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1. Introduction

The bioeconomy as a concept can encompass the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. In such a case it includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries. In this report the focus of the bioeconomy is rather on the primary sectors and hence excluding such sectors belonging in the manufacturing industries, the energy production activities (dealt with in the sector analysis on energy) and research and innovation (also dealt with in a separate report). In focusing on primary production the focus is hence on agriculture, forestry and fisheries (including aquaculture). This work is based on analysis of material from a large amount of organisations and official agencies. The topic historically can be said to deal more generally with “sustainable development” within these sectors, whereas in later years there has emerged some strategies, analyses and roadmaps towards the greening of the sectors (using the concepts of the green economy or green growth). There is evidently more focus on the greening of agriculture than on forestry. Similarly, the restructuring of the fish industry has implied that much work can be found dealing with sustainable fisheries and aquaculture.

In a general context, forests are more important than the fishery sector in terms of both GVA and employment generated in the EU. Evidently agriculture is much more important and this is the motivation for why the agricultural sector has received the most attention in this report. Obviously greening of the sectors is much more than just a substitution of damaging throughputs, or being more efficient in the use of variable resources. But based on an analysis of the amount on inputs used in relation to total production one rationale for focusing more on agriculture and fisheries emerges. It is evident that forestry utilise less variable cost inputs (that is the day to day inputs to production) than do the other sectors. In fact, less than 17 % in inputs to production values in the sector comes from physical inputs. The value is rather created from biological processes and from capital investments. Hence, the greening of forestry becomes much more about changing practices, types of forests planted, interaction with other sectors (such as biofuels) and similar aspects. Some of these aspects will be brought forward in relation to the greening of the forest sector, but in general the main sectors in the report are agriculture and fisheries where we can also focus on throughput substitution, efficiency and more general on some damaging inputs and processes.

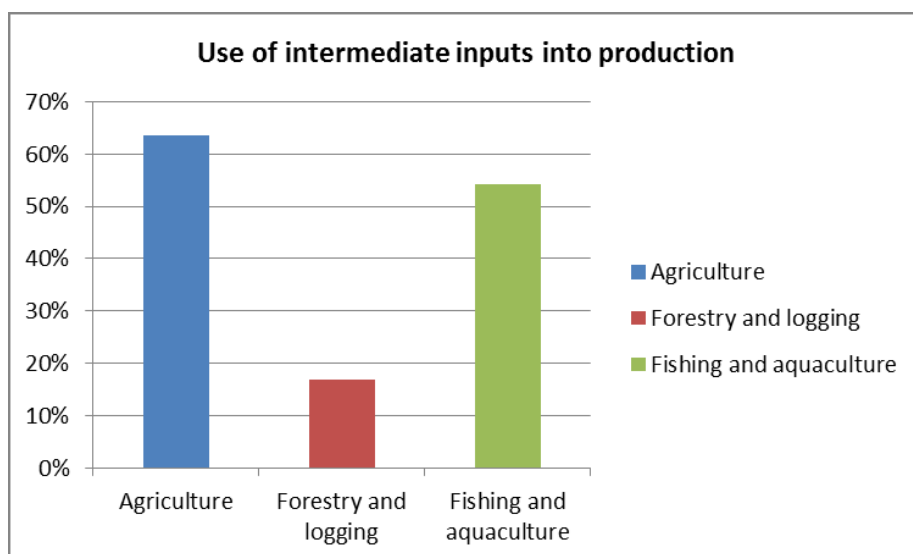
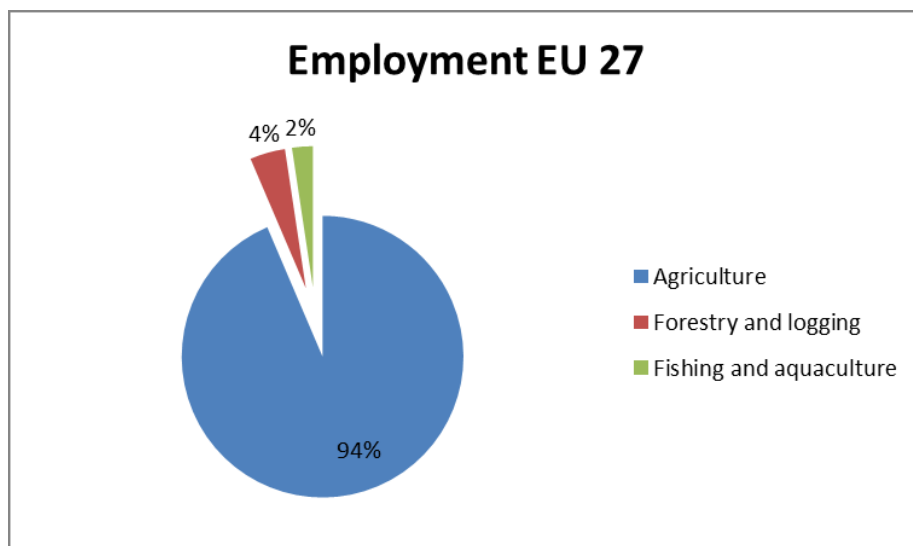
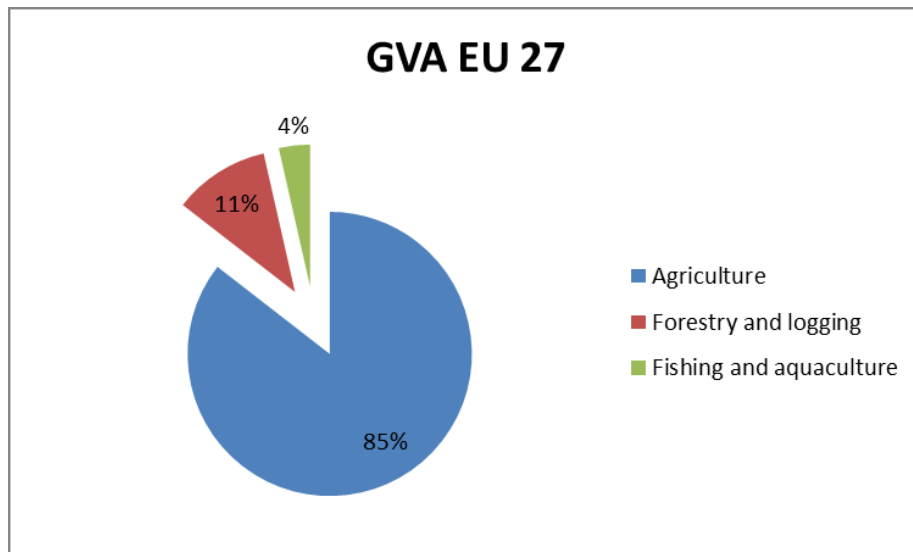


Figure 1. General overview of bioeconomy sectors.

Around half the EU's land is farmed and farming is hence an important factor shaping the natural environment, aesthetics and social aspects of many EU regions. In fact agriculture and forestry together represent 78% of European land cover in the EU-27, ranging from 50% in Malta to 95% in Poland. Agriculture and forestry therefore continue to play a major role in maintaining natural resources and cultural landscapes as a precondition for other human activities in rural areas. Farming and nature influence each other as farming is dependent on many ecological services for its production; and at the same time heavily influences nature by adapting land and using resources and sinks. Even though industrial farming uses more and more resources produces outside the area of the farm (feed, chemicals, pesticides, machinery, knowledge, etc.) a substantial link will always exist between farming and "the place". The same is true for forestry which provides many services to animals and humans, while being ultimately dependent on natural environments for the growth and wellbeing of trees. Agriculture and forests cover the vast majority of our territory and play a key role in determining the health of (predominantly) rural economies and landscapes. From this territorial perspective farmers and forest owners perform many different functions ranging from food and fibre products to countryside management, nature conservation, and tourism. Farming and forestry can thus be described as having multiple functions in a way that is quite different from many other sectors of the modern economy. Its role is not only to produce raw materials, but also to guarantee the survival of the countryside as a place to live, work and visit. From a territorial and green economy perspective this makes these activities, as part of the Bioeconomy sector, highly relevant for studying a transition to a green economy.

Farming has contributed over the centuries to creating and maintaining a unique countryside. Agricultural land management has been a positive force for the development of the rich variety of landscapes and habitats, including a mosaic of woodlands, wetlands, and extensive tracts of an open countryside. The ecological integrity and the scenic value of landscapes make rural areas attractive for the establishment of enterprises, for places to live, and for the tourist and recreation businesses. The links between the richness of the natural environment and farming practices are complex. Many valuable habitats in Europe are maintained by extensive farming, and a wide range of wild species rely on this for their survival. But inappropriate agricultural practices and land use can also have an adverse impact on natural resources, like: pollution of soil, water and air; fragmentation of habitats and; loss of wildlife.

As pointed out by the FAO, agriculture faces multiple challenges. It has to produce more food and fibre to feed a growing population, provide more feedstocks for a potentially huge bio-energy market, adopt more efficient and sustainable production methods and adapt to uncertain impacts of climate change. The FAO has estimated that the world will have to produce 70% more food for an additional 2.3 billion people by 2050. This larger population will not only increase the world demand for food, but also for animal feed (as meat consumption increases), fibre for clothing and housing, clean water and energy.

A transformation of today's predominant agriculture paradigms is urgently needed because conventional (industrial) agriculture as practiced in the developed world has achieved high productivity levels primarily through high levels of finite inputs, such as chemical fertilizers,

herbicides, and pesticides; extensive farm mechanization; high use of transportation fuels; increased water use that often exceeds hydrologic recharge rates; and higher yielding crop varieties resulting in a high ecological footprint.

Agriculture that is based on a green-economy vision integrates location-specific organic resource inputs and biological processes to restore and improve **soil** fertility; achieve more efficient **water** use; increase crop and livestock **diversity**; support integrated **pest and weed** management and promotes employment and smallholder and family farms. Green agriculture has the potential to substantially reduce agricultural **GHG emissions** by annually sequestering nearly 6 billion tonnes of atmospheric CO₂. The cumulative effect of green agriculture in the long term will provide the adaptive resilience to climate-change impacts.

Investments are one of the most important factors to enhance and expand supply-side capacities, with farmer training, extension services, and demonstration projects focusing on green farming practices that are appropriate for specific local conditions. Investments in setting up and capacity building of rural enterprises are also required. Additional investment opportunities include scaling up production and diffusing green agricultural inputs (e.g. organic fertilizers, biopesticides, etc.), no-tillage cultivation equipment, and improved access to higher yielding and more resilient crop varieties and livestock. Investments in post-harvest storage handling and processing equipment, and improved market access infrastructures would be effective in reducing **food losses and waste**.

The Europe 2020 Strategy calls for a development of the bioeconomy as a key element for smart and green growth in Europe. In this context the Bioeconomy refers to the sustainable production and conversion of biomass into a range of food, health, fibre and industrial products and energy. Advancements in bioeconomy research and innovation uptake will allow Europe to improve the management of its renewable biological resources and to open new and diversified markets in food and bio-based products. Today the EU's bioeconomy sectors are worth € 2 trillion in annual turnover and account for more than 22 million jobs and approximately 9% of the workforce. Significant growth is expected to arise from sustainable primary production, food processing and industrial biotechnology and biorefineries, which lead to new bio-based industries, transform existing ones, and open new markets for bio-based products. New high skilled jobs and training options need to be developed to meet labour demands in these industries, as well as in agriculture, forestry, fisheries and aquaculture. It is estimated that direct research funding associated to the Bioeconomy Strategy under Horizon 2020 (EU's new program for research and innovation) could generate about 130 000 jobs and € 45 billion in value added in bioeconomy sectors by 2025.

The Common Agricultural Policy (CAP) has identified three priority areas for action to protect and enhance the EU's rural heritage. These are in line with a green growth perspective even though they should be seen more in the light of the prevailing discourse on sustainability (of agriculture and rural areas). The priorities includes: biodiversity and the preservation and development of 'natural' farming and forestry systems, and traditional agricultural landscapes; water management and use; and dealing with climate change. The

main drivers as we will see below are targeted payments to rural development measures and for promoting environmentally sustainable farming practices, like agri-environment schemes. Also, farming must comply with environmental laws by sanctioning the non-respect for these laws by farmers through a reduction in support payments from the CAP and through the enforcement of cross compliance measures for the single farm payment.

The European Union (EU) has a total area of forest and other wooded land area of 136 million ha accounting for about 36% of its surface area. Contrary to what is happening in other parts of the world, forest cover in the EU is slowly but steadily increasing at a rate of approx. 0.3% per year and forests are present in a huge variety of climatic, geographic, ecological as well as socio-economic conditions. Ecologically, EU forests belong to numerous vegetation zones, ranging from the coastal plains to the Alpine zone, while socio-economic management conditions vary from small family holdings to large estates belonging to vertically integrated companies. (EC 2003).

Traditionally, the most important function of forests has been (and still is in many parts of the world) their use as a renewable source of timber and other products, such as resin, cork, mushrooms and berries: this is known as the raw material function of forests. Besides their economic role, forests offer many other benefits, which are increasingly being re-discovered as useful to society. In Europe, increasing leisure time, for instance, has made the recreational use of forests important socially. Environmental benefits of forests, such as biodiversity and landscape conservation, impact on global and regional climates, water and soil protection, are highly valued, even if not expressed in monetary terms. In mountain areas, avalanche control and protection against erosion are additional functions. Over the last decade, increasing attention has been paid to the role of the world's forests in the carbon cycle. Forests are generally managed in order to fulfil several functions simultaneously. That means, for example, that in a forest essentially providing soil protection but which is also important for biodiversity and recreation, selective timber harvesting can be performed whilst maintaining the former forest functions. (EC 2003).

The EU major objectives in relation to forestry are: promotion of the sustainable development of the EU forestry sector as a contribution to rural development and, in particular, to the creation and preservation of jobs in rural areas; protection of our natural environment and our forest heritage by ensuring the role of forests and forestry in soil protection, erosion control, water regulation, improvement of air quality, carbon sequestration, mitigation of and adaptation to climate change effects, conservation of biodiversity and the restoration of damaged forests. The protection of forests against biotic and abiotic factors; improvement of ecological, economic and socially sustainable forest management within the framework of the internal market, and in line with the Union's international obligations; assuring the competitiveness of the EU forest based industries; improvement of forest monitoring instruments in accordance with the requirements of existing environmental agreements; increasing the use of sustainably-produced wood and other forest products, as environmentally friendly and climate neutral sources of materials and energy through encouraging certification of sustainable forest management and encouraging labelling of related products; promotion of sustainable and equitable forest management as a means of reducing poverty and thus contribute effectively to the EU's development policy. (EC 2003).

EU action under existing responsibilities are based on the following. With their many functions, forests are essential to rural areas and constitute a major component of an integrated rural development policy, particularly because of their contribution to income and employment and their ecological and social value. Forests and their structural and biological diversity are an important part of the European natural environment and their protection and conservation falls within the scope of a number of EU policies and is the subject in particular of specific environmental measures such as the EU Biodiversity Strategy and Action Plans and the Natura 2000 network of protected areas. Forests play an important role in climate change mitigation and forest-related actions are foreseen in the context of the European Climate Change Programme. For forest products, and in particular wood (as well as cork and resins), the rules of the Internal Market apply, including the normal EU competition rules on state aids, mergers and cartels. Thus, a number of important EU policies have a considerable impact on forests. The EU therefore has a key role to play in achieving the objectives laid down by the Member States and the EU in the framework of the Forestry Strategy. (EC 2003).

2. Conceptual elements

This chapter is organised as follows. First we introduce the concept of green growth/green economy for the bioeconomy in more general terms. After that a section discusses the aspect of input use and throughput substitution for the sectors, before we go into some specific sections that go through the aspects of greening for agriculture and to some extent forestry.

