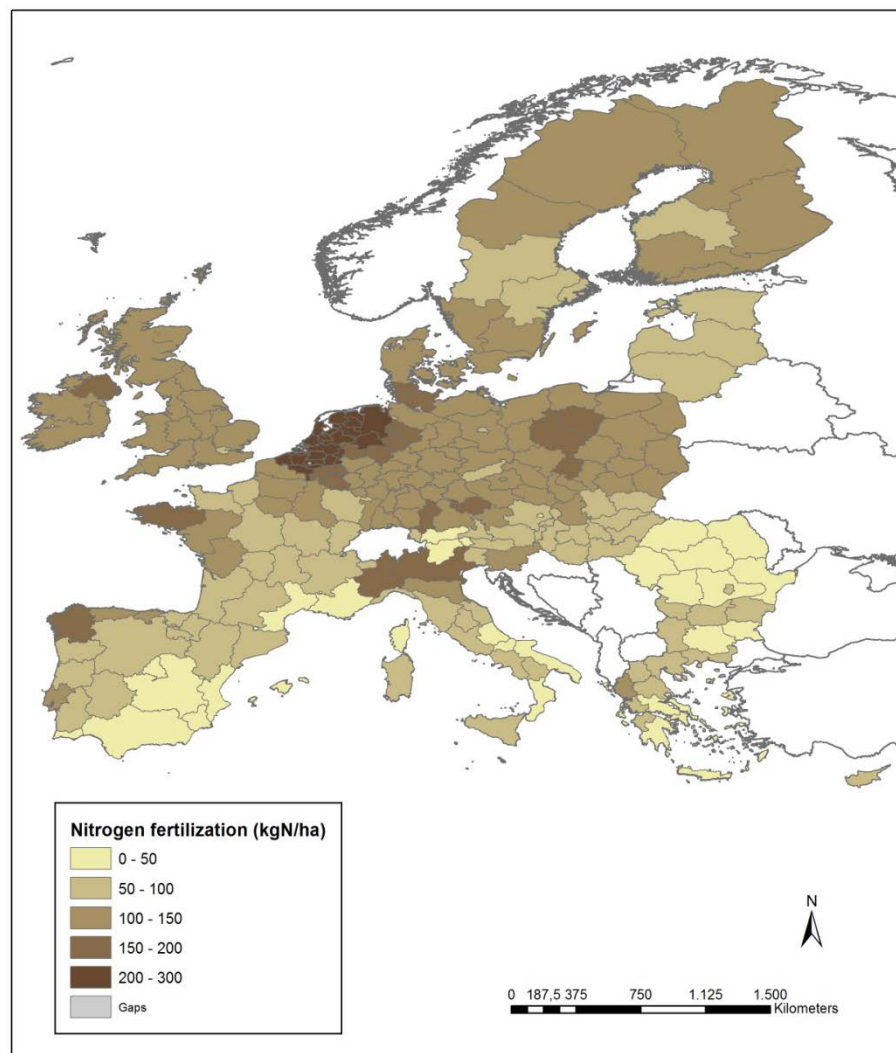


Figure 20. Total fertilizer use in kg N/ha

3.14. Climate classification

For climate classification we used the map of the environmental zones of Europe (Figure 21) as produced by Metzger et al. (2005). The classification is based on twenty of the most relevant available environmental variables, which were analysed by principal component analyses and were clustered. The Environmental Stratification of Europe (EnS) consists of 84 strata, which have been aggregated into 13 Environmental Zones (Table 5). The stratification has a 1 km² resolution. Table 6 presents the average climate characteristics of the 13 zones.

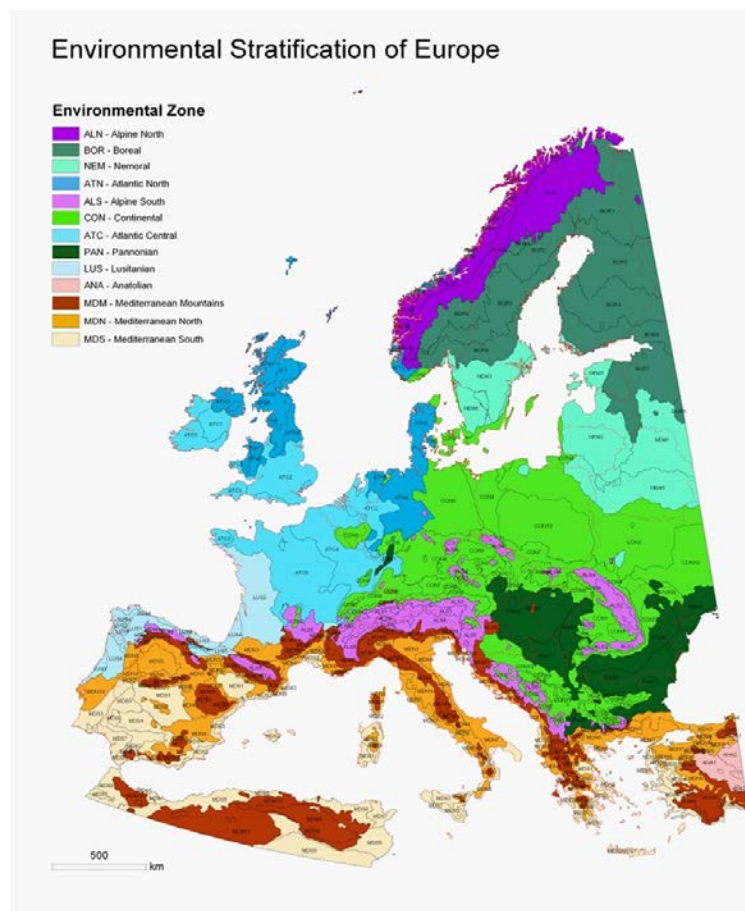


Figure 21. The environmental stratification of Europe (Metzger et al., 2005)

Table 5. The 13 Climatic Zones or Environmental Zones

Nr	Environmental Zone	Main locations and characteristics
1	Alpine North (ALN)	Scandinavian mountains
2	Alpine South (ALS)	The high mountains of central and southern Europe
3	Atlantic North (ATN)	NW Europe; under influence of the Atlantic ocean and the North sea
4	Atlantic Central (ATC)	Western Europe, moderate climate
5	Boreal (BOR)	The lowlands of Scandinavia
6	Continental (CON)	Central Europe; warm summers and cold winters
7	Lusitenean (LUS)	The southern Atlantic area; warm summers and mild winters
8	Mediterranean North (MDN)	Mediterranean north, with Cork Oak, fruit plantations and Olive groves
9	Mediterranean Mountains (MDM)	Mediterranean mountains, influenced by Mediterranean and mountains
10	Mediterranean South (MDS)	Typical Mediterranean climate; mild winter and hot, dry summers
11	Nemoral (NEM)	Southern Scandinavia, Baltic states and Belarus
12	Pannonian (PAN)	The steppic part of Europe; cold winters and dry hot summers
13	Anatolian (ANA)	The steppes of Turkey, a Mediterranean steppic environment (not relevant for EU-27)