According to “**UNEP Towards a green economy (2011): Agriculture investing in natural capital**” the greening of agriculture refers to the increasing use of farming practices and technologies that:

- Maintain and increase farm productivity and profitability while ensuring the provision of food on a sustainable basis;
- Reduce negative externalities and gradually lead to positive ones; and
- Rebuild ecological resources (i.e. soil, water, air and biodiversity “natural capital” assets) by reducing pollution and using resources more efficiently.

Farming practices and technologies that are **instrumental in greening agriculture** include:

- Restoring and **enhancing soil fertility** through the increased use of naturally and sustainably produced nutrient inputs¹; diversified crop rotations; and livestock and crop integration;
- **Reducing soil erosion and improving the efficiency of water use** by applying minimum tillage and cover crop cultivation techniques;
- **Reducing chemical pesticide and herbicide use** by implementing integrated biological pest and weed management practices; and
- **Reducing food spoilage and loss** by expanding the use of post-harvest storage and processing facilities.

A diverse, locally adaptable set of agricultural techniques, practices and market branding certifications such as Good Agricultural Practices (GAP), Organic/Biodynamic Agriculture, Fair Trade, Ecological Agriculture, Conservation Agriculture and related techniques and food supply protocols exemplify the varying shades of “green” agriculture.

The **Directorate general for internal policies** recently published a report on **How to improve the sustainable competitiveness and innovation of the EU agricultural sector** (2012) where they introduce the concept of “Sustainable competitiveness”. This concept can perhaps be interpreted as a parallel to green growth as it embodies the environmental and social dimensions in the word “sustainability”, and the economical dimension in the word “competitiveness”.

The report states that the notion of “sustainable competitiveness” has been described by the Commission as follows: “The overarching objective for the future CAP should be sustainable competitiveness [...] **to achieve an economically viable food production sector, in tandem with sustainable management of the EU's natural land-based resources.**” This sounds much like the definition of green growth developed by e.g. UNEP.

Sustainable competitiveness is used in the report to describe an agricultural sector which is able to maintain viable production throughout the territory of the EU, and which at the same time protects natural and cultural resources and contributes to successful climate change mitigation and adaptation. Innovation is viewed as a key means by which sustainable competitiveness should be achieved. It should embrace all actors, private, public and voluntary, in the rural economy and rural communities and include the policy process, its integration and implementation.

¹ Although organic sources of fertilizer and natural methods of pest and weed management are central elements of green agricultural practices, the highly efficient and precise use of inorganic fertilizers and pest controls may also be included in the broad spectrum of sustainable farming practices that need to be adopted to achieve global food security. This far more efficient use of inorganic agriculture inputs is particularly required in the initial phase of a long term transition to a green agriculture paradigm.

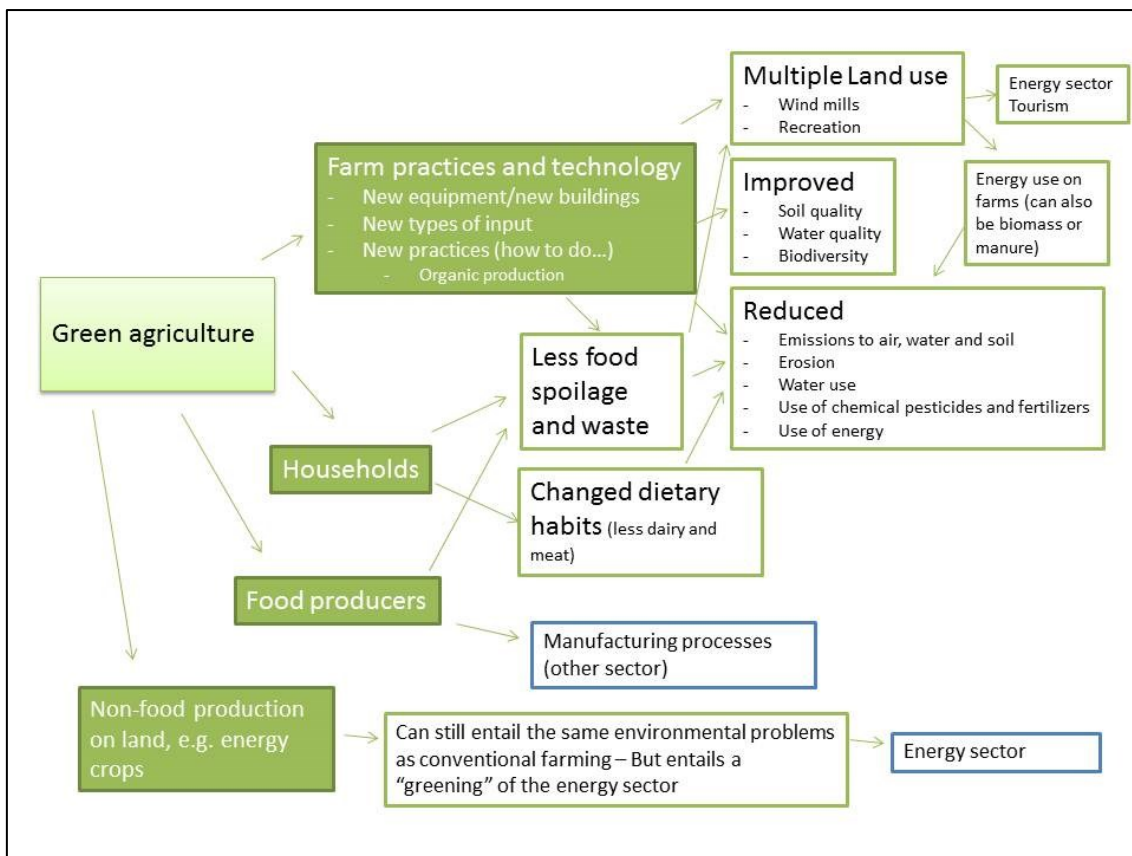


Figure 2. Possible aspects of green agriculture (own elaboration)

When it comes to **forestry** the major sources for discussing green growth that have been found are the European Commission (e.g. the forest strategy for EU), the UN (e.g. UNEP and FAO). In the UNEP (2008) report on Green jobs: towards decent work in a sustainable low carbon world, the greening of the forest sector is perceived as employment in the fields of **“Reforestation and afforestation projects”, “Agroforestry”, “Sustainable forestry management and certification schemes”, and “Halting deforestation”**.

The EU forest plan for the years 2007-2011 focuses on the aspects of **“Climate change mitigation”, “Biomass and energy”, “Protecting Biodiversity”, “Fire and pollution” and “Plant health”**.

The UNECE/FAO publication **The forest sector in the green economy**, focuses on the aspects of **“biomass energy”, “green infrastructure and buildings”, “forest resources as carbon sinks”** and the role of **“environmental services from forests”**.

Based on this very first conceptualisation of the different aspects of greening of the sectors it could be suggested that the concepts in the agricultural sector focuses more on use of damaging or limited inputs and management techniques; whereas the forest concepts are focusing more on new ways of using forest materials as renewable materials. This is

obviously a simplified picture since organic farming, energy production and consumer change is part of the agricultural concepts; and certification schemes and reforestation is part of the forest concepts. But never the less – there might be an interesting distinction on how greening of the sectors are framed and perceived.

2.1 Throughput substitution in general: a first picture of the sectors

In general a greening of agriculture, forestry and fisheries can entail a substitution towards more sustainable, renewable or re-usable resources in the entire production processes. This will imply a focus on different inputs in different sub-sectors of agriculture and forestry. It will also entail different focus on substitution or resource efficiency in different countries. This is illustrated below by an analysis of the input-output tables for the UK and Sweden where the most important inputs for the sectors have been depicted. It is evident that a few inputs are the major ones in each sector and that after these a “basket” of inputs are used in the magnitude of 2-5 percent of inputs. Still, some of the minor inputs can still be important since this category includes chemicals, energy, fossil fuels, and water; resources that are clearly in focus for a greening of the sectors as we will see later in this chapter.

As an example, for UK agriculture the major physical inputs are made up of feed, agricultural services (this includes use of other farmers machinery and equipment), coke and petroleum products, fertilizers and electricity. There is an evident scope for efficiency and substitution and the links to the major dimensions of green growth depicted above is clear.

Crop And Animal Production, Hunting And Related Service Activities (UK)	
Prepared animal feeds	22.5%
Products of agriculture, hunting and services	20.0%
Coke and refined petroleum products	8.3%
Inorganics and fertilisers	7.2%
Legal services	5.9%
Wholesale and retail trade	4.0%
Financial services	3.5%
Electricity, transmission and distribution	2.4%

In forestry the major input categories are (besides the internal use within the sector) coke and petroleum, transport services, equipment for transport and motor vehicles. As for agriculture the implications for substitution in both variable and (semi) fixed assets (fuel and vehicles) are profound.

Forestry And Logging (UK)

Products of forestry, logging and services	45.3%
Coke and refined petroleum products	7.1%
Land transport services	6.7%
Wholesale and retail trade	5.1%
Rental and leasing services	3.5%
Other transport equipment	2.7%
Motor vehicles	2.4%

Fishing and aquaculture utilizes a large amount of fuel for boats and equipment, as well as feed for aquaculture, electricity and materials in the form of plastics, rubber and vehicles. It is evident that the major component of greening of fisheries and aquaculture entails a focus on fuels, energy and feed.

Fishing And Aquaculture (UK)	
Coke and refined petroleum	17.9%
Prepared animal feeds	14.8%
Fish and other fishing products; aquaculture products; support services to fishing	14.4%
Electricity, transmission and distribution	5.2%
Rubber and plastic products	4.5%
Ships and boats	3.7%
Repair and maintenance of ships and boats	3.6%
Financial services	3.4%
Gas: steam and air conditioning supply	3.3%
Specialised construction works	3.1%

The picture is similar for Sweden with the major scope for greening of agriculture, with respect to resource use, found in feed, chemicals, fuels, constructions and electricity. Within the sector itself the major component is use/lease of other farmer's machinery and this goes back to fuel and equipment.

Products of agriculture, hunting and related services (Sweden)	
Products of agriculture and services	24.7%
Feed and food products	21.1%

Wholesale and retail trade	12.4%
Chemicals and chemical products	8.1%
Coke and refined petroleum products	7.5%
Constructions and construction works	3.5%
Electricity, gas, steam	3.2%
Repair and services of machinery and eq.	2.8%
Machinery and equipment	2.5%
Veterinary, scientific and techn. services	2.1%

For Swedish forestry the picture is similar as for the UK with the major scope to be found in energy, machinery, equipment and constructions.

Products of forestry, logging and related services (Sweden)	
Products of forestry, logging and services	17.2%
Coke and refined petroleum products	14.7%
Wholesale and retail trade	8.1%
Repair and services of machinery and eq.	7.2%
Machinery and equipment	6.1%
Financial services	5.9%
Wood and of products of wood	5.3%
Constructions and construction works	4.6%
Agriculture, hunting and related services	3.9%
Electricity, gas, steam	2.8%

The fishery and aquaculture sector offers some surprises as the major inputs comprise of fossil fuels, textiles, wood products, warehousing and transport. For the greening of the sector the picture is though the same, a focus on fuels, energy and fixed assets related to these flows (e.g. vehicles and buildings).

Fish and other fishing products; aquaculture products; support services to fishing (Sweden)	
Coke and refined petroleum products	33.5%
Wholesale and retail trade	12.2%
Textiles, wearing apparel and leather	11.0%

Wood and of products of wood	10.2%
Warehousing and services for transp.	6.2%
Other transport equipment	4.9%
Land transport services	4.3%
Repair and services of machinery and eq.	4.1%
Financial services	3.0%
Fabricated metal products	1.9%

Finally, to give an example of a southern European country, and to show the availability of data, the input-use structure for Spain is depicted below for the same sectors, compiled from the official Spanish I-O tables for the year 2000.

Spain input structure for 2000 (from national Use-matrix)					
Agriculture, livestock and hunting		Forestry		Fishing, operation of fish hatcheries and fish farms	
Prepared animal feeds	30.5%	Trade, maintenance and repair services	12.8%	Other transport supporting services	16.5%
Products of agriculture	11.5%	Pesticides and agro-chemical products	6.3%	Ships and boats and repair services	14.3%
Live animals and animal products	6.7%	Insurance and pension funding	6.1%	Coke, refined petroleum products	11.7%
Wholesale and commission trade	5.5%	Coke, refined petroleum products	6.0%	Wholesale and commission trade	4.8%
Basic chemicals	5.3%	Products of agriculture	5.8%	Prepared animal feeds	4.4%
Fabricated metal products	4.8%	Other land transportation services	4.8%	Textiles and textile products	4.1%
Land transportation services	3.8%	Market human health services	4.8%	Retail trade services	3.9%
Pesticides and agro-chemical products	3.6%	Fabricated metal products	4.7%	Other food products	3.9%
Coke, refined petroleum products	3.3%	Agricultural machinery	4.7%	Telecommunications services	2.6%
Pharmaceutical products	2.7%	Wholesale and commission trade	3.5%	Fabricated metal products	2.4%
Collected and purified water	2.6%	Retail trade services	3.2%	Plastic products	2.4%
Agricultural services	2.2%	Legal, accounting, and auditing	2.6%	Other land transportation	2.3%

However, this static and input focused analysis is quite limited in analysing the aspects and component of a greening of these sectors. Greening is as much about processes, externalities, use of territorial resources and interaction with other sectors as it is about traded inputs to the production processes. Therefore the next section offers a wider insight into how greening of the sectors has been discussed.

2.2 Specific aspects of greening agriculture

Agricultural practices and land use have an effect on natural resources, notably biodiversity, water, soil, and climate change. Some of the key components of a transformation to a green production of food and fibre have been outlined in various reports

recently and in what follows we try to place some emphasis on these aspects, which are mainly to do with natural resources directly, but which also extends to waste and energy. Also the aspect of food habits should not be neglected in this respect since the reduced consumption of meat and dairy products would greatly reduce the environmental impact of the sector. This section is an attempt to understand the factual decomposition of what a greening of these activities would actually mean, as a way of understanding what is behind all the big-word green growth. These are the processes that are supposed to be addressed and in this chapter we introduce them conceptually and with some illustrative facts. Further information on the **current** state and trends of these resources, emissions or flows is discussed to greater length in chapter 3.

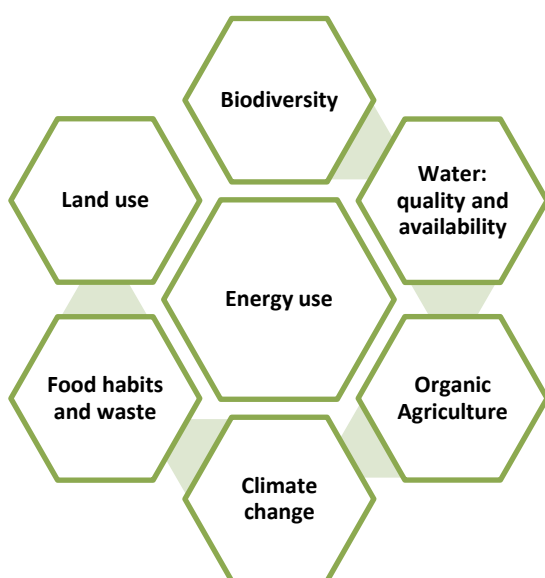


Figure 3. Specific aspects in this chapter focusing on the greening of agriculture

2.2.1 Biodiversity

The link between certain types of farming and biodiversity is not a simple one. The impact of agriculture on biodiversity can be both positive and negative depending on production system and local circumstances. In some cases, agricultural processes supports (or is intrinsically associated with) a high level of biodiversity. Agriculture can contribute in a positive way to species diversity by maintaining the agri-ecological (and cultural) landscapes which provide for a mosaic of habitats and many areas of interaction between fields, meadows and forests. In fact many species of flora and fauna are dependent on these boarder zones associated with the agricultural landscape and forestry. Also, agriculture contributes in maintaining domesticated and wild species and genetic resources. On the other hand, negative effects include intensive production and expansion of heterogeneous landscapes (as well as deforestation) and the specialization of crops and animals. Furthermore, intensive use of inputs such as pesticides and fertilizers can result in species loss and less diversity. These are processes associated with the productivistic agricultural paradigm which have been augmented by previous schemes of the common

agricultural policy (e.g. export subsidies, coupled direct payments and intervention prices).

It is estimated that high nature value farmland covers more than 20% of the agricultural area in most member states (even more than 30% in some). One example is that 16% of the EU-27 utilised agricultural area is located in mountainous areas, where agriculture contributes actively to maintaining biodiversity. Appropriate methods of production, such as extensive farming and crop rotation, may also support biodiversity. The implementation of Natura 2000 represents a significant contribution to the preservation of the biodiversity on farmland. The designated sites cover over 10% of the agricultural area of the EU-27. Also, 21% of the total forest area in the EU belongs to Natura 2000 sites, this share being close to 50% in Bulgaria, Sweden and Finland. However, a decline in the population of farmland birds (one important indicator for biodiversity), largely attributed to intensive farming, can be observed in many Member States. This trend seem to have stabilised at EU level over the last decade but still biodiversity remains a problem for modern farming techniques. Biodiversity is an important component of greening of the agricultural sector, ultimately playing an important role both for continued agricultural production (which depends ultimately on biological processes), and for society more widely (future medicines, recreation, ecosystem stability, nature as a buffer, etc.).

2.2.2 Water: quality and availability

Water quality is influenced by several human activities, yet agriculture plays an important role for many of its features due to both irrigative processes and emissions (e.g. run-off's). Agriculture can impact in different ways on the good chemical and good quantitative status of groundwater and surface waters. Water quality may be negatively affected by the presence of pesticide residues, nutrients from fertilisers, or sediments from soil erosion. Today the agricultural sector in Europe is responsible for (at least) one third of the water use in the region. Southern European countries use the largest percentages of abstracted water for agriculture. This generally accounts for more than two-thirds of total abstraction. In northern Member States, levels of water use in agriculture are much lower, with irrigation being less important but still accounting for more than 30 % in some areas. The amount of water used for irrigation depends on factors such as: climate, crop type, soil characteristics, water quality, cultivation practices. This is water that is internalised into the food and fibre that we eat and use, and which is used for irrigation, animal management and other on-farm activities. Agriculture also affects the quality of water available for other uses. In some parts of Europe, pollution from pesticides and fertilisers used in agriculture alone remain a major cause of poor water quality. Although the concentration of nitrates in surface water has decreased over the last years in most Member States, significant surpluses of nutrients (nitrogen and phosphorus) reveal that farming practices still remain too intensive in some parts of the EU.

The pressure from agriculture on water use is also critical in some regions as the share of irrigated area is higher than 20% of the agricultural area in several Member States. Irrigation is the source of a number of environmental concerns, such as the excessive depletion of water from subterranean aquifers, irrigation-driven erosion and increased soil salinity. On the other hand, traditional irrigation systems create diverse and intricate landscapes, which support a variety of wildlife and have important cultural and historic

value. Irrigation is an area where new **practices and policies** can make a significant difference in water efficiency gains. In southern European countries such as Greece, Italy, Portugal, Cyprus, Spain and southern France, the arid or semi-arid conditions necessitate the use of irrigation. In these areas, nearly 80% of water used in agriculture currently goes to irrigation. However, irrigation does not have to be so water intensive. Water efficiency gains are already being obtained across Europe through both conveyance efficiency (the proportion of abstracted water that is delivered to the field) and field application efficiency (the water actually used by a crop in relation to the total amount of water that was delivered to that crop). In Greece, for example, improved conveyance and distribution efficiency networks have led to an estimated 95% water efficiency gain compared to previously-used irrigation methods. Forests can also contribute to the protection of water and at EU-27 level, 11% of the forests and other wooded land area is managed so as to protect water and soil. However, this management does not cover all the EU-27.

Climate change adds an additional element of uncertainty to the availability of water resources. With prospects of changing precipitation patterns, some parts of Europe are expected to have more and others less freshwater available in the future.

The main CAP instruments promoting sustainable water management are the following:

- Certain rural development measures support investments for improving the state of irrigation infrastructures or irrigation techniques that require the abstraction of lower volumes of water, as well as actions to improve water quality.
- The cross-compliance framework includes statutory requirements related to water protection and management arising from the implementation of the groundwater directive and nitrates directive, as well as GAEC standards.
- At EU level, the Water Framework Directive plays a vital role in protecting water quality and quantity. This Directive requires Member States to establish river basin management plans (at the latest by end 2009), and to ensure that water pricing policies provide adequate incentives for users to use water resources efficiently (at the latest by end 2010).
- Payments under Article 38 of the Rural Development Regulation will contribute to the implementation of the Water Framework Directive.

More on water policy in chapter 4

2.2.3 Energy use

Agriculture can play a dual role in relation to energy, both as a consumer and producer of energy. Farming is a direct energy consumer for crop and livestock production, and also consumes energy indirectly in terms of the energy required to produce fertilisers, pesticides, machinery and other inputs. But agriculture can also produce energy through biomass production which includes in the case of bioenergy, biofuels, such as bioethanol, and bio power in the form of heat and electricity (OECD, 2008).

OECD makes a distinction between direct and indirect energy consumption in agriculture. *Direct* on-farm energy consumption by primary agriculture covers consumption for irrigation, drying, horticulture, machinery and livestock housing. *Indirect* energy, on the

other hand, refers to energy consumption for the production, packaging and transport of fertilisers and pesticides and in the production of farm machinery. A simple model/or concept for energy in agriculture in agriculture is developed by the OECD (2008) (see figure below).

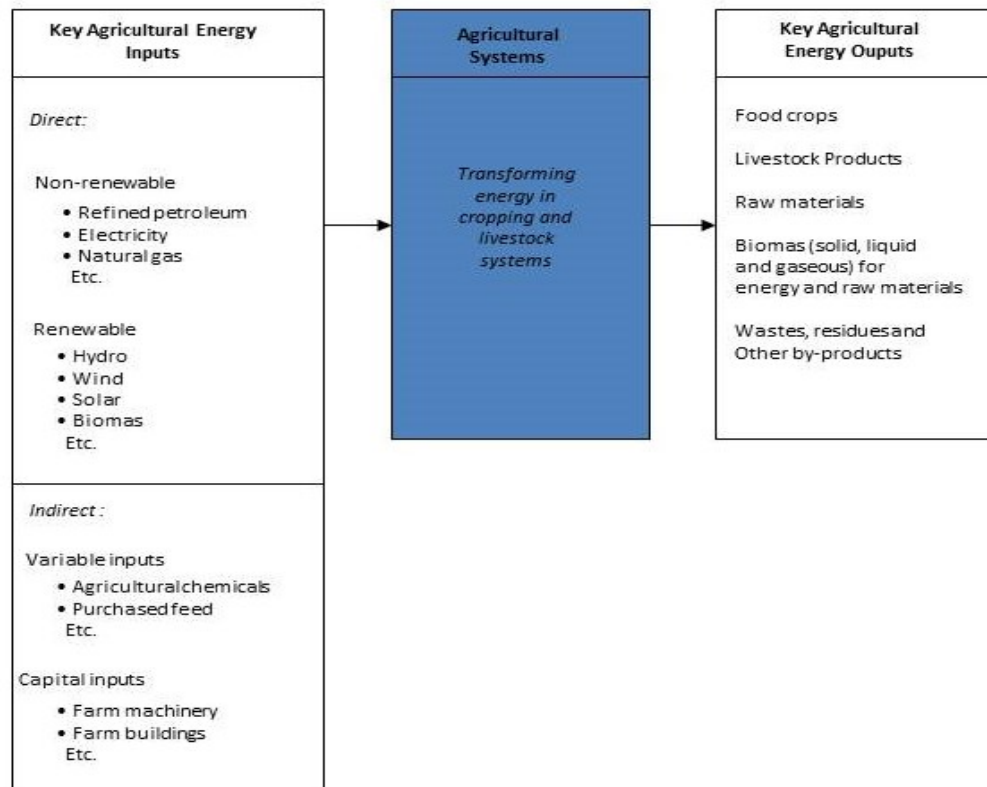


Figure 4. A concept for energy consumption in agriculture. Source: OECD (2008), Environmental Performance of Agriculture in OECD Countries Since 1990, OECD Publishing.

Petrol and diesel are the main sources of on-farm energy consumption in most OECD countries, accounting for over 50% in both the EU15 and the United States. With the expansion in renewable energy production across an increasing number of countries, its share in on-farm energy consumption, though small, has risen, notably in Austria, Denmark and Finland. There has also been a trend in many countries toward an increasing share of electricity in on-farm energy consumption to power machinery, partly reflecting the substitution of labour for machinery.

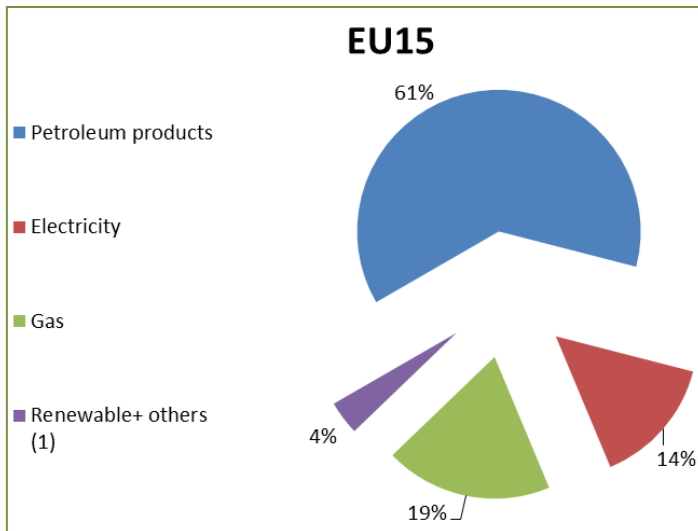


Figure 5. Composition of on-farm energy consumption in 2002, (1) includes solid fuels. Source: OECD (2008), *Environmental Performance of Agriculture in OECD Countries since 1990*, OECD Publishing.

Much of the expansion in on-farm energy consumption in the EU has occurred in Poland, Spain and Turkey. The growth in energy consumption in these countries is largely explained by a combination of rising agricultural production since the 1990s, continued expansion of mechanisation and increasing machinery power, and the substitution of labour for machinery.

Improvements in on-farm energy consumption efficiency (on-farm energy consumption growing at a lower rate than growth in farm production) are apparent for many countries. For example, on-farm energy consumption declined in Austria, Denmark and France, despite an increase in agricultural production.

2.2.4 Land use

Agriculture is the main land user in many European countries, the fact that much of the rural landscape is influenced by farming has led to the widespread perception that rural matches with farming even though the employment in agriculture generally is lower than in other small business and other activities. Across the EU, agricultural land management has created rich landscape diversity, including a mosaic of woodlands, wetlands, and an open countryside. Whilst farming in the past has shaped the landscape the farming activities that helped create those features have lost their competitiveness. The agricultural policy stresses the importance of preserving the farmed landscape as traditional agricultural landscapes form part of the cultural and natural heritage, the ecological integrity and the scenic value of landscapes. Such landscapes make rural areas attractive for the establishment of enterprises, for places to live, for tourism, and recreation businesses. The recently established concept of High Nature Value Farming recognises the causality between certain types of farming activity and natural values, such as high levels of biodiversity or the presence of species and habitats of conservation concern.

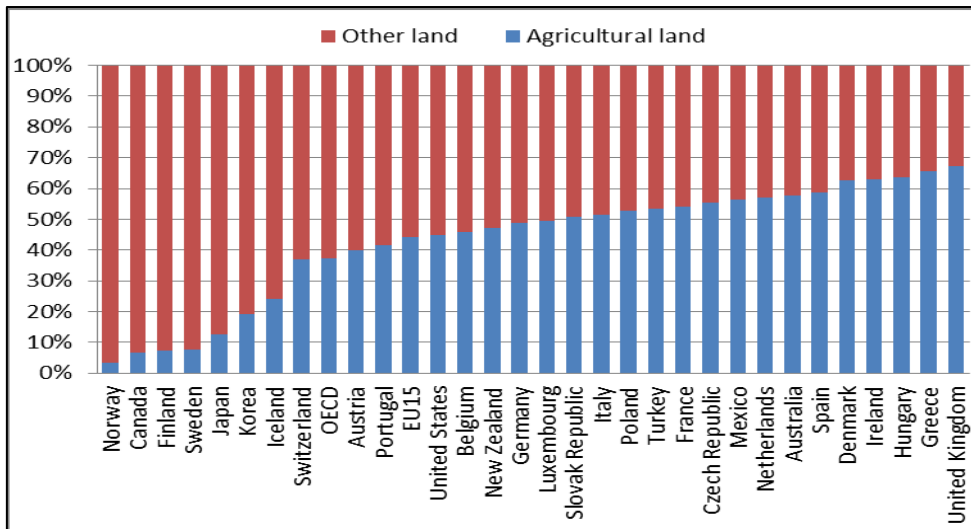


Figure 6. Land use in agriculture as share of total land in EU countries.

More intensive agricultural landscapes can however also be beneficial with respect to biodiversity as certain farmland features can provide for nesting and breeding sites, food sources and migratory corridors. There are also examples of entirely intensively managed farming areas that sustain large populations of species important for nature conservation.

The environmental assets of landscapes generated through agricultural land management have the characteristic of public goods. Policy measures are needed to ensure delivery. Policy measures contributing to the provision of valuable landscapes and its associated assets are notably agri-environment measures. Also, measures such as compensatory allowances in Less Favoured Areas and pillar I Direct Payments help to sustain farming, even though they are not primarily targeted towards environmental outcomes. This means that land which would otherwise return to forest or wilderness can be kept open to the benefit of for instance recreation or biological values. Such land also acts as a resource for future production of agricultural biomass.

Another aspect of land use in respect to green growth, however not directly associated to greening of agricultural processes, is the possibility for land use multifunctionality where other activities (such as windmills, recreation) can take place alongside agricultural production on the same land.

2.2.5 Organic Agriculture

Many believe that organic farming is one type of farm practice that can help in greening the agricultural sector. This is not a straight forward analysis though since some evidence question the possibility to produce enough food globally (using organic fertilisers and non-chemical ways to prevent pests) and the total effect on the environment given more use of machinery in relation to the size of the harvest. This depends heavily on the fuel for machinery and equipment as well as natural circumstances and crops grown. Anyway, organic farming (in Europe) relies on a number of objectives and principles, as well as

common practices designed to minimise the human impact on the environment, while ensuring the agricultural system operates as naturally as possible. According to the EU commission typical organic farming practices include:

- Wide crop rotation as a prerequisite for an efficient use of on-site resources
- Very strict limits on chemical synthetic pesticide and synthetic fertiliser use, livestock antibiotics, food additives and processing aids and other inputs
- Absolute prohibition of the use of genetically modified organisms
- Taking advantage of on-site resources, such as livestock manure for fertiliser or feed produced on the farm
- Choosing plant and animal species that are resistant to disease and adapted to local conditions
- Raising livestock in free-range, open-air systems and providing them with organic feed
- Using animal husbandry practices appropriate to different livestock species

Obviously, many of the benefits of organic farming relates to the aspects brought forward as the main components of greening the entire agricultural sector. Specifically, according to the Commission communication COM (2004:415) the main benefits of organic farming relate to:

- Pesticides: research indicates that organic farming has, on average, a greater effect on the improvement of the landscape, wildlife conservation and faunal and floral diversity than non-organic farming systems. Restricting the use of pesticides, as is the case in organic farming, also improves water quality and fewer pesticide residues are found in food products.
- Plant nutrients: organic farming usually results in lower nitrate-leaching rates than those achieved on average in integrated or non-organic agriculture, as shown by studies on autumn nitrogen residues in the soil of almost all relevant crops.
- Soil protection: management practices broadly used by organic farmers, such as growing catch crops to reduce nitrate leaching, wider and more varied crop rotations, and mixed grazing to reduce mono-specific overgrazing, all help to protect the soil. Although the organic matter content of soil is highly site-specific, it is usually higher on organic compared to non-organic farms.
- Biodiversity and nature protection: organic farming contributes to the preservation of species and natural habitats by means of its reduced inputs, its high share of grassland within holdings and its greater use of indigenous breeds and plant varieties.
- Animal welfare: organic farming may have a positive impact on animal welfare since the standards for organic farming include several requirements in this area that go further than the statutory provisions.