Table 6. Relative area in Europe, mean winter and summer temperature and rainfall and the number of days when the mean temperature is above 5°C of the 13 Environmental Zones

Nr	ENZs	Relative area, %	Mean temperature, °C		# days Temp > 5°C	Mean rainfall, mm		
			Winter	Summer		Winter	Summer	Total
1	ALN	5	-6	6	130	504	432	937
2	BOR	14	-5	9	157	263	349	612
3	NEM	8	-1	13	196	276	374	650
4	ATN	5	4	12	255	658	491	1149
5	ALS	5	1	11	220	475	614	1089
6	CON	20	2	15	227	270	415	685
7	ATC	8	6	14	296	437	389	826
8	PAN	7	4	18	250	231	337	568
9	LUS	3	9	16	353	622	406	1028
10	ANA	1	3	12	n.a.	202	138	340
11	MDM	9	7	18	298	424	292	716
12	MDN	9	8	18	335	411	277	688
13	MDS	9	12	21	363	368	149	516

For further simplification we also aggregated these 13 classes into five main climate zones (Figure 22):

- Boreal (BOR and NEM),
- Atlantic (ATN, ATC and LUS)
- Alpine (ALN and ALS)
- Continental (CON and PAN)
- Mediterranean (MDN, MDM and MDS)

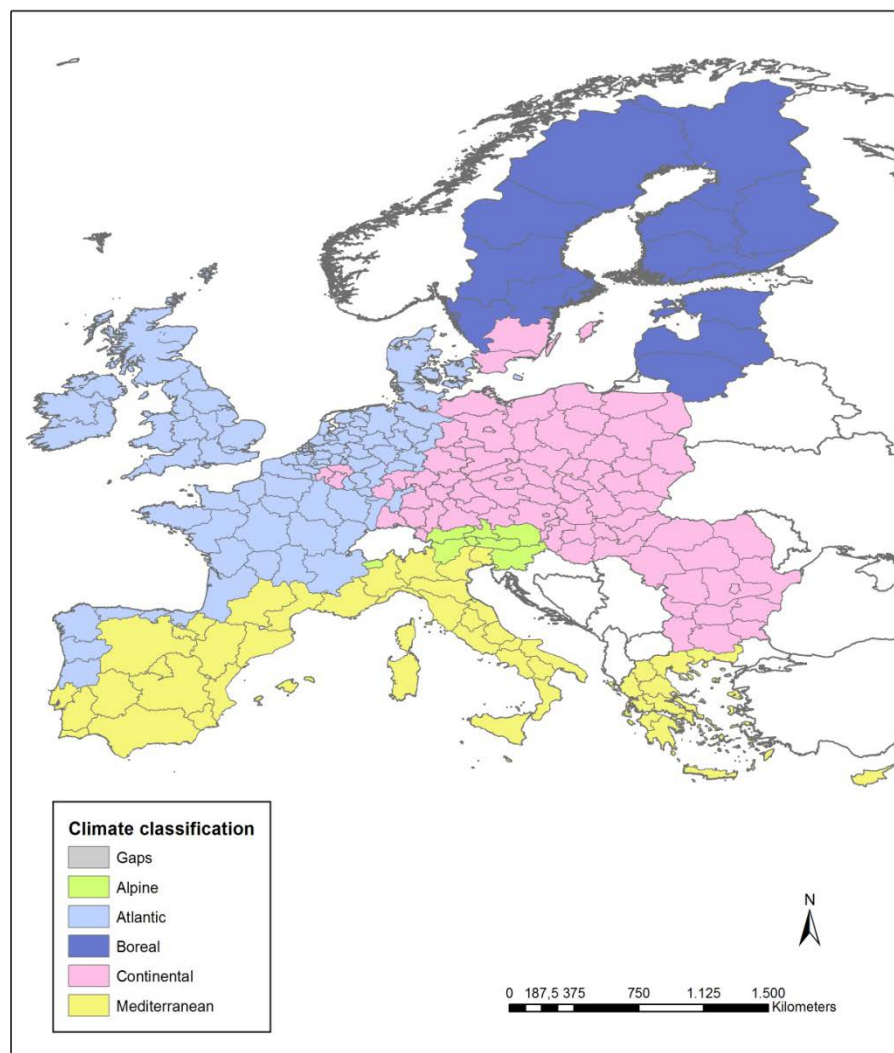


Figure 22. Main climate zones

3.15. Organic farming percentage of the agricultural area

The area of organic farming is expressed as percentage of the utilized agricultural area (UAA). These data are based on the 2010 FSS statistics at regional level from Eurostat (ef_mporganic) and exclude the farms in conversion to organic farming. The Eurostat data also offer the possibility to detail the area of organic farming by main crops. Most of regions show very low percentages of organic farming around 0-5% out of UAA. Only Salzburg region in Austria and Severozapad region in Czech Republic show the highest percentages between ranges 20-30% out of UAA (Figure 23).

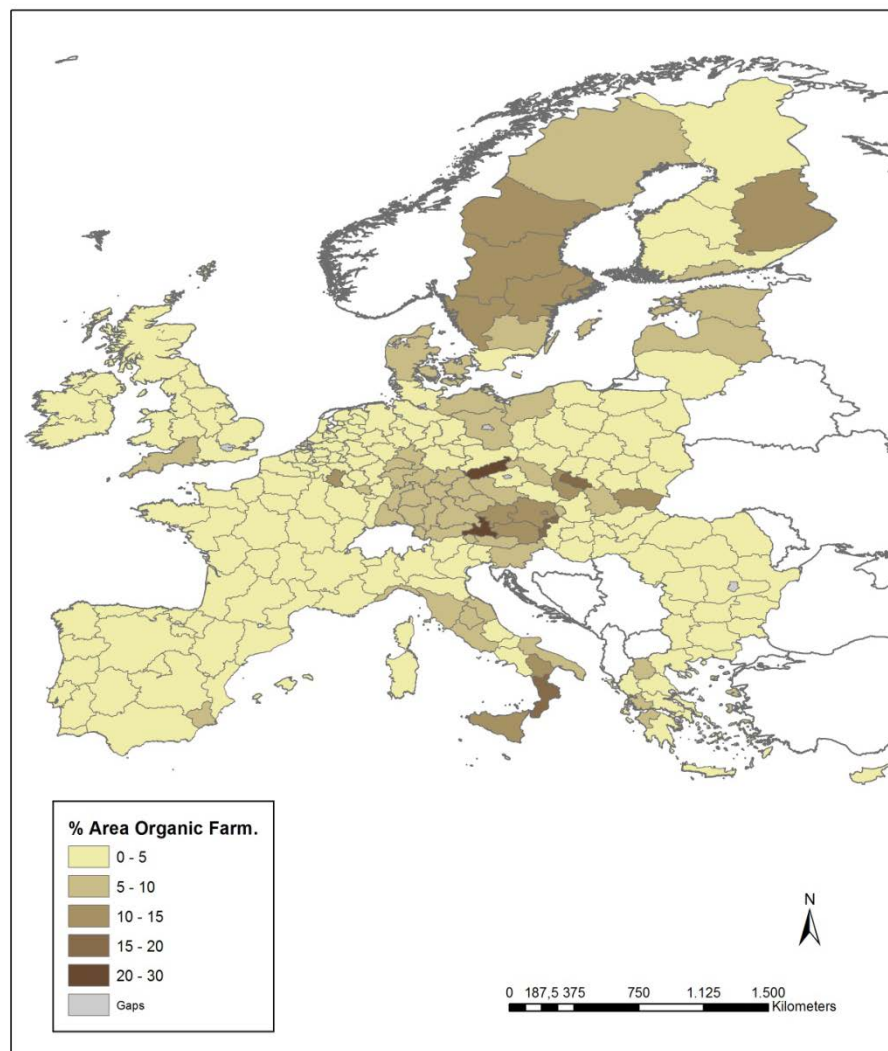


Figure 23. Area of organic farming as percentage of the utilized agricultural area (UAA)