Facts and figures from the EU show that an increasing part of agricultural area is now devoted to organic production, with an estimated 7.6 mio ha in 2008, i.e. 4.3% of EU-27 utilised agricultural area (UAA). In the period 2000-2008, the average annual rate of growth was 6.7% in the EU-15 and 20.0% in the EU-12. The area under organic agriculture is close to or higher than 9% of the total UAA in five Member States: the Czech Republic, Estonia, Latvia, Austria (15.5%) and Sweden. In 2008, it is estimated that there were about 197 000 holdings involved in organic agriculture in the EU-27, i.e. 1.4% of all EU-27 holdings. Consumer food demand grows at a fast pace in the largest EU markets, yet the

organic sector does not represent more than 2% of total food expenses in the EU-15 in 2007.

2.2.6 Climate change

Agriculture has an impact on climate change in many different ways, e.g. through the emission of various greenhouse gases from animal husbandry, the use of fossil fuels in machinery, production (or in agriculture use) of fertilisers, conversion of land previously used as sinks, etc. But agriculture can also contribute to the mitigation of climate change by providing new sinks to greenhouse gases. Agriculture mainly contribute to the emissions by releasing methane - from livestock digestion processes and stored animal manure, and nitrous oxide - from organic and mineral nitrogen fertilizers. In the EU, however, the production of these gases is limited, and falling. With 471 million tonne of CO₂ equivalents, agriculture produced 9.6% of the EU emissions of greenhouse gases in 2008. However, with an average annual decrease of 0.7% per year between 2000 and 2008 - linked to improved production methods and diminishing cattle numbers - greenhouse gas emissions from agriculture have been decreasing at a quicker pace than in other sectors of the economy (down from 11 % in 1990). Moreover, the production of renewable resources from agriculture amounted to 12 million tonne of oil equivalent in 2008 and the area devoted to this purpose in 2008 is estimated around 5 million ha. Hence, EU agriculture contributes increasingly to the mitigation of climate change.

The production of renewable resources from forestry reached 68 million tonne of oil equivalent at EU-27 level in 2007 and grew at an average annual rate of 4.4% over the period 2000-2007.

2.2.7 Food habits and waste

The EU food manufacturing sector and households alone waste about 90 million tonnes of food annually or 180 kg per person, not taking into account losses in agriculture and fisheries. This has a huge impact on the amount of resources used in this sector; resources which are in fact wasted (or to some extent transferred through the energy intensive food production and consumption process - to energy production; if waste is used for heat or fuel production). The material below is from the publication "The Protein Puzzle" made by PBL, the Netherlands Environmental Assessment Agency.

It is evident from looking at the relationship between GDP and protein consumption (figure 7) that we consume more protein the richer we get. Obviously there are some cultural and ethical differences to such patterns but the overall picture is such.

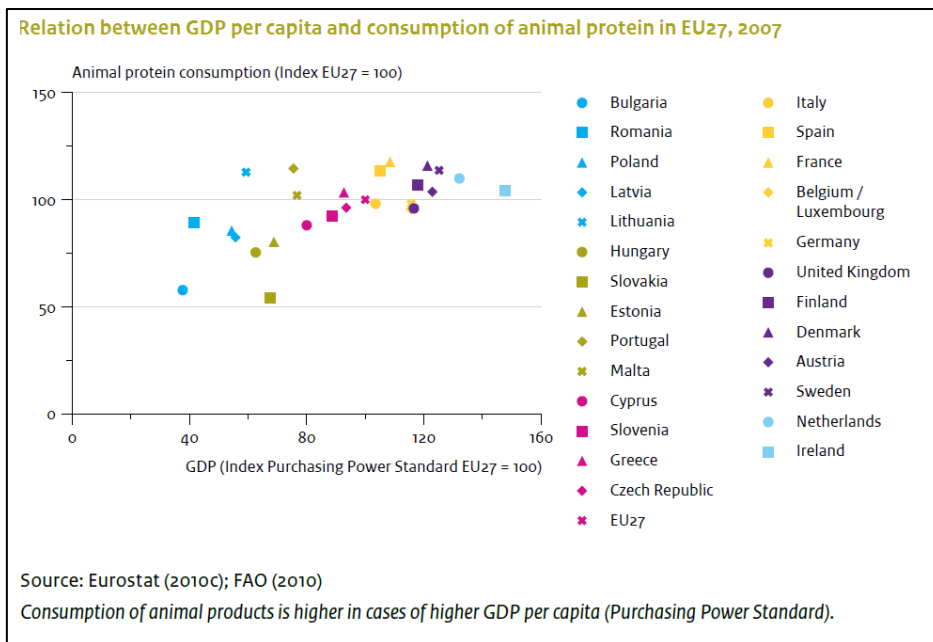


Figure 7. Source: *The Protein Puzzle PBL, the Netherlands Environmental Assessment Agency (2011)*

As the prosperity of the EU has increased the trend is towards consuming more dairy, pig meat and poultry. The consumption of other protein products per capita is rather stable since the 1960s.

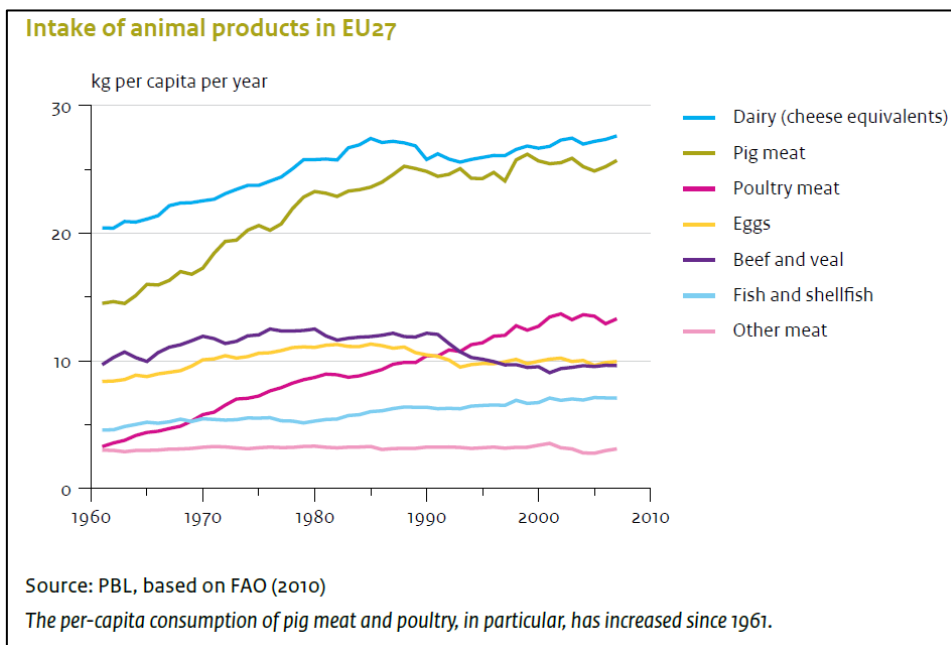


Figure 8. Source: *The Protein Puzzle PBL, the Netherlands Environmental Assessment Agency (2011)*

Over all the intake of protein in the EU is well above the recommendations made by the world health organisation, in fact it is almost the double. Hence a cut-back on meat would be beneficial not only for the environment and resource base – but also for human wellbeing.

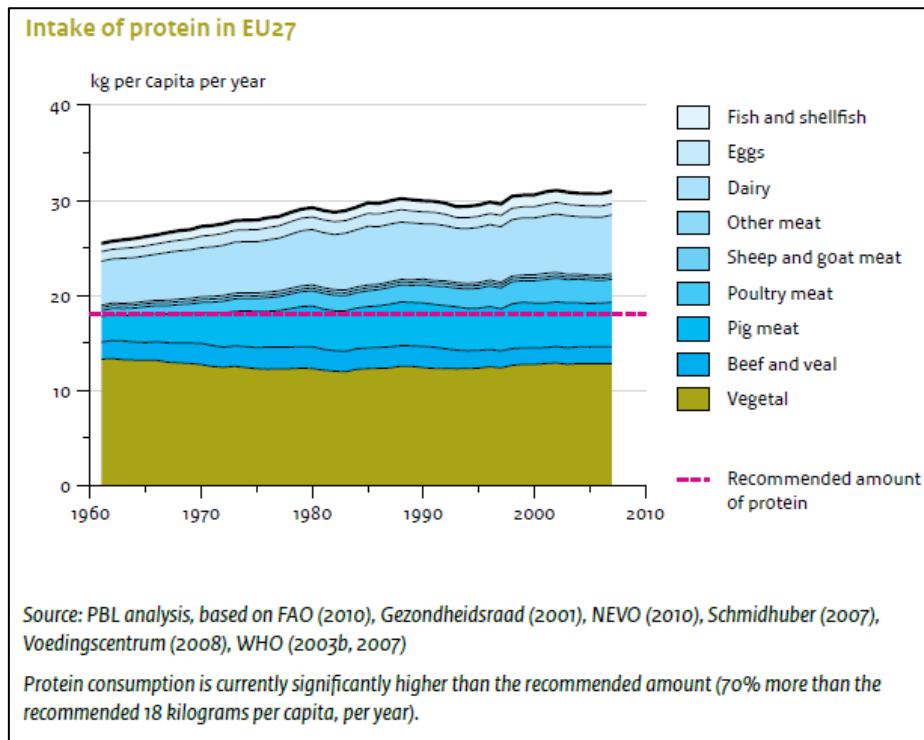


Figure 9. Source: *The Protein Puzzle* PBL, the Netherlands Environmental Assessment Agency (2011)

The fact that over-consumption of meat and other protein product causes severe problems for the environment is due to multiple reasons. It involves both feed production (inputs such as land, water and other resources), manure nitrogen leakage, land use for grazing, greenhouse gas emissions from animals, etc.

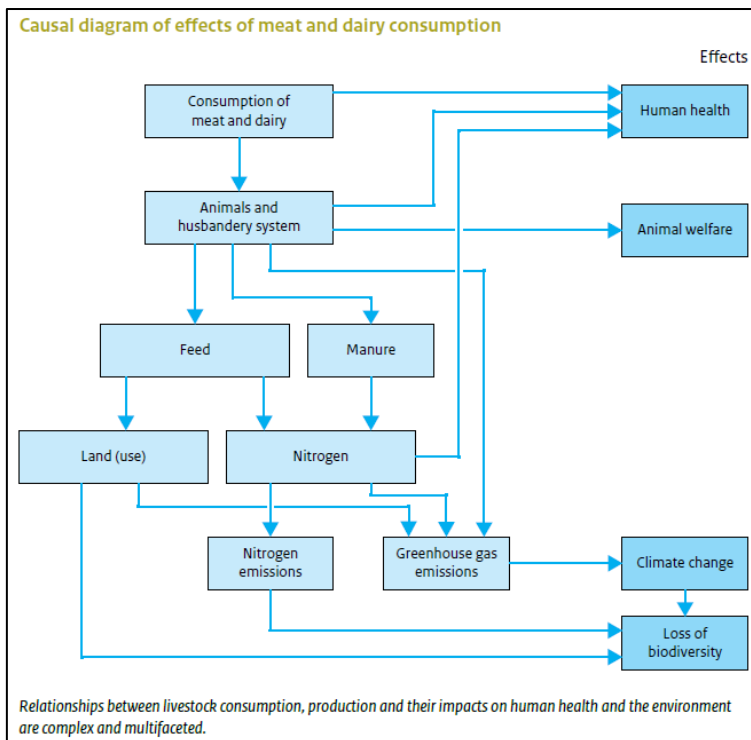


Figure 10. Source: *The Protein Puzzle PBL*, the Netherlands Environmental Assessment Agency (2011)

As shown in the picture the most severe impact for GHG emissions are from beef and veal, dairy cows and pigs sectors. Poultry and egg production have less of an impact. What should be pointed out is that these figures are per sector and not per protein unit.

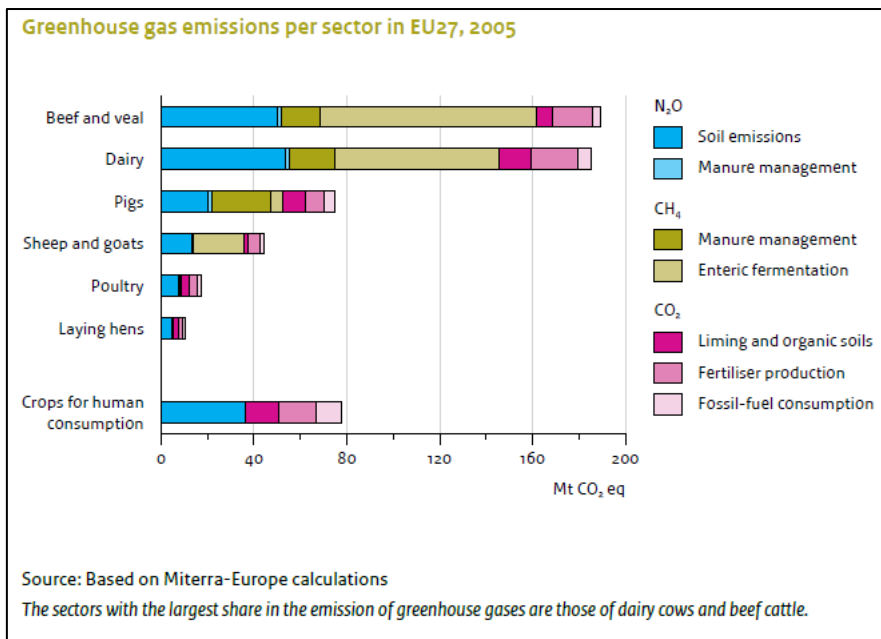


Figure 11. Source: *The Protein Puzzle PBL, the Netherlands Environmental Assessment Agency (2011)*

The picture is the same when it comes to feed use per sector. But here dairy cows are using more inputs compared to beef and pigs (looking at overall sectors once again).

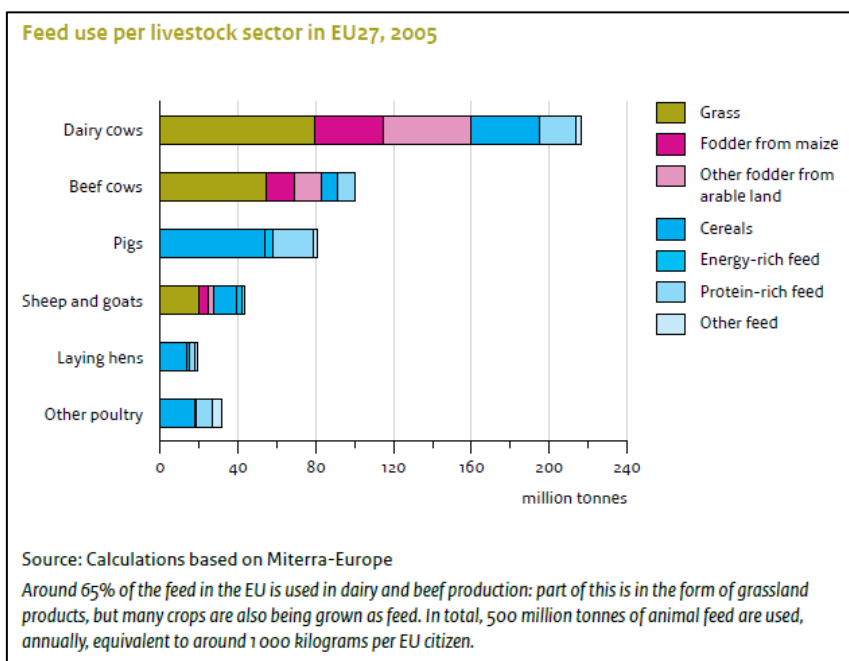


Figure 12. Source: *The Protein Puzzle PBL, the Netherlands Environmental Assessment Agency (2011)*

The picture for land consumption is the same. The land used for dairy production in EU is actually almost the same as that used for crops for human consumption.