3.16. Main soil type

The main soil type is derived from the European soil database (<http://eusoils.jrc.ec.europa.eu/ESDB Archive/ESDB/>). The classification is according to the latest WRB classification. The relevant soil types for Europe are listed in Table 7. The European soil map (Figure 24) has been overlaid with the CORINE land use map, to derive the fraction of soil type under agricultural land.



Figure 24. European Soil map

Table 7. Soil types from European soil database

Code	Soil type
AB	Albeluvisol
AC	Acrisol
AN	Andosol
AR	Arenosol
CH	Chernozem
CL	Calcisol
CM	Cambisol
CR	Cryosol
FL	Fluvisol
GL	Gleysol
GY	Gypsisol
HS	Histosol

KS	Kastanozem
LP	Leptosol
LV	Luvisol
PH	Phaeozem
PL	Planosol
PZ	Podzol
RG	Regosol
SC	Solonchak
SN	Solonetz
UM	Umbrisol
VR	Vertisol

Figure 25 shows the main main soil type for EU -27 member countries at Nuts2 level, being Cambisol, Luvisol and Podzol the most frequent soil types in the figure.

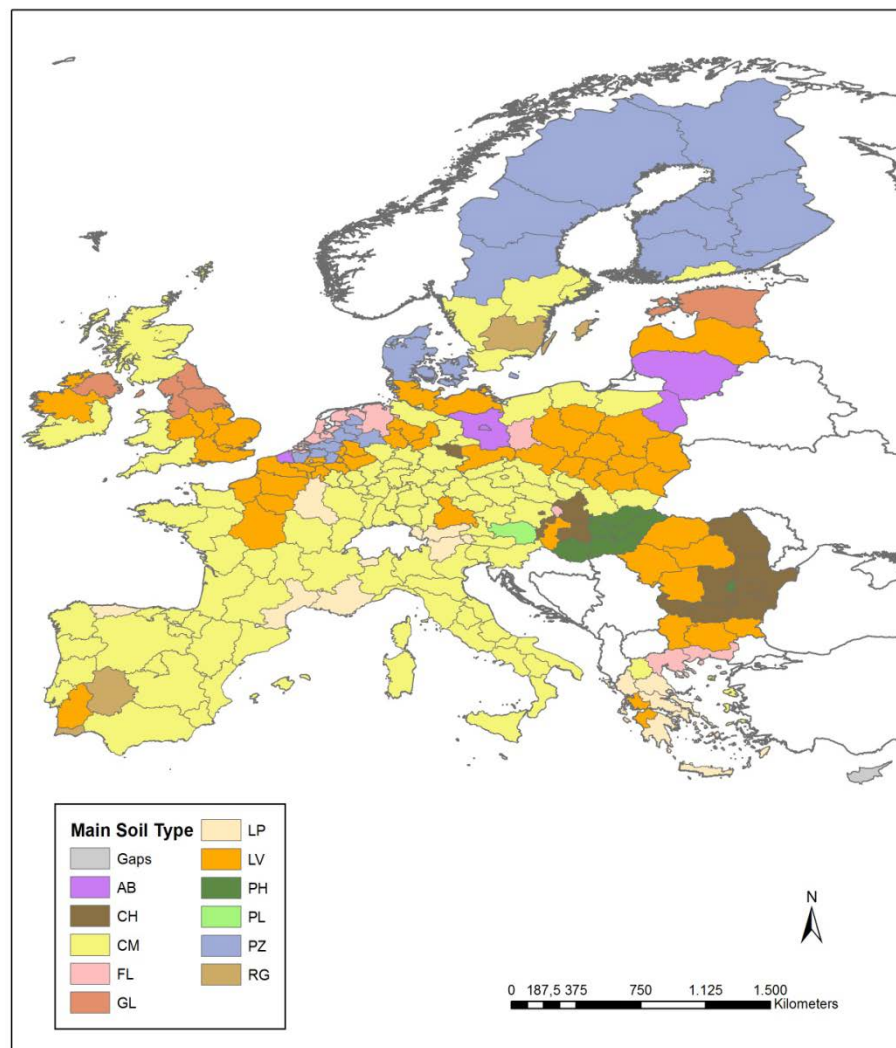


Figure 25. Main soil type

3.17. Secondary farming systems

The secondary farming systems have been also derived from the SEAMLESS project (<http://www.seamless-ip.org>). As we did for the main farming system, we aggregated these 21 farm types into the following six main farming systems: Field crops, Permanent crops, Pasture and grasslands, Industrial crops, Horticulture and Mixed farms (Table 3). The farm types and farming systems can be expressed in number of farms or number of hectares. Data for Romania, Bulgaria, Cyprus and Malta is missing.

Figure 26 shows the predominant secondary farming systems in EU-27, they are mixed farms, field crops and pasture and grasslands. Regions of Netherlands and Greece show industrial crops and regions of Spain permanent crops and horticulture.