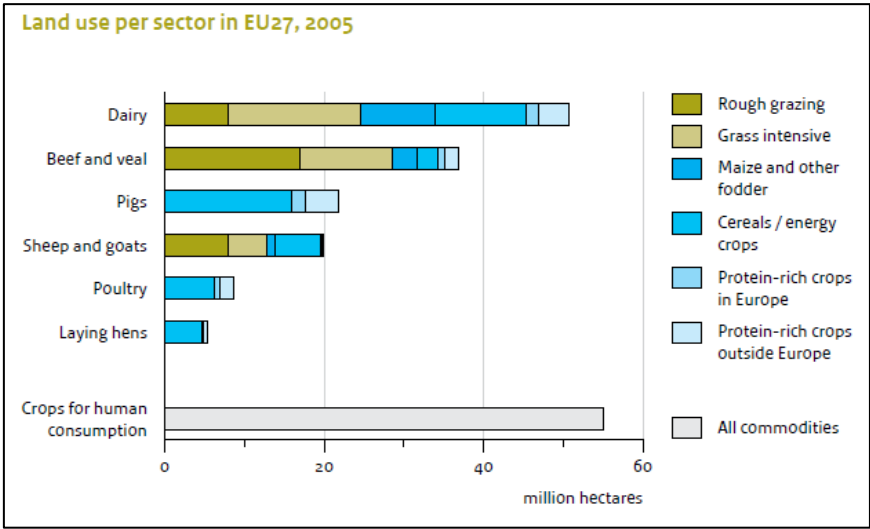


Figure 13. Source: The Protein Puzzle PBL, the Netherlands Environmental Assessment Agency (2011)

These figures were for the sectors as such, but the picture is actually the same once we look at the impact per kg of products. The big difference is for milk which has less of an impact than even poultry and egg.

Table 1. Source: The Protein Puzzle PBL, the Netherlands Environmental Assessment Agency (2011)

Carbon footprint and land use related to protein-rich products

Product	Carbon footprint kg CO ₂ eq/kg	Land use m ² /kg	Of which grassland (m ² /kg)
Beef and veal (16 studies, n=29)	9-129	7-420	2-420
Feedlot systems (n=4)	14-40	15-20	ca 2
Mixed systems/dairy calves (n=8)	9-42	15-29	2-26
Meadow systems, suckler herds (n=9)	23-52	33-158	25-140
Extensive pastoral systems (n=6)	12-129	286-420	250-420
Culled dairy cows (n=2)	9	7	ca 5
Pig meat (10 studies, n=13)	4-11	8-15	
Poultry (4 studies, n=5)	2-6	5-8	
Eggs (4 studies, n=5)	2-6	4-7	
Sheep meat (4 studies, n=5)	10-150	20-33	ca 18-30
Milk (9 studies, n=11)	1-2	1-2	ca 1
Cheese ¹	6-22	6-17	ca 7
Soy milk (1 study, n=1)	1	1	
Shellfish (3 studies, n=5)	1-86		
Fish (fisheries) (5 studies, n=5)	1-7		
Farmed fish (6 studies, n=10)	3-15	2-6	
Meat substitutes containing egg or milk proteins (1 study, n=2)	3-6	1-3	0-2
Meat substitutes, 100% vegetal (2 studies, n=4)	1-2	2-3	
Pulses, dry (2 studies, n=3)	1-2	3-8	

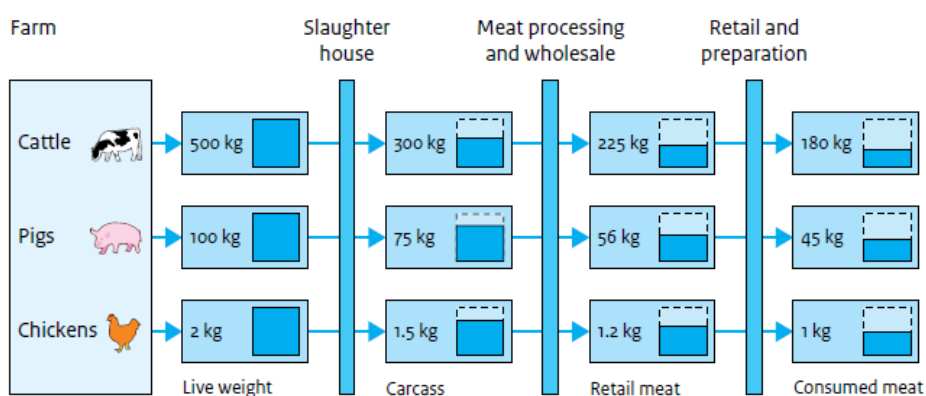
Carbon footprint and land use related to protein-rich products, per kilogram of product, from several LCA studies (cradle to retail, n = number of analysed products, for land use this number may be less).

¹ Based on milk and data from Berlin (2002). For cheese, 6 to 7 kilograms of milk are required (Blonk et al. 2008).

² Only land used for vegetal feed component.

When it comes to waste the most important losses appear in the production of beef. From a 500 kg cow there is only 180 kg reaching the consumer. For a 2 kg chicken the loss is 1 kg.

From farm to fork, overview of losses in the meat chain



Source: PBL, based on Blonk (2008); Luske & Blonk (2009)

Figure 14. Source: The Protein Puzzle PBL, the Netherlands Environmental Assessment Agency (2011)

As shown below the make-up of food waste from the UNEP the problems of food waste in developed countries are primarily in private homes, retail stores, transport and food services.

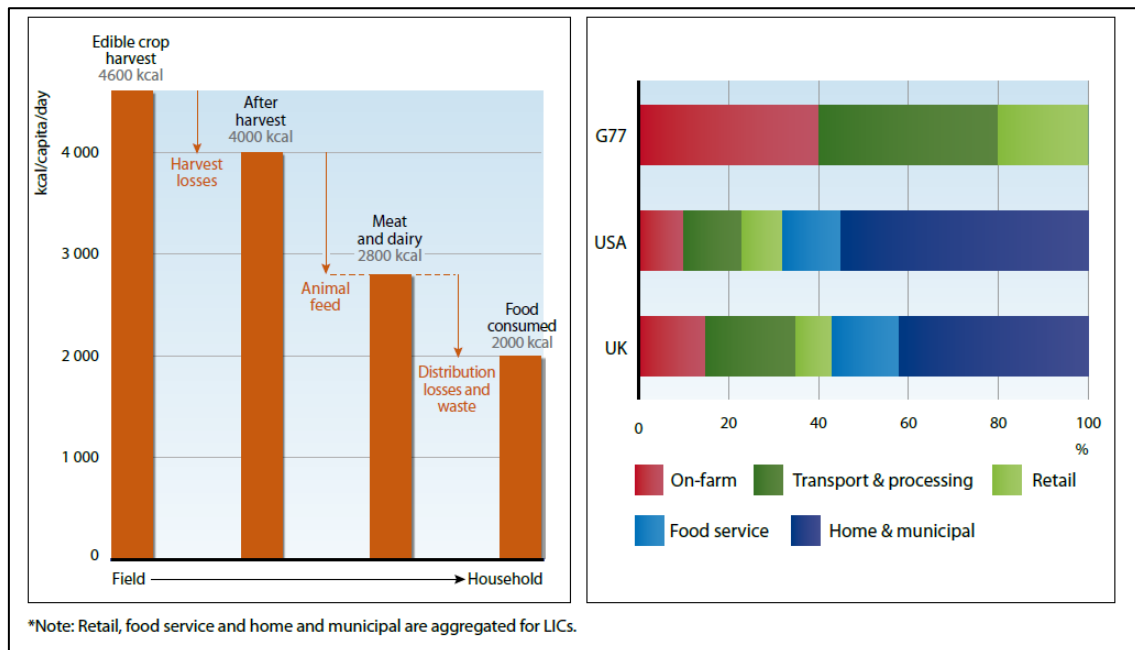


Figure 15. The make-up of food waste. Source: UNEP 2011.

2.3 A green growth strategy for agriculture

OECD's (2011) green growth strategy for agriculture has a dual aim to ensure that enough food is provided for a growing population, but that this is pursued in a sustainable way. This entails increasing output while managing natural resources. It also involves reducing the carbon intensity, waste and adverse environmental impacts throughout the food supply and consumption chain. Furthermore, it visions an enhanced provision of environmental services such as carbon sequestration, flood and drought control, conservation of biodiversity and attractive landscapes for living and recreation. It should be recognized that agriculture and food production can generate both environmental harm as well as positive impacts on ecosystems. Agriculture both depends on natural resources and has a great impact on them. Resource endowments and context (absorptive capacity, thresholds, soil, climate, etc.) differs widely across countries and at different stages of production and between production systems. Therefore context is critical in the discussion about green growth strategies for agriculture and food production.

The OECD (2011) green growth strategy for agriculture focuses on:

- Increasing productivity in a sustainable manner. Increase resource efficiency throughout

the production and consumption chain, both in the way inputs are used and waste is managed. Practically this requires research and innovation towards new practices, and education and information to make sure such new practices will be applied at the farms and by consumers.

- Making sure markets are well functioning and provide correct signals. Correct means prices which also take into consideration externalities, both positive and negative. Prices should reflect scarcity in resources but also in resources which are historically not traded on markets (clean air, biological diversity, absorptive capacity, some sources of water, smell, animal welfare, etc.). Positive aspects of land management and biological services are also a part of green growth in agriculture and forestry and should be priced in order to secure a suitable level of provision.

- Markets should also make sure that property rights are well defined and enforced. With property right there are stronger incentives to manage resources (land, forests, marine ecosystems, water, etc.) more sustainable in the long run. Open access encourage over exploitation (tragedy of the commons) and require special solutions to be efficient and sustainable. In many situations well defined property rights will ensure sustainable exploitation in a more efficient way.

There is a clear time dimension to green growth in agriculture where basic needs for food in developing countries are posed against more long run impacts of sustainability in how this food is produced. This poses a global issue much similar to that of carbon emissions and poverty. These issues call for global solutions where mechanisms of technology and knowledge transfers are utilized.

The vision is that...

Environmental protection and provision of ecological services are viewed as components of economic growth and not as competing ideas which reduce production and growth. Within this model growth is measured both quantitatively and qualitatively, well-being includes environmental quality and growth also includes accounting for resource use. There is a long term perspective in planning with a policy perspective that correct for market failure, stimulates technological progress, new structures and changes consumer behaviour. All governmental agencies, private sector units and individuals are responsible for managing the environment. There are targeted support and fiscal incentives towards green innovation and taxes and charges on all environmental externalities. Linkages between specific economic activities are investigated and the full lifecycles of products are taken into consideration in planning and policy.

Getting the prices right...

Making sure that prices reflect the full costs of production (internalizing externalities) is mentioned time and again and is one of the most important policy strategies to reach green growth (obviously in parallel with technological development and structural societal

changes). One study cited by the OECD showed that the main mechanisms behind the (obviously expected) price-energy and price-fertilizer use relationships was using machinery less intensive, servicing machinery more frequently, changes in what is actually grown, and the use of precision application methods.

There are both complementarities and disagreement between a green growth strategy for agriculture and the traditional growth model for the sector and its contribution to society. For one thing since agriculture is directly dependent on natural resources for its production a green growth impact on sustaining these resources would strengthen the agricultural sector. For individual farmers or groups of farmers other direct economic impacts could be the benefits of increased price premiums from certification or from governmental payments for agri-environmental measures such as conservation programs or ecological production. The disagreements (non-growth impacts of the “greening”) are primarily in the short run. These include reduced growth in economic terms in the agricultural sector in developed countries as environmental rules are imposed and where farmers turn their attention to provision of public goods rather than traditional production.

Investments are a key factor...

Investments into the sector and in more high skilled labour could also improve profitability and the social sustainability in agricultural regions (e.g. improved rural development). In the long run food safety could be improved if resources were managed more sustainable (land management, water availability, toxic pesticides abandoned, etc.) and the health of farm workers could be improved in both the short and long run. Green growth in agriculture and the food system will require an examination of product life cycles and for governments to evaluate what they can do to help reduce energy usage and product waste. In order to address environmental issues many manufacturing companies in OECD countries are beginning to focus on eco-innovation, i.e. innovation that results in a reduction of the environmental impact of producing and delivering products to consumers. An important feature of such innovation is that it shifts the emphasis from end-of-pipe pollution control to a focus on product life cycles and integrated environmental strategies and management systems (OECD, 2009a). There are many examples in food and agriculture where such an approach is important. A considerable amount of waste can be generated in the food and agricultural system, which not only adds to pressure on the land and water resources used by the system but also represents an untapped resource. The food and agricultural system has become increasingly energy intensive. The growth in the production of convenience foods and changes in the presentation of foods to consumers (e.g. sales of washed and packaged vegetables rather than in their relatively unprocessed state) incurs energy usage and generates a waste stream in the form of packaging. The standards set by retailers (e.g. requirements on the size and appearance of fruit and vegetables) can also add to the amount of material entering the waste stream as products that do not meet those requirements may be unable to find a market. Much of the food product waste which used to be fed to livestock (which is prohibited on food safety grounds) now ends up in landfill sites, which could be used instead for bioenergy production. Nevertheless, in some countries investment in facilities to produce biogas from food waste is underway – with investment subsidies.

In the publication **“THE EUROPEAN BIOECONOMY IN 2030 Delivering Sustainable Growth by addressing the Grand Societal Challenges”** a collaboration of EU technology platforms proposes a strategy for moving towards a bioeconomy in Europe. They say: “The Bioeconomy refers to the sustainable production and conversion of biomass into a range of food, health, fibre and industrial products and energy. Renewable biomass encompasses any biological material as a product in itself or to be used as raw material. The transition from a dependence on fossil fuels to a situation where agriculture not only will continue to provide food security but also biomass as a renewable raw material for industry will be the basis of the coming integrated Bioeconomy. The Bioeconomy is already making substantial contributions to sustainable development and this contribution will increase in the future: higher quality, renewable raw materials will be produced sustainably, and food security and a healthy environment will continue to be assured. Conversion to a wider range of end products, whether food, feed, fuel, fibre or other healthcare or industrial products, is also sustainable, being efficient, producing little or no waste, and often using biological processing. Developing all sectors of the Bioeconomy in concert will provide global food security, improve nutrition and public health, make industrial processing cleaner and more efficient and make a significant contribution to the effort to mitigate climate change. The integrated Bioeconomy we envisage is not simply about science, but is rather an integration of science with business and society. “

2.4 Specific aspects of greening forestry

Forestry, which is one of the major land use practices in Europe, has a key influence on environmental quality, not only through the well-known functions of climate regulation, catchment protection and safeguard against erosion, but also by its contribution to nature protection and conservation of biodiversity. Most European forests can be qualified as “semi-natural” but there are few undisturbed forest areas remaining in the EU. Even forests of nature conservation importance are either planted or have been managed over long periods of time and “virgin” or “old growth” forest areas are limited to small patches in cultivated landscapes or

to less accessible locations in larger (managed) forests.

There is growing acceptance and understanding by policy makers for the forestry sector’s potential for growth in the green economy. Governments, international organizations and other stakeholders such as key industry players have been the drivers for promoting a greening of the economy, by supporting initiatives which support the benefits of transferring to environmentally-friendly technologies, clean energy and climate change mitigation and adaptation. The forest sector is particularly important in terms of its environmental, economic and employment impact. These green growth initiatives are seen as the best way to promote real growth, reducing impacts on environment, combating climate change and triggering an employment boom in the 21st century. Specifically, environmentally sound investments such as green buildings, sustainable energy, and climate change mitigation projects, can yield significant gains in terms of economic growth, sustainable job creation, and poverty reduction.

In the UNEP (2008) report on Green jobs: towards decent work in a sustainable low carbon world, the greening of the forest sector is perceived as employment in the fields of **“Reforestation and afforestation projects”, “Agroforestry”, “Sustainable forestry management and certification schemes”, and “Halting deforestation”**. Augmenting this picture by looking into UN and EC documents the picture that emerges of what green forestry is can be summarised as in figure x.

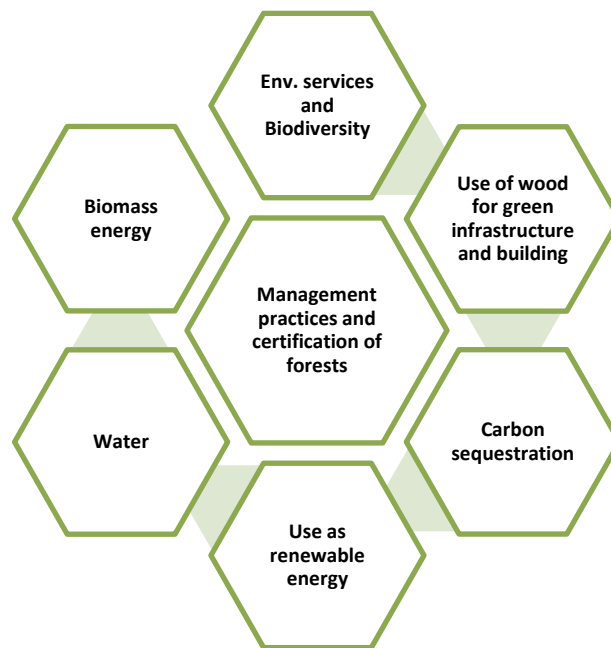


Figure 16.

In the EU Forest action plan (2007-2011) the aspects of how forests can contribute to the wellbeing of EU citizens are outlined as in figure x. This is not the same thing as green growth in the forest sector; but it sheds some light on the different functions that forests and forestry play for society.

HOW FORESTS AND FORESTRY SERVE THE NEEDS OF EU CITIZENS AND IMPROVE THEIR LIVING ENVIRONMENT

The functions of forests and forestry	
Economic	<ul style="list-style-type: none"> ■ providing a source of income ■ serving as a workplace ■ providing renewable resources for local and household consumption ■ providing raw materials for forest-based industries ■ supplying materials for high quality wood products ■ delivering a local and renewable source of energy
Environmental	<ul style="list-style-type: none"> ■ providing an ecosystem rich in biodiversity ■ mitigating the effects of climate change through carbon sequestration ■ protecting water resources ■ providing ecological stability and integrity in the landscape ■ safeguarding against avalanches and landslides in mountainous regions ■ preventing soil erosion and combating desertification ■ purifying the air
Social	<ul style="list-style-type: none"> ■ supplying recreational and leisure amenities, especially to city dwellers ■ providing a healthy living environment ■ protecting against natural disasters ■ making rural areas attractive to live in ■ safeguarding cultural, heritage and spiritual values

Figure 17. Source: EU Forest action plan (2007-2011).

In what follows we will briefly go through some of the aspects brought forward about greening of the forestry sector.

Climate change

Mitigating climate change is one of the largest and most complex challenges facing the world, with a unique complexity on the interface of biophysical processes, economic activity and considerations of geographic and intergenerational equity. The forest sector is at the origin of nearly a fifth of anthropogenic carbon emissions, mostly through deforestation, but also through wildfires, forest damage and wood harvest. At the same time, the forest sector can make a significant contribution to mitigating climate change. (UN, 2010)

Forests play an important role in the earth's carbon balance. They sequester carbon by taking in CO₂ from the atmosphere and transform it into biomass through photosynthesis. Forests accumulate large stocks of carbon in the form of woody biomass and through trees' roots in forest soils. In sustainably managed forests the amount of carbon that is released as a result of harvesting, is equal to or smaller than the amount taken from the atmosphere, making it 'carbon-neutral' or a 'carbon sink' in the longer term. But when forests are burned, either naturally or by man, and when deforestation and degradation occurs, then forests are responsible for greenhouse gas (GHG) emissions, in fact, 17.4% according to International Panel on Climate Change (IPCC). Promoting the expansion of sustainably managed forests could provide further carbon sinks, allowing the forest-based sequestration of carbon to contribute to offsetting global GHG emissions. (UN, 2009)

The main climate change mitigation strategies focused on the forest sector are (UN, 2010):

- Sequestering carbon in forests
- Sequestering carbon in harvested wood products
- Substituting for non-renewable raw materials
- Substituting for non-renewable energy.

Wood energy

According to the FAO State of the World's Forests 2009 report, the "production and consumption of key wood products and wood energy are expected to rise from the present to 2030, largely following historical trends. The most dramatic change will be the rapid increase in the use of wood as a source of energy, particularly in Europe, as a result of policies promoting greater use of renewable energy."²¹ Despite the global economic recession, wood energy production and consumption increased in the past two years largely because of Governments' policies to promote renewable energy sources in an effort to mitigate climate change and to improve energy security. Government's policies for promoting renewable, wood-based energy through ambitious targets if maintained will continue to lead to increasing demand for wood from Europe and possibly also from outside (e.g. trade, imports, etc.). (UN, 2009)

Wood has a significant potential to expand its contribution to renewable energy supplies within the UNECE region. Currently with a share of over 50% of renewable energy, the contribution by wood to renewable energy generation is expected to increase, especially in absolute terms, driven by renewable energy targets set by policy makers, in particular in the European Union where wood energy and other forms of bioenergy constitute an important part of the package, especially in the so-called renewables directive (European Commission, 2008)²². There is in particular a potential to increase the contribution by the forest sector to renewable energy generation as presently, only 60% of the increment of forests is being harvested throughout Europe. Considering the increasing demand for wood for energy, the utilisation rate could still increase without threatening sustainable forest management. In general (with few exceptions), the ratio of fellings to net annual increment is over 50% in countries in northern and central Europe, while it is lower than 50% for countries in southern Europe. (UN, 2009)

Building materials

As energy prices and atmospheric temperatures continue to rise, energy efficiency techniques and green buildings can help reduce humanity's environmental footprint and decrease GHG and other anthropogenic emissions. Green buildings have a major role to play in mitigating the adverse effects of climate change. A study produced by the Commission for Environmental Cooperation, evaluated the impact of North American buildings and their contribution to climate change and found that in Canada and the US, commercial and residential buildings are responsible for 20 and 40% of primary energy consumption, respectively. The US Green Building Council estimates that green building,

on average, currently reduces energy use by 30%, carbon emission by 35%, and generates cost savings of 50 to 90%. Construction and insulation of environmentally-sound buildings can play a major role in reducing the carbon footprint of buildings. (UN, 2009)

Recent comparisons show that the production of steel and concrete as building material requires up to two times more energy than wood-based products. Extraction costs for wood such as logging and transportation are less than costs associated with mining for iron and aluminium. Wood is also a natural insulator for temperature and sound. Fire retardant-treated wood-based insulation is proving to be more economical, and more environmentally friendly than fibreglass or polystyrene. From a life-cycle perspective, building with wood can be, depending on local and climatic conditions, more sustainable than building with other materials. Green building systems employ sustainably produced wood to construct new and renovate existing buildings. Wood-framed housing is gaining market share in Europe, among others as a result of the many environmental and economic advantages of wood. European countries with green building systems include the UK, the Netherlands, Germany and Italy. Compared with North America, the situation of certified forest products in the construction sector for green building in Europe is quite divergent between countries. A survey by the UNECE/FAO Certification Network indicated that green building is not yet a major topic in some countries with a high share of forest area certification such as Norway, Finland and Luxembourg. One of the reasons may be that due to the high share of certification, the use of certified wood in the construction market is self-evident. Consequently, green building is concentrating on topics such as energy efficiency rather than just on the use of certified timber. (UN, 2009)

Environmental Services and Biodiversity

There are many values and services in forests beyond timber, and non-wood forest products which are often inadequately acknowledged by society and accounted for economically. There is some potential for recognizing the ecosystem values of forests such as biodiversity conservation, protection against erosion, watershed protection and climate change mitigation through carbon sequestration more appropriately, through economic valuation. The ecosystem services provided by sustainable managed forests are precious. Opportunities present themselves to internalize the cost of securing their provision. These are predominantly public goods and there are often no associated markets, prices and costs, and consequently, these forest environmental services are rarely accounted for in our current economic system even though they are essential to meet societies' needs, by ensuring quality of life and supporting a sustainable and green economy. The implementation of proper mechanisms to value ecosystem services through payments for environmental services schemes (i.e. protection or improved management of a particular forest that has the highest potential to protect or enhance specific environmental services) could help maintaining biodiversity and help preserve healthy forests. It would also reinforce the protection of non-wood forest products such as valuable genetic resources that are yet undiscovered. The current economy depends upon these services provided by ecosystems without remunerating the service providers adequately. According to recent studies, ecosystem services supplied annually are worth many trillions of dollars.³⁵ This means that the long-term costs for not adequately valuating these services may greatly exceed the short-term benefits of economic development. Generating adequate mechanisms to value these services can form an important emerging area of work for the

forestry sector. Good practices from other sectors can be referred to such as the “PES in integrated water resources management” (UNECE Water Convention). Payments for environmental services should be regarded as one of many tools in the toolbox for good forest management and protection. The success of such mechanisms will however depend on the accurate valuation of these services and on establishing incentive structures and institutions that are both practical and equitable. Acknowledging these services would help improve sustainable forest management and therefore become an integral part of a more sustainable economy, which could benefit both the forest and the consumer. (UN, 2009)

As briefly introduced after the first glance at the conceptual elements is interesting to note that while greening in the agricultural sector seems to be much about the use of inputs, management practices and supply side measures – the greening of forestry is framed more in the way wood products can be used as substitutes for non-renewable resources, and how forests can be utilised in climate change mitigation measures (sinks etc.). However, the certification of forests are one management factor which is important in green forestry.

3. The current state and performance

In this section we take a step back and have a look at the current situation in Europe when it comes to the structure of the sectors as well as their economic and environmental performance. This will provide a picture to link up with the green growth concepts in the previous sections to allow us to understand the possibilities for the sectors to develop. It will also show the state and trends in some of the critical environmental dimensions brought forward, such as emissions, land use and water.

3.1 General states and performances

In this first part we focus on the more general state of each sub sector to provide a background picture of the sectors and of how they have been developing over the last decades.

3.1.1 The “Bioeconomy” taken together

The bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries. Based on available data from a wide range of sources it is estimated that the European bioeconomy has an annual turnover of about € 2 trillion and employs more than 22 million people and approximately 9% of the total EU workforce (*COMMISSION STAFF WORKING DOCUMENT Accompanying the document Communication on Innovating for Sustainable Growth: A Bioeconomy for Europe*)

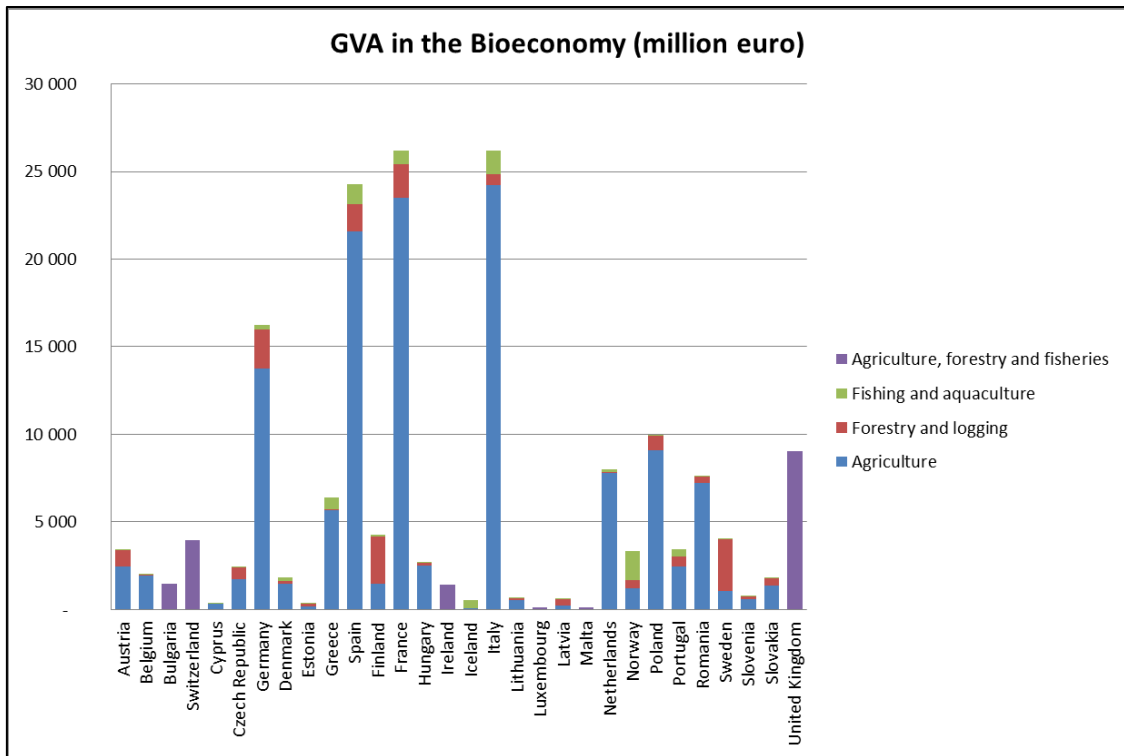


Figure 18. GVA.

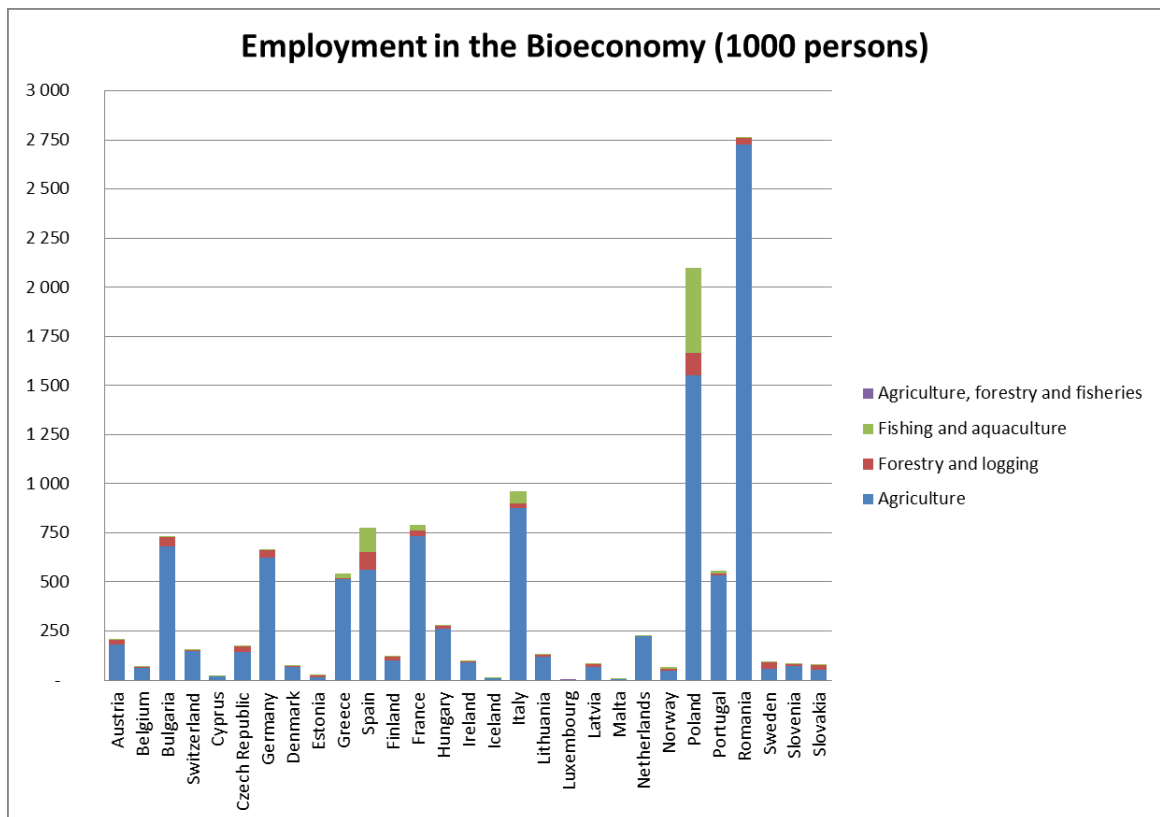


Figure 19. Employment.