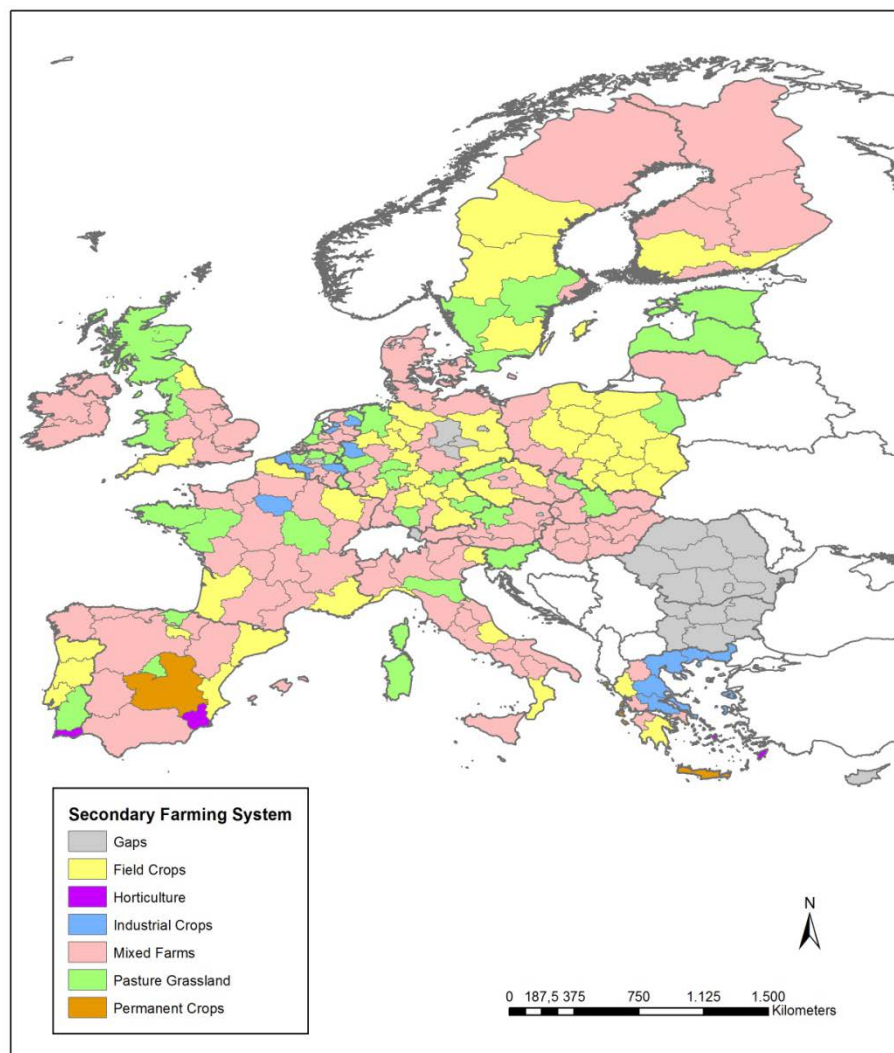


Figure 26. Secondary farming systems

3.18. Main crops in the secondary farming system

As we did for the main crops in the main farming systems, based on Eurostat regional statistics the crop areas of 34 crops are listed (in 1000 ha) per NUTS2 region. The crop classification is based on the CAPRI crop types. These crops can be linked to the main farming systems (Table 4). Data for Romania, Bulgaria, Cyprus and Malta is missing.

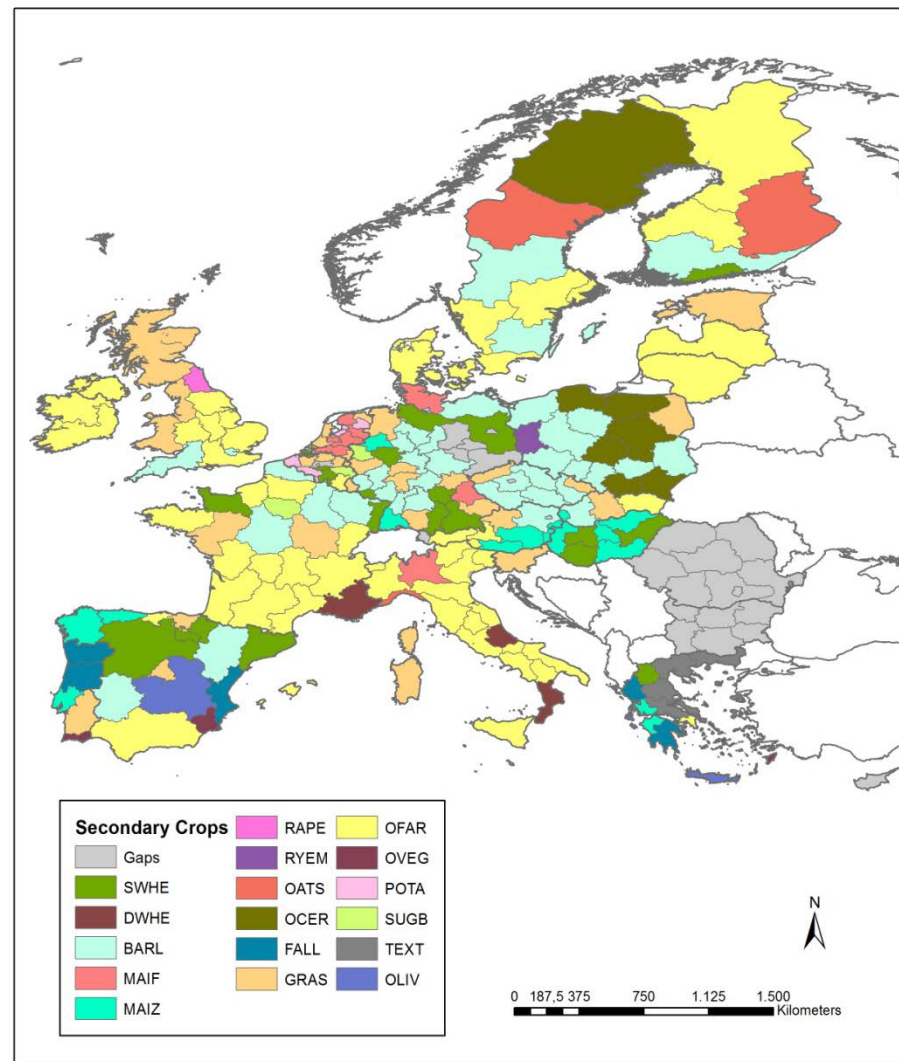


Figure 27. Main crops in the secondary farming system

Figure 27 shows the main crops in the secondary farming system, being fodder on arable land or barley some of the most frequent crops in the figure.

3.19. Area of secondary farming system

The area of secondary farming system is expressed in 1000 ha of the total utilized agricultural area (UAA). Data for Romania, Bulgaria, Cyprus and Malta is missing. The biggest areas of secondary farming systems in terms of hectares are found in regions from Spain, United Kingdom, Ireland, France, Denmark, and Lithuania (Figure 28).

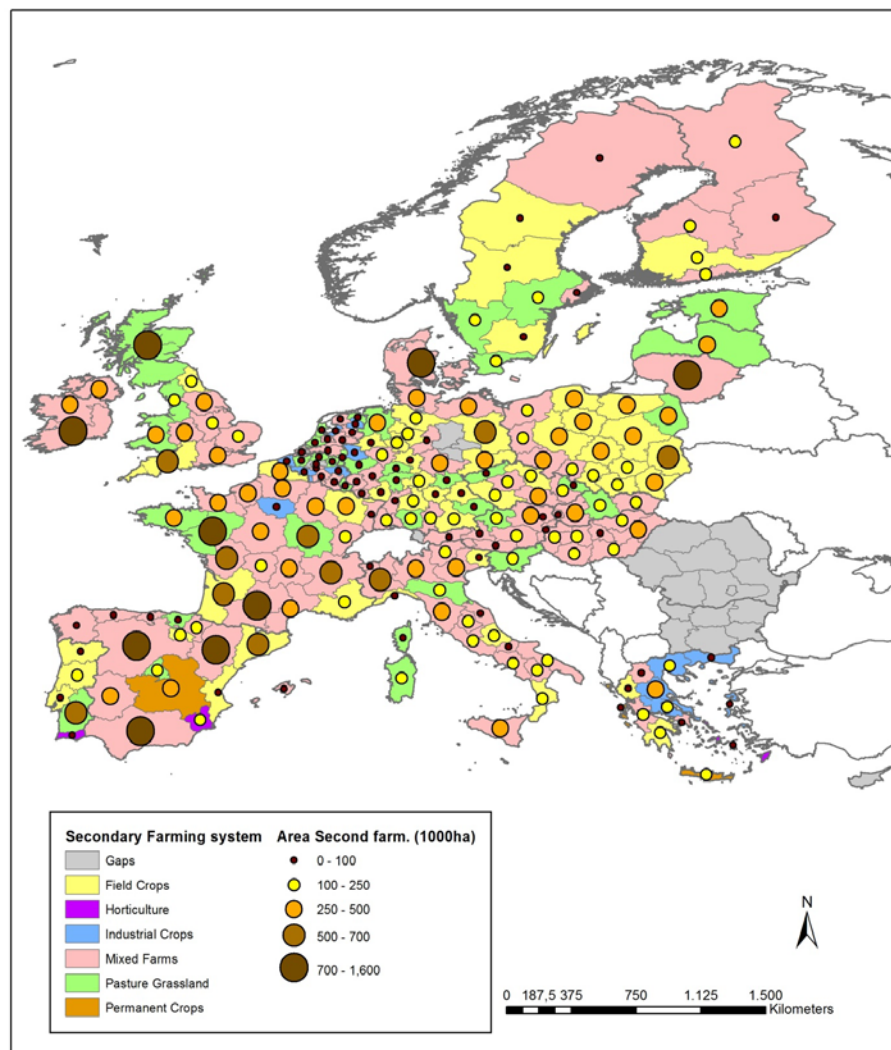


Figure 28. Area of secondary farming system in 1000 ha

3.20. Secondary farming system percentage of agricultural area

The area of secondary farming system as percentage of the total utilized agricultural area (UAA). Data for Romania, Bulgaria, Cyprus and Malta is missing. Regions showing the highest percentages of secondary farming systems are mainly located in Netherlands, Belgium, Germany, Czech Republic, Greece and France (Corse) (Figure 29).

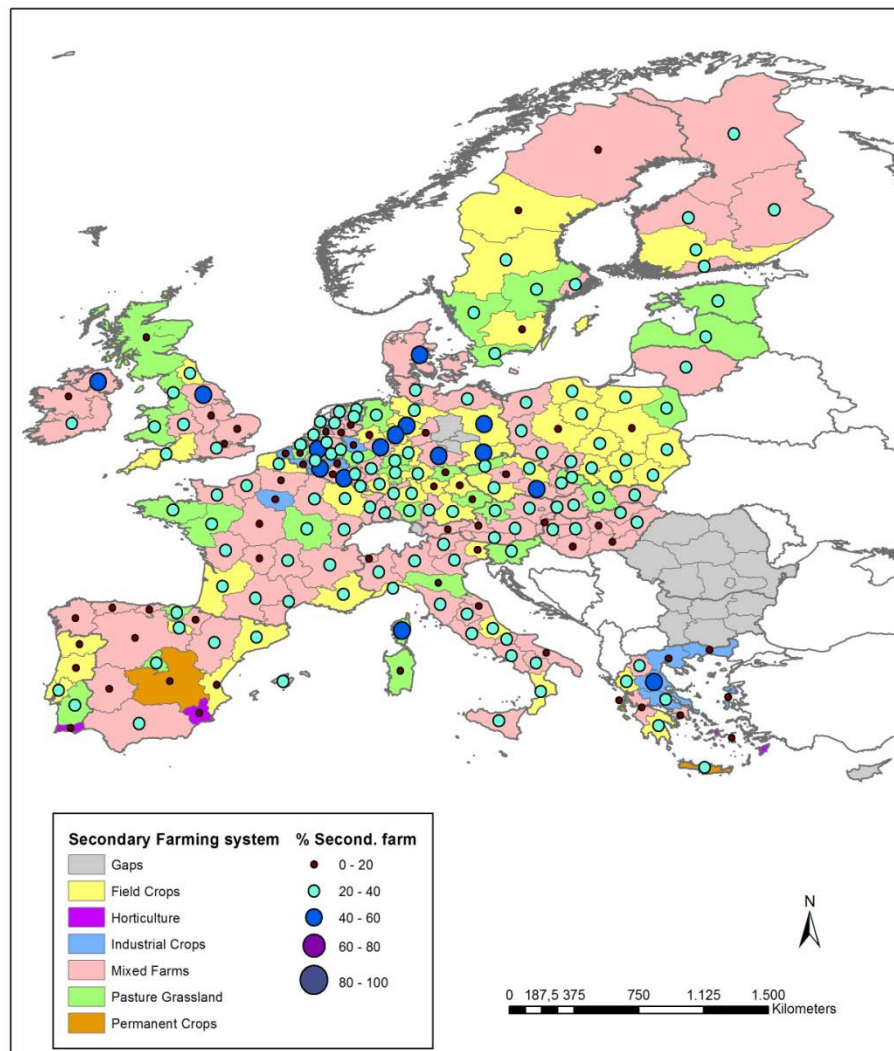


Figure 29. Area of secondary farming system as percentage of the total utilized agricultural area (UAA)

3.21. Crop yield of secondary farming system

The average crop yield, in kg of dry matter (DM) per ha, is provided for the secondary farming systems. As we did before for the main farming system, this average crop yield is the weighted average of the crops mentioned in Table 4. Crop yields are based on Eurostat statistics, for 17 main crops the data is available at NUTS2 level, while for the other crops national crop yields are used. The highest crop yields in the secondary farming system are found again in some regions of Netherlands, Belgium and France. The lowest crop yields in the secondary farming system are found in some regions of Spain, Italy, Poland, Greece, Sweden, Finland, Lithuania and Estonia. Data for Romania, Bulgaria, Cyprus and Malta is missing (Figure 30).