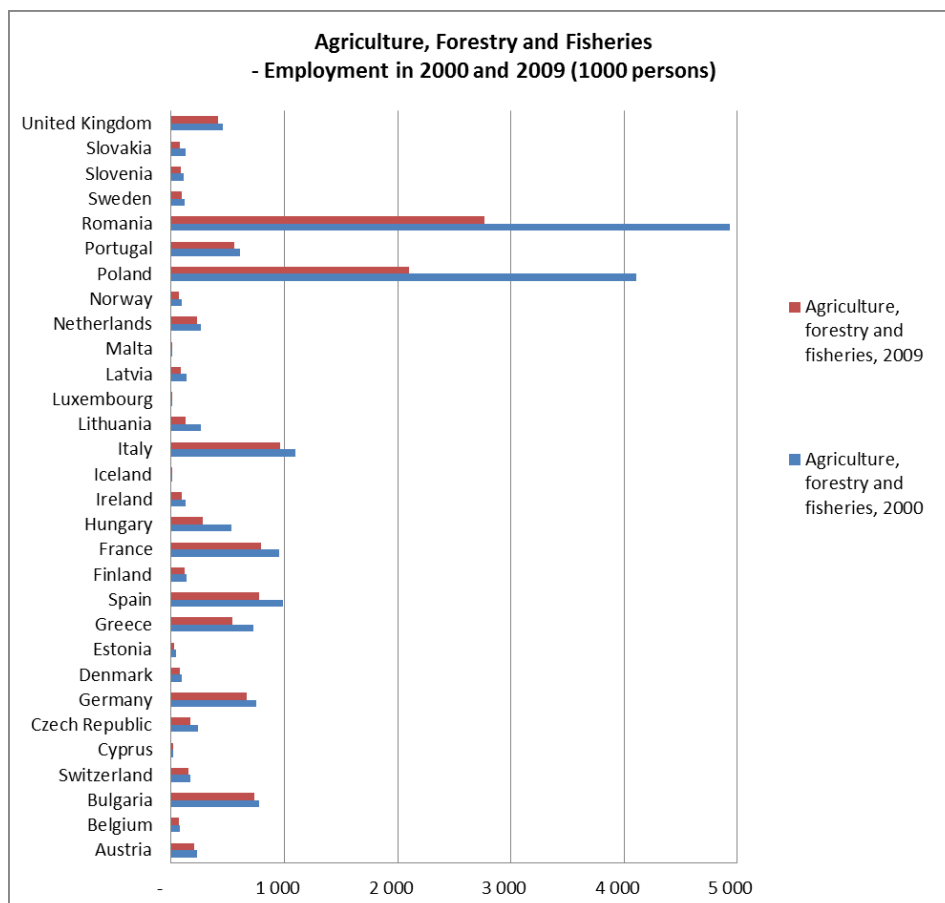


Figure 20. Change in employment.

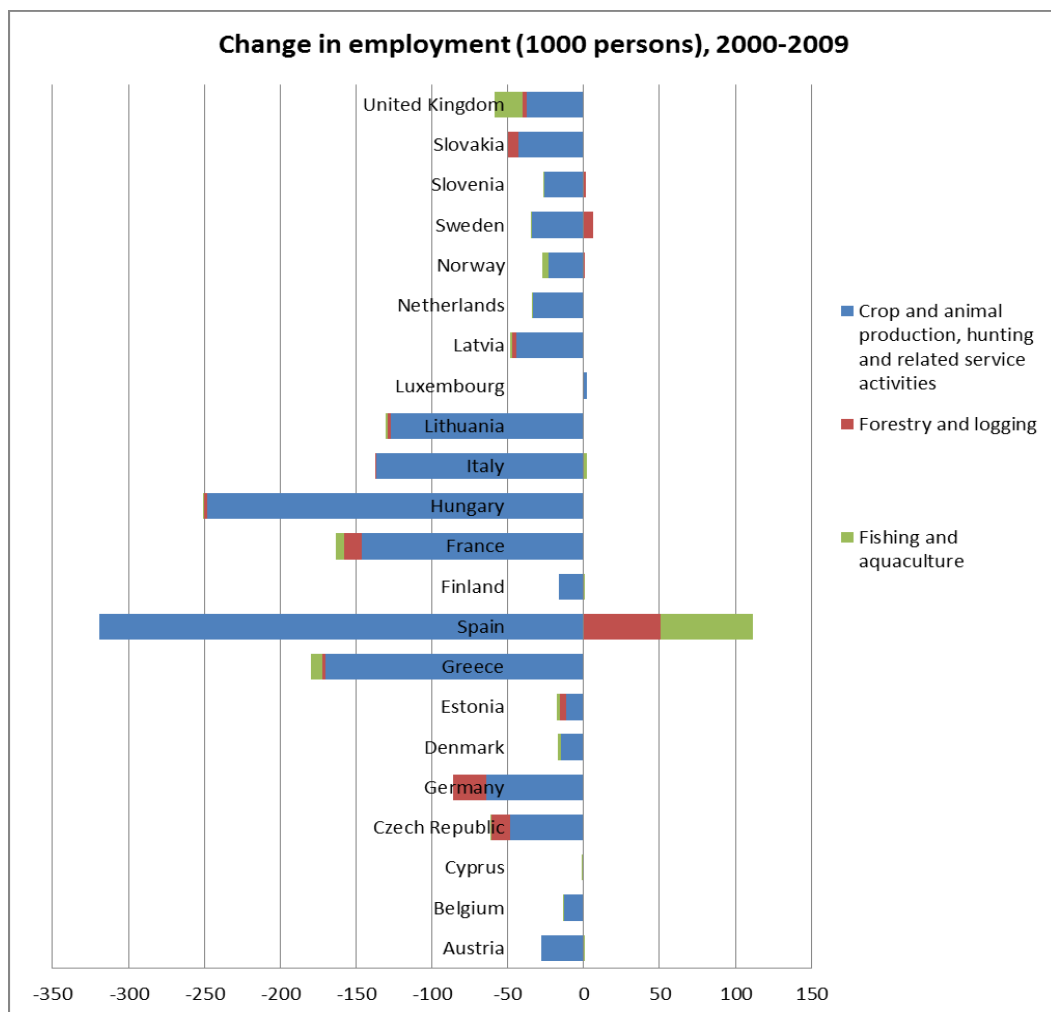


Figure 21. Disaggregated change in employment.

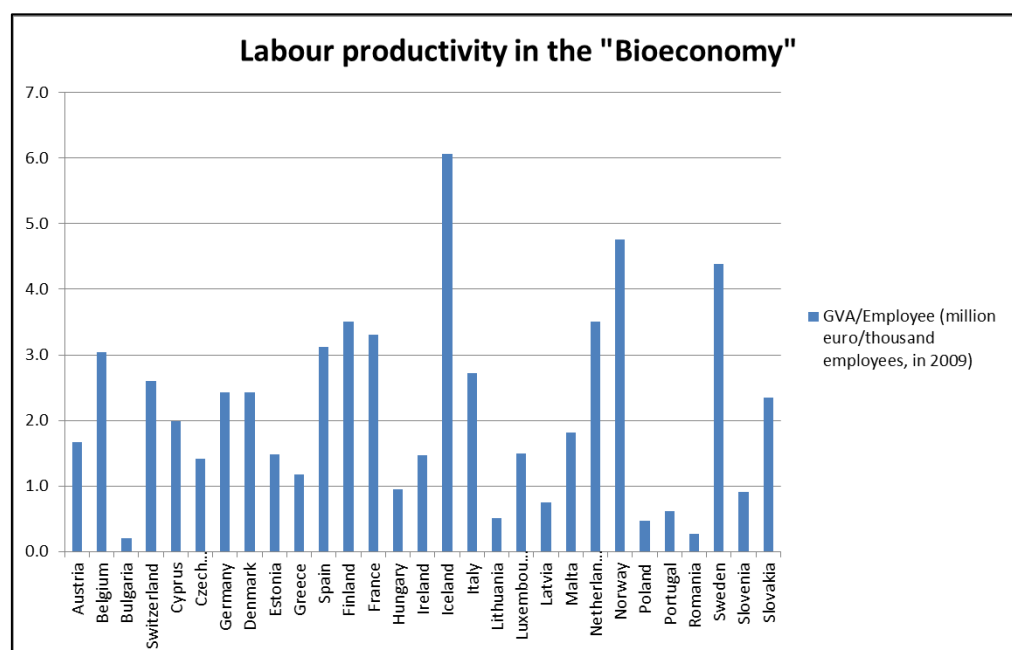


Figure 22. Labour productivity in bioeconomy.

Table 2. The bioeconomy in the EU. Source: "COMMISSION STAFF WORKING DOCUMENT

Accompanying the document Communication on Innovating for Sustainable Growth: A Bioeconomy for Europe"

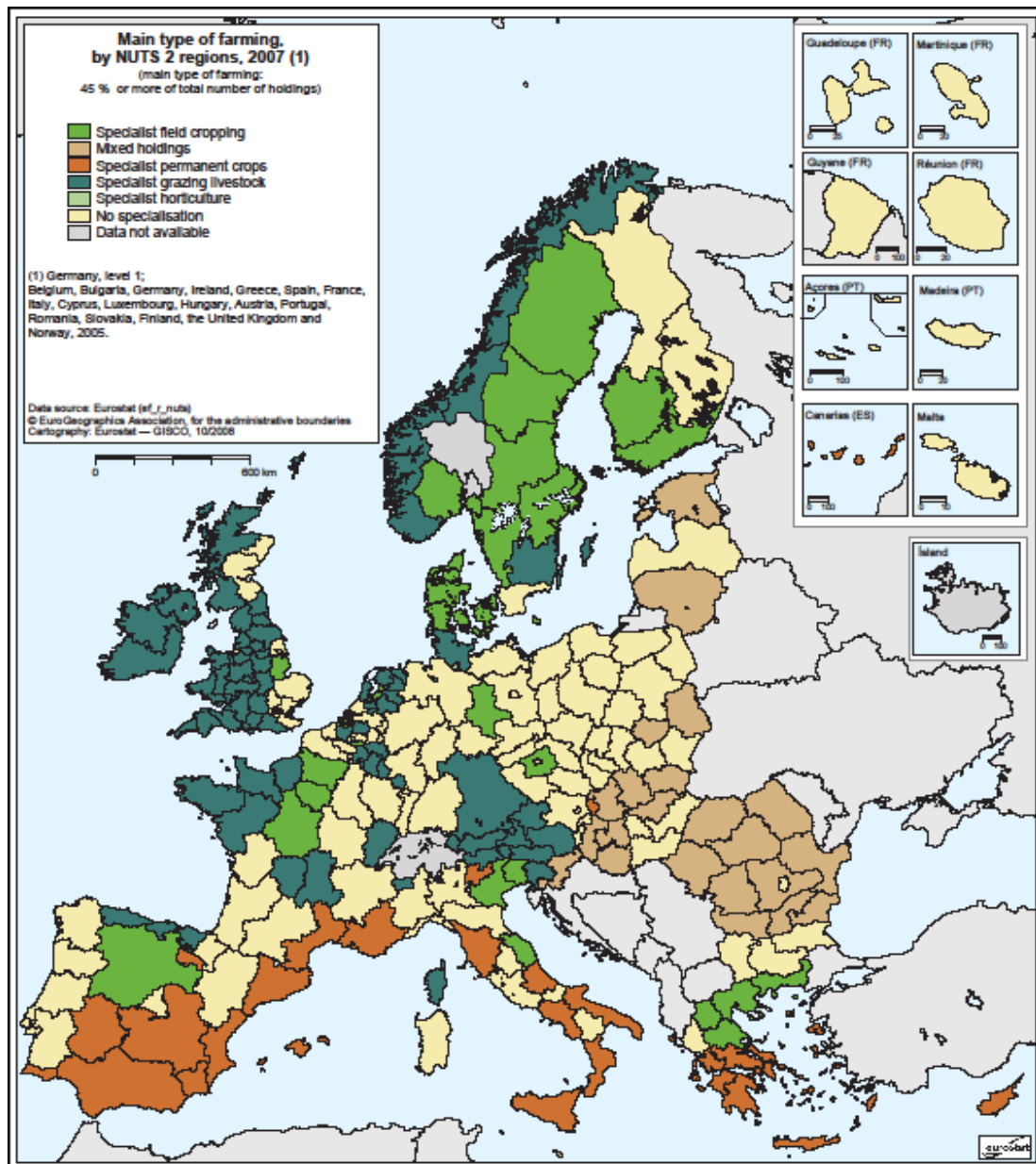
Sector	Annual turnover (billion €)	Employment (thousands)	Data source
Food	965	4400	CIAA
Agriculture	381	12000	COPA-COGECA, Eurostat
Paper/Pulp	375	1800	CEPI
Forestry/Wood ind.	269	3000	CEI-BOIS
Fisheries and Aquaculture	32	500	EC***
Bio-based industries			
<i>Bio-chemicals and plastics</i>	50 (estimation*)	150 (estimation*)	USDA, Arthur D Little, Festel, McKinsey, CEFIC
<i>Enzymes</i>	0.8 (estimation*)	5 (estimation*)	Amfep, Novozymes, Danisco/Genencor, DSM
<i>Biofuels</i>	6**	150	EBB, eBio
Total	2078	22005	

*Estimation for Europe for 2009; **Estimation based on a production of 2.2 million tonnes bioethanol and 7.7 million tonnes of biodiesel at average market price in Europe; ***EC, Facts and figures on the CFP, Basic Statistics Data, ISSN 1830-9119, 2010 Edition

3.1.2 Agriculture

The structure of agriculture is rather diverse across Europe as depicted by map 1 below. Dairy production is important in northern countries as well as the UK. Sweden, Denmark and Finland also rely heavily on specialized field crops and have a historical structure (still remaining) of mixed holdings of animal husbandry and crops. Also there are some areas with a great diversity of farms, classified as non-specialised areas, specifically in southern Sweden and eastern Finland. Central Europe is characterised by this pattern of farms, but there are some areas in France, Germany and Be-Ne-Lux. where specialised livestock production is predominant. Eastern European countries are still characterised by mixed holdings with a high degree (still) of self-subsistence farming. Mediterranean countries have a more crop and vegetable oriented production (and rely more heavily on irrigated farm systems). This is where we find the permanent crop systems, in Spain, southern France, Italy and Greece. However, northern Spain is more similar to central Europe with specialised livestock regions and areas of crop production.