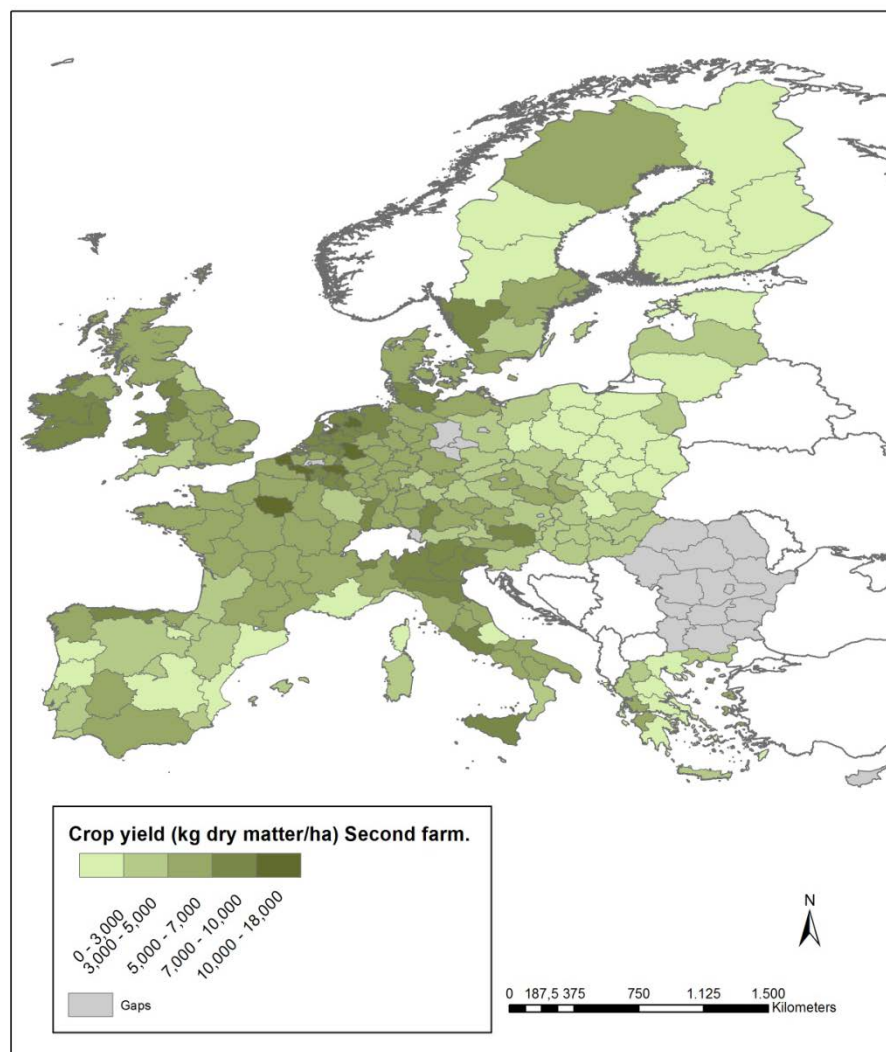


Figure 30. Average crop yield in kg dry matter/ha of the secondary farming system

3.22. Farmer's formation level about soil management and GHG emissions

In Figure 31 we identify the average level of farmer's formation about soil management and GHG emissions associated using next categories:

- No knowledge
- Low
- Medium
- High
- Very high

These data were only available and provided by partners for regions of case study countries. The regions in Mediterranean areas show lower average formation level of farmers about soil management and GHG emissions.

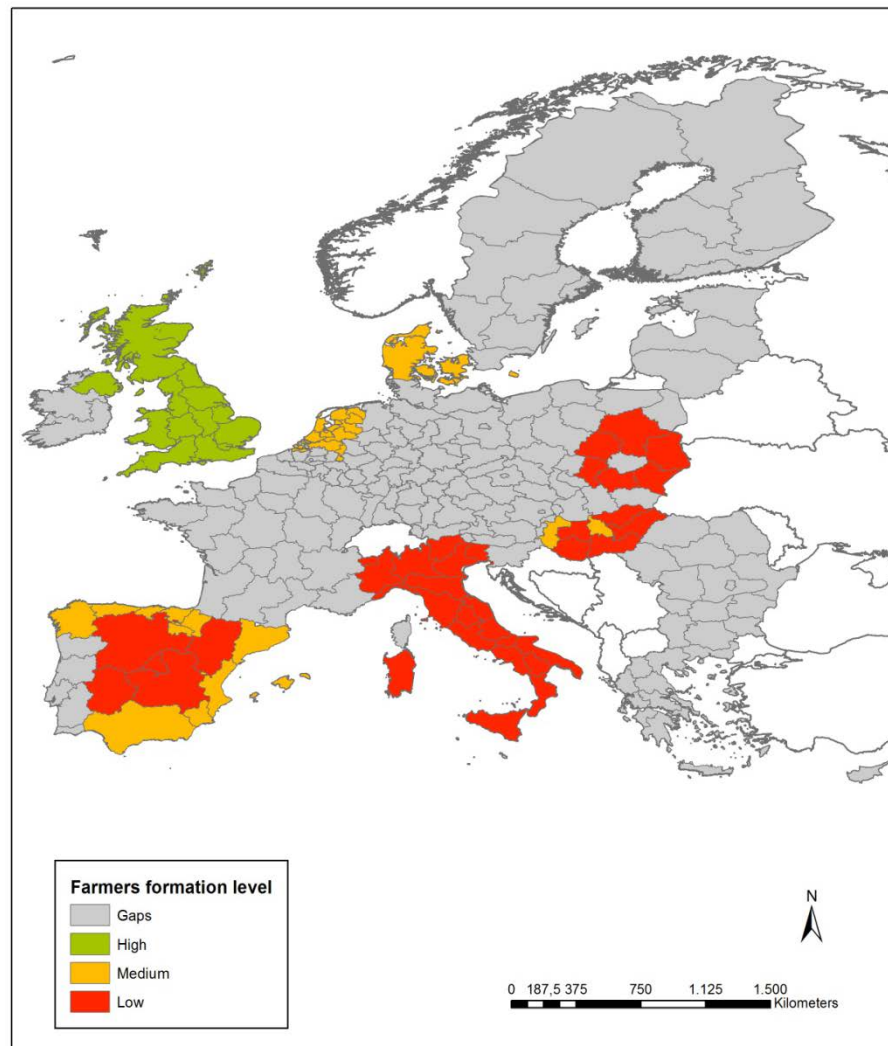


Figure 31. Average level of farmer's formation level about soil management and GHG emissions

4. Gaps of knowledge and future work

4.1. Gaps of knowledge

The development of Smartsoil database about typical farming systems, and the data collection process involved a number of limitations. The partner's compilation of many data was a difficult task, since data from the National Statistical Institutes database are strongly disaggregated and available in various formats, so that none extraction routine could be run. Furthermore, most of the information was not disaggregated at main or secondary farming system level. We show in table 6 a summary of lacks of knowledge on the asked indicators. When the information was not possible to find in National Statistical sources, it was retrieved from literature or interviews.

It is remarkable that data provided by UNIFI showed differences on secondary farming systems with data provided by Miterra database for some regions of Italy. The reason may be the different reference period for the provided data (National Census of Agriculture and National Statistical Institute database referred to 2010 from UNIFI and Eurostat regional and national statistics 2008 from Miterra database). To homogenize the source to all regions of the study, data from Miterra database were chosen. Main differences were found for these regions: Valle d'Aosta, Liguria, Provincia Autonoma Trento, Emilia-Romagna, Toscana, Campania, Puglia, and Sicilia. The secondary farming system referred to UNIFI source of information are permanent crops and the main crops of these farming system are olive and fruit trees.

Specifically, the main limiting factor to obtain potential production is an important indicator to establish the risk to climate change on typical farming; however it is not well defined in the available information for NUTS2 level of regions. The farmer's formation level was only found at general level, hence not specific to soil management and GHG emissions as requested, but at least provide an unbiased overview on educational level of case study countries farmers at NUTS2 level.

Table 8. Gaps of knowledge in the database and sources of information

Questions	Gap of knowledge	Source and comments
Main farming system	No	Data are derived from the SEAMLESS project (http://www.seamless-ip.org) and Eurostat regional and national statistics 2008. Data for Romania, Bulgaria, Cyprus and Malta is missing
Total area UUA (ha)	No	Data are derived from Eurostat regional and national statistics 2008.

Farm profits: Standard output (SO)	No	Data are derived from Eurostat regional and national statistics 2010. Most of standard output data for Germany regions are missing
Main soil management practices of the main farming system	Yes	Only available for partner's countries. The partners found these data from national surveys or via interviews to stakeholders and experts consulting
Use of management practices (%) based on areas relative to arable land	No	Data are based on SAPM survey from 2010. Many of soil management practices data for Germany regions are missing.
Main crops in the main farming system	No	Data are derived from Eurostat regional and national statistics 2008 for first main crop.
Area of main farming system (ha)	No	Data are derived from Eurostat regional and national statistics 2008. Data for Romania, Bulgaria, Cyprus and Malta is missing.
Area of main farming system (%)	No	Data are derived from Eurostat regional and national statistics 2008. Data for Romania, Bulgaria, Cyprus and Malta is missing.
Irrigated area (%)	No	Data are derived from SAPM 2010 survey from Eurostat Data for Ireland is missing
Main crop yield (kg/ha) of main farming system	No	Data are derived from Eurostat regional and national statistics 2008. Data for Romania, Bulgaria, Cyprus and Malta is missing
Main limiting factor to obtain potential production	Yes	Only available for partner's countries. The partners found these data via interviews to stakeholders and experts consulting
Nitrogen fertilizer use (kg of N/ha)	No	Data are derived from FAO statistics at national level
Climate classification	No	Data are derived from the map of the environmental zones of Europe as produced by Metzger et al. (2005)
Area of organic farming (% of total)	No	Data are derived on the 2010 FSS statistics at regional level from Eurostat.
Main soil type	No	Data are derived from the European soil database (http://eusoils.jrc.ec.europa.eu/ESDB_Archive/ESDB/)
Secondary farming system	No	Data are derived from the SEAMLESS project (http://www.seamless-ip.org) and Eurostat regional and national statistics 2008. Data for Romania, Bulgaria, Cyprus and Malta is missing
Main crops in the secondary farming system	No	Data are derived from Eurostat regional and national statistics 2008 for first main crop. Data for Romania, Bulgaria, Cyprus and Malta is missing
Area of second farming system (ha)	No	Data are derived from Eurostat regional and national statistics 2008. Data for Romania, Bulgaria, Cyprus and Malta is missing
Area of second farming system (% of agricultural area)	No	Data are derived from Eurostat regional and national statistics 2008. Data for Romania, Bulgaria, Cyprus and Malta is missing

Main crop yield (kg/ha) of secondary farming system	No	Data are derived from Eurostat regional and national statistics 2008 Data for Romania, Bulgaria, Cyprus and Malta is missing
Total fertilizer use (kgN/ha)	Yes	Only available for some partner's countries. The partners found these data from national surveys or via interviews to stakeholders and experts consulting
Farmer's formation level	Yes	Only available for partner's countries. The partners found these data from national surveys or via interviews to stakeholders and experts consulting

4.2. Further work

Here is a summary of actions that might be undertaken in the future to enhance the delivered information on WP2 "Current and future crop and soil management system in Europe. They are identified in the text below.

Action 1: Where information is still missing or the disaggregation required complex modeling, a possible way to overcome the issue could be undertaken:

- To gather the information directly from experts or stakeholders (i.e. interviews to farmers unions, thematic desks of national or regional institutions, advisors, and so on)
- Retrieve information on the average quantities for each crop in each NUTS2 level from literature or interviews.
- Instead of retrieving specific information on the quantity of input factors we might try to define 2-3 classes such as low, medium and high input levels.

Action 2: The results from project Catch-C in experimental fields recreating different environmental conditions on EU countries and soil management practices might be compared with the results from WP2 indicators and reports. This comparison would be an useful measure of the results' robustness.

Action 3: It is expected that along this year new data in soil carbon content will become available to enhance the typology about this important matter (eg: LUCAS database) combining with 2.1 results.

Action 4: We will model correlations between agronomic and socioeconomic outputs from WP2 deliverables by statistical and econometric analysis, in order to find out what are the determinant factors on soil management practices implementation.

5. Conclusions

Spain, Denmark, United Kingdom and Lithuania show the regions with the largest agricultural extension in terms of hectares, followed by France, Ireland, Romania and Poland.

The predominant main farming systems in EU-27 are field crops, mixed farms and pasture and grasslands. Some exceptions are found in regions of Netherlands with industrial crops or in regions of Spain and Italy with permanent crops. Data provided by partners reflected a higher amount of permanent crops than Eurostat data, especially in Italy and Spain regions. The rest of countries of case study regions do not show changes in their typical farming system between sources of data.

The biggest areas of main farming systems in terms of hectares are found in regions from Spain (Andalucía, Castilla La Mancha and Castilla León) and United Kingdom (Scotland), followed by regions of Denmark, Poland, France and Lithuania. The regions showing low percentages of main farming systems, are probably sharing the agricultural area with others relevant farming systems.

The most frequent crops in the main farming system are soft wheat, fodder on arable land and grassland. The highest crop yields in the main farming system are found in Netherlands and Ireland regions as well as northwest regions of Spain. In the other hand, the lowest crop yields in the main farming system are found in some regions of Spain, Italy, Finland, Lithuania and Estonia.

The predominant secondary farming systems in EU-27 are mixed farms, field crops and pasture and grasslands. Regions of Netherlands and Greece show industrial crops and regions of Spain permanent crops and horticulture.

The biggest areas of secondary farming systems in terms of hectares are found in regions from Spain, United Kingdom, Ireland, France, Denmark, and Lithuania. Regions showing the highest percentages of secondary farming systems are mainly located in Netherlands, Belgium, Germany, Czech Republic, Greece and France (Corse).

The most frequent crops in the secondary farming system are fodder on arable land and barley. The highest crop yields in the secondary farming system are found again in some regions of Netherlands, Belgium and France. The lowest crop yields in the secondary farming system are found in some regions of Spain, Italy, Poland, Greece, Sweden, Finland, Lithuania and Estonia.

Regions of case study countries show how they are implementing different combinations of practices for their main farming systems, nevertheless conventional tillage remains as a common feature for all of them.

Many of the regions in EU-27 are implementing more than 60% of conventional tillage out of total arable land. The soil management practice of reduced tillage is not extensively

undertaken. Only Cyprus, Halle region in Germany and Severoiztochen region in Bulgaria are implementing approximately 60-80% of reduced tillage and no region is implementing more than 80% of reduced tillage out of total arable land. In the same way that the implementation of the reduced tillage practice is limited, the agricultural practice of zero tillage is barely undertaken in most of the EU-27 regions. The EU-27 average of reduced tillage implementation out of total arable land is approximately 18% and for zero tillage is 3%.

Normal winter crop cover is more extensively undertaken between ranges of 40-60% out of total arable land. Only Cyprus is implementing more than 80% of normal winter crop cover.

Most of regions show lower percentages than 60% of bare soil, except Limousin region in France and Valle D'aosta in Italy showing percentages between 60-80% out of total arable land and Corse from France showing more than 80% of bare soil out of total arable land.

Crop rotation is widely undertaken in most of the EU-27 regions. The EU-27 average of crop rotation implementation out of total arable land is approximately 86%.

Most of the regions are barely implementing residue management with percentages lower than 20% out of total arable land and there is no region with percentages higher than 60%. Cover or intermediate crop is found to be the soil management practice less implemented due to most of the regions are showing very low percentages of this practice out of total arable land.

The regions showing the greatest farm profits belong to Spain, Denmark, France and Italy. Others regions showing high farm profits are found in United Kingdom, Netherlands and Poland.

Mediterranean regions are the most irrigated areas as well as Denmark. The most frequent soil types for Eu-27 member countries at Nuts2 level are Cambisol, Luvisol and Podzol. Regarding to nitrogen fertilization, Netherlands and Belgium regions are applying the higher amount.

Regions of case study countries show several factors which are affecting the potential production in the main farming system such as water availability, rain, temperature, altitude and gradient, leaching, erosion, salt intrusion, pest and diseases, soil compaction, farm size, farmer knowledge, wet peat soils. Water availability remains as a common feature for most of them, especially in Mediterranean regions.

Most of regions show very low percentages of organic farming around 0-5% out of UAA. Only Salzburg region in Austria and Severozapad region in Czech Republic show the highest percentages between ranges 20-30% out of UAA.

The average level of farmer's formation about soil management and GHG emissions was only available and provided by partners for regions of case study countries. The regions in Mediterranean areas show lower average formation level of farmers about soil management and GHG emissions.

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7. Annex: Guidelines for Task 2.2



Guidelines for Task 2.2: data on farming systems

WP2 of SmartSOIL

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8th March 2013

Data at the case study level

The case study managers in SmartSOIL will fill the Questions in the revised excel database and explained below from what they know about the case, from national or European databases, interviews with farm advisors or otherwise (e.g. UK from UK farm survey, NL and DK from national surveys if possible).

You may also find many of requested data available from Eurostat Farm Structure Survey database (Total area UUA, standard output (SO), irrigation, areas of different crops...)

http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/regional_statistics/data/database

Expand Regional statistics by NUTS classification (reg),

Click on Structure of agricultural holdings (reg_ef), Structure of agricultural holdings 2010 (reg_ef_2010), Key farm variables (reg_ef_kv),

Please select data, search for region, year (as recent as possible), then indicator and press update.

Indicators (questions) in the database

The indicators in the database are presented as questions (Q1 to Qx). The questions are described below.

Q1. Main farming system (largest occupied area)

Select only one of the following options that best represent the main farming system at the Nuts2 level.

Possible answers: Permanent crops; Field crops; Horticulture; Pasture and grasslands; Industrial crops; Agro-forestry; Mixed farmland; Other (please specify)

Q2. Total area UUA

Area occupied by main farming system. Ha of total agricultural area at the NUT2 level.

Q3. Farm profits – Standard output

Indicator of the economy of farming business (€) (from EUROSTAT 2011)

Q4. Main soil management practices of the main farming system

Select only one of the following options that best represent the main management practices at the Nuts2 level.

For Permanent crops, the possible choices are:

- Reduced tillage (RT)
- Spontaneous catch crops (CC1)
- Cultivated catch crops (CC2)
- Residue Management (RM)
- RT + CC1/CC2 + RM
- RT + CC1/CC2
- Other combination (write)

For Field crops

- Reduced tillage (RT)
- Conventional tillage (CT)
- Direct planting (DP)
- Rotation and adding legumes (RA)
- Residues Management (RM)
- RT + DP + RA + RM
- RT + DP + RA
- CT + RA
- Other combination (write)

For Horticulture (Write)

For Pasture and grasslands

- Spontaneous
- Managed by farmer

Q5. Main crops

Possible answers: 1-3 main crops at the Nuts2 level (National surveys and information)

Q6. Area of main farming system (ha)

Hectares of total main farming system area

Q7. Area of main farming system (%)

Percent value of total main farming system area by total agricultural area

Q8. Irrigated area

Percent value of main crop irrigated area/main crop total (EUROSTAT; FAO; National Surveys)

Q9. Main crop yield

Main crop average yield (kg/ha), at NUT2 level.

Q10. Main limiting factor to attain potential production

Eg: water availability, rain, temperature, humidity, plant or seed variety,market...

Q11. Total fertilizer use

Average nitrogen fertiliser use (kg /ha). Average fertilizer quantity per hectare used just for main crop at the NUT2 region.

Q12. Climate classification

Choose between following options:

- Mediterranean
- Oceanic
- Continental
- Tundra
- Mountain

Q13. Area of organic farming (% of total)

Percentage of area dedicated to organic farming in the main agricultural system at NUT2 level (National surveys)

Q14. Main soil type

Main soil type: Use USDA soil taxonomy:

- Alfisols
- Andisols
- Aridisols
- Entisols
- Gelisols
- Histosols
- Inceptisols
- Mollisols

- Oxisols
- Spodosols
- Ultisols
- Vertisols

Q15. Secondary farming system (second occupied area)

Select only one of the following options that best represent the second farming system at the Nuts2 level.

Possible answers: Permanent crops; Field crops; Horticulture; Pasture and grasslands; Industrial crops; Agro-forestry; Mixed farmland; Other (please specify)

Q16. Main crops in the secondary farming system

Select only one of the following options that best represent the main management practices at the Nuts2 level.

For Permanent crops, the possible choices are:

- Reduced tillage (RT)
- Spontaneous catch crops (CC1)
- Cultivated catch crops (CC2)
- Residue Management (RM)
- RT + CC1/CC2 + RM
- RT + CC1/CC2
- Other combination (write)

For Field crops

- Reduced tillage (RT)
- Conventional tillage (CT)
- Direct planting (DP)
- Rotation and adding legumes (RA)
- Residues Management (RM)
- RT + DP + RA + RM
- RT + DP + RA
- CT + RA
- Other combination (write)

For Horticulture(Write)

For Pasture and grasslands

- Spontaneous
- Managed by farmer

Q17. Area of second farming system (ha)

Hectares of total main farming system area

Q18. Area of second crop (% of agricultural area)

Percent value of total second farming system area by total agricultural area

Q19. Second farming system irrigated area (% total area)

Percent value of second crop irrigated area/second crop total (EUROSTAT; FAO; National Surveys)

Q20. 2nd Crop yield (kg/ha)

Second crop average yield (kg/ha), at NUT2 level.

Q21. Total fertilizer use (kgN/ha)

Average nitrogen fertiliser use (kg /ha). Average fertilizer quantity per hectare used just for main crop at the NUT2 region.

Q22. Farmer`s formation level about soil management and GHG emissions

Identify the average level of farmer`s formation level about soil management and GHG emissions associated using next categories:

- No knowledge
- Low
- Medium
- High
- Very high

Q23. References

Please include here all the references that you have used to fill the template.