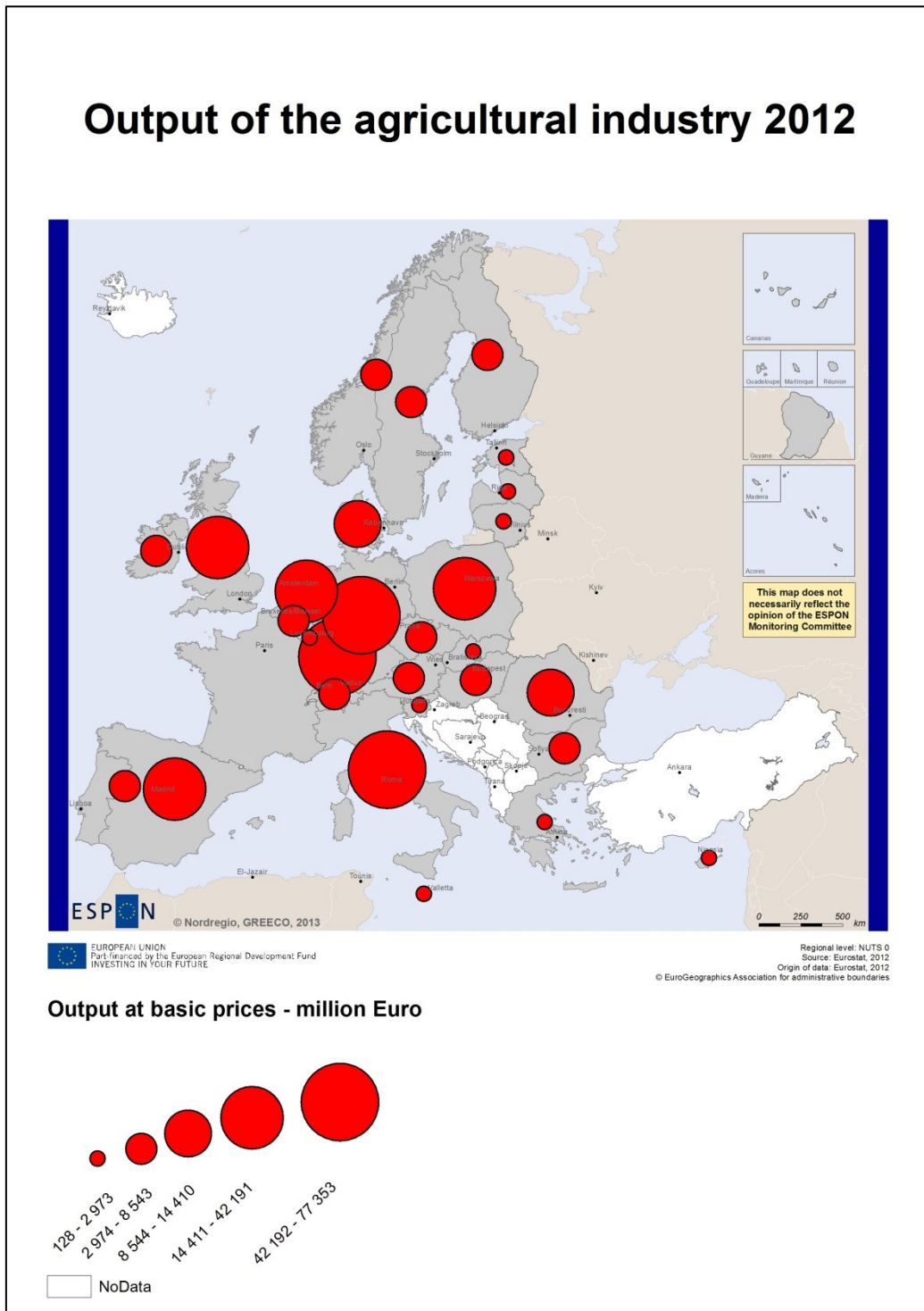
In 2007 there were approximately 13.7 million of agricultural holdings in the EU, representing a decrease by -9% compared to 2003 (15 million holdings in 2003). The distribution of crop-specialist, livestock-specialist and mixed-farming holdings remained rather stable between 2003 and 2007. In 2007, 40% of agricultural holdings were specialised in cropping (20% in field crops, 2% in horticulture, 18% in permanent crops), whereas 22% were specialised in livestock and 38% were mixed-farming holdings (12% in mixed cropping, 12% in mixed livestock, 14% in mixed cropping-livestock) (Eurostat).



Map 1. Structure of EU agriculture by Nuts 2 regions. Source: Eurostat.

The largest agricultural producers in the EU are France, Germany, Italy, Spain, the Netherlands and the UK. Map 2 below shows the broad picture of agricultural output values but is a rather blunt picture. To zoom in on the actual contributions to the economy in each country Table 3 (below) shows the exact contribution of agriculture to each country GVA.

Globally, the world trade in agricultural products exploded after the 1970s and the EU is one of the major importers and exporters of agricultural commodities. Basically western-Europe makes up approximately 45 % of both world imports and exports of agricultural commodities. Major exporters are Denmark, France, the Netherlands and the UK.

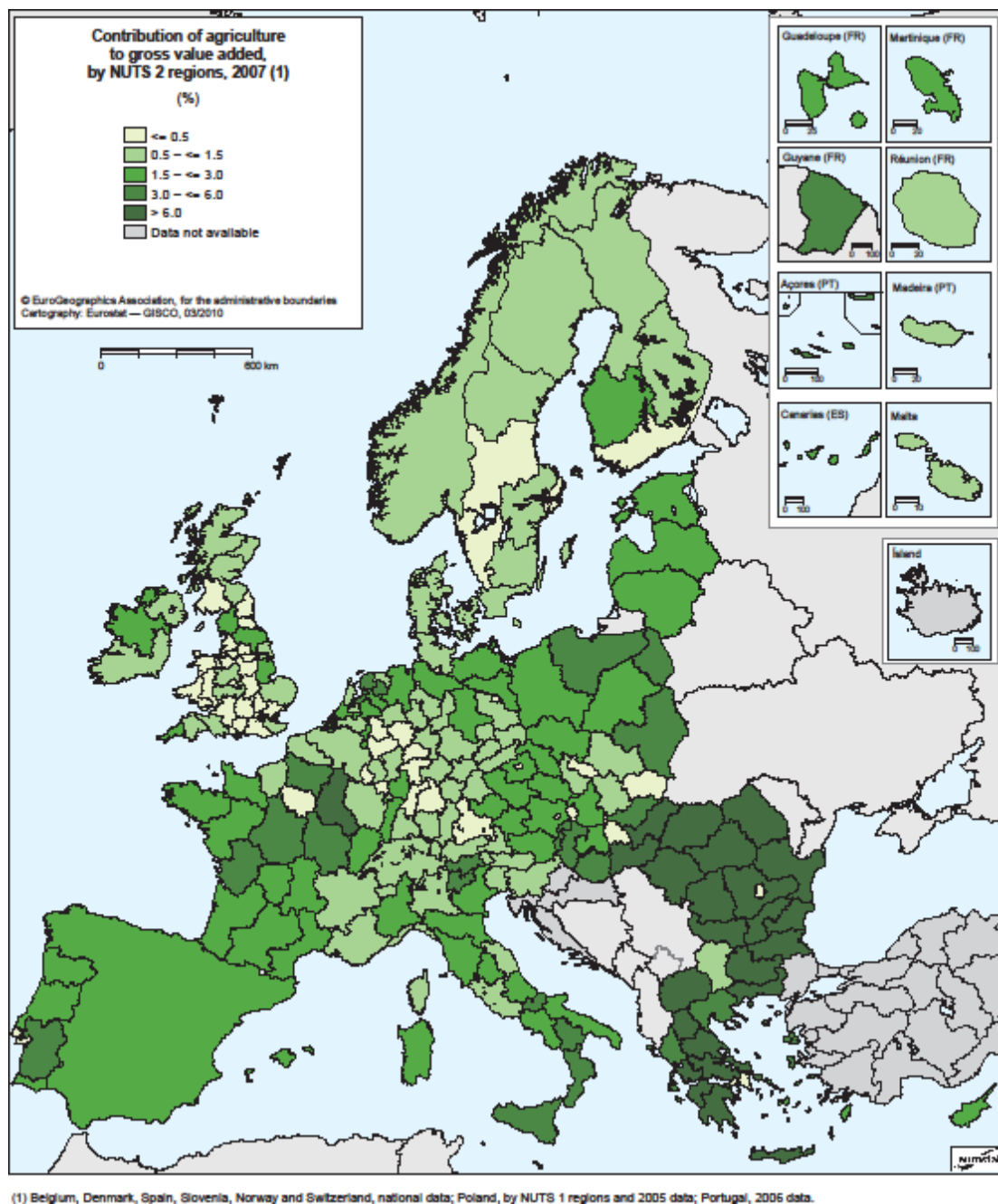


Map 2. Output of the agricultural industry (basic prices, million Euro). Data for latest available year in Eurostat database.

Table 3: The importance of agriculture in GVA in Europe (million euro and share). Source: Eurostat

CTRY	2007		2008		2009	
	GVA in Agriculture	% of Total GVA	GVA in Agriculture	% of Total GVA	GVA in Agriculture	% of Total GVA
BE	2 638.0	0.9	2 074.0	0.7	2 047.0	0.7
BG	1 547.5	6.0	2 040.2	6.9	1 694.2	5.6
CZ	2 819.6	2.5	3 386.9	2.5	2 794.1	2.3
DK	2 267.7	1.2	1 946.8	1.0	1 755.9	0.9
DE	20 940.0	1.0	19 960.0	0.9	17 310.6	0.8
EE	439.4	3.2	396.1	2.8	309.3	2.6
IE	2 380.7	1.4	2 083.7	1.3	1 421.6	1.0
GR	6 871.1	3.5	6 568.0	3.2	6 622.3	3.2
ES	27 201.0	2.9	26 494.0	2.7	25 955.0	2.6
FR	37 476.0	2.2	35 738.0	2.0	30 010.5	1.7
IT	28 480.6	2.1	28 329.6	2.0	25 683.6	1.8
CY	309.0	2.2	346.1	2.3	346.1	2.3
LV	667.9	3.6	629.4	3.0	550.4	3.3
LT	1 009.0	3.9	1 075.5	3.7	802.2	3.4
LU	134.9	0.4	127.9	0.4	103.3	0.3
HU	3 425.3	4.0	3 856.7	4.2	2 605.0	3.3
MT	116.3	2.4	98.3	1.9	103.8	2.1
NL	10 548.0	2.1	9 566.0	1.8	8 798.0	1.7
AT	4 332.5	1.8	4 386.6	1.7	3 794.1	1.5
PL	11 775.0	4.3	11 872.7	3.7	10 054.8	3.6
PT	3 583.3	2.5	3 433.4	2.3	3 442.8	2.3
RO	7 193.4	6.5	9 266.9	7.4	7 484.8	7.1
SI	760.7	2.5	823.0	2.5	756.0	2.4
SK	2 007.5	4.1	2 466.3	4.2	2 256.3	3.9
FI	4 723.0	3.0	4 641.0	2.9	3 956.0	2.7
SE	5 078.5	1.7	5 182.5	1.8	4 486.7	1.8
UK	12 607.8	0.7	12 755.6	0.8	10 139.9	0.7

In relation to the rest of the economy agriculture is most important in the new member states where it can contribute to more than 5 % of GVA nationally and more than 6 % in some regions (map 3 below). Also in Western Europe some regions have more than 3 % of their GVA from agriculture, and in Greece most regions are above 6 %. In fact in some regions in Romania and Hungary the contribution to GVA is above 20%, not shown in the map.



Map 3. Agriculture's contribution to GVA in Nuts 2 regions. DG Agri (2010).

Much of the food sector activity depends upon the production of the primary sector, e.g. dairy industry, but there is also a substantial amount of raw material imports to the EU for value adding processes. The EU has been operating a diversified import tariff system where lower tariff rates have applied for agricultural primary products compared to food and beverages.

At EU-27 level, agriculture and forestry covers 47% and 31% of the territory, respectively. These levels differ greatly among Member States, forest being the dominant land cover in

Nordic (Estonia, Finland, Sweden) and mountainous (Slovenia, Austria) Member States. At EU-27 level, the share of agricultural area in the territory is proportionally lower in rural areas (40%) than in urban areas (53%) due to the importance of forests in many rural regions. Between 1990 and 2000, urbanization has led to the loss of agricultural land especially in the major centres of population. This shift is partly offset by a conversion of forest and semi-natural land to agriculture.

At Member State level, conversion of forest and semi-natural marginal land to agriculture appears to be taking place in Spain and Greece, while there are clear patterns of land abandonment or withdrawal of farming in marginal areas elsewhere in the EU

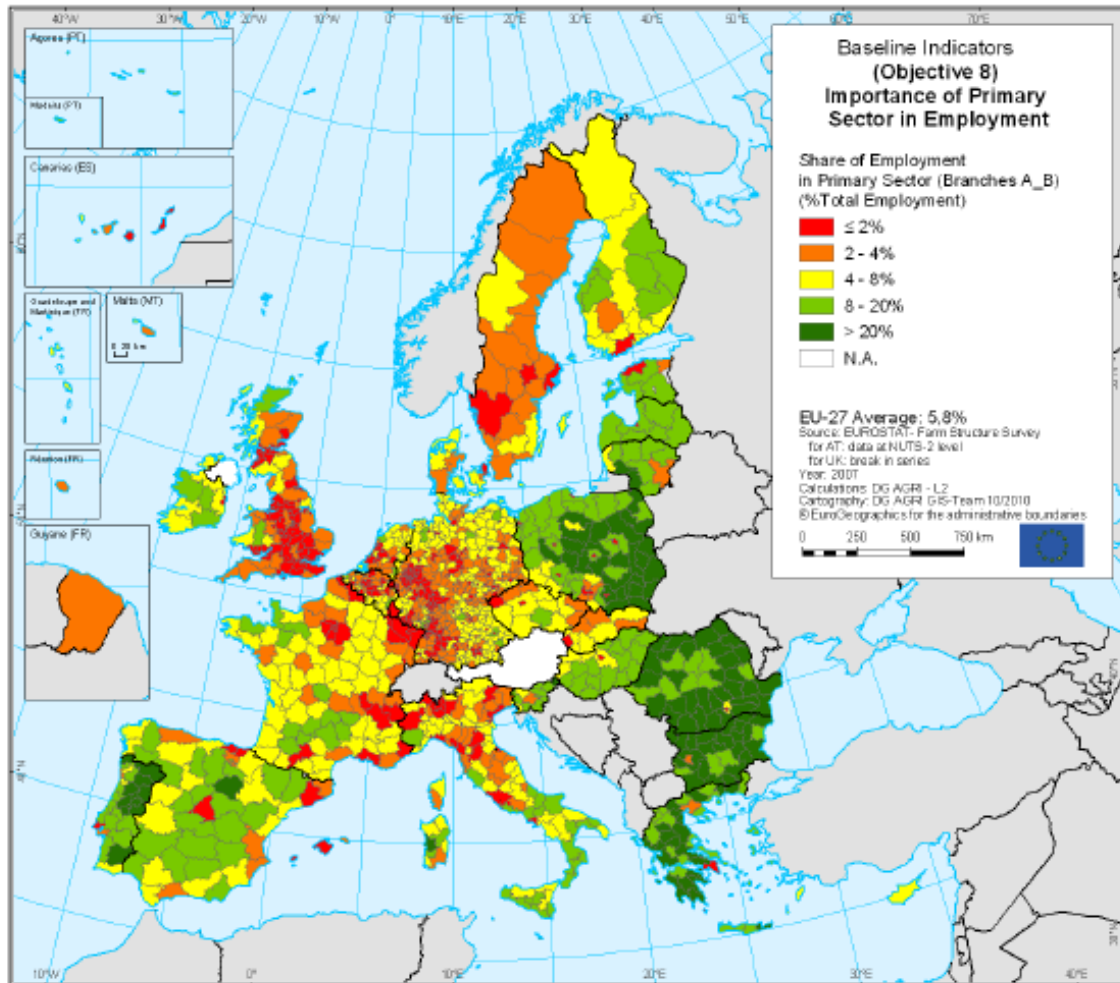
The combined agricultural and food sector in Europe accounts for 17 million jobs (7.6% of total employment) and for 3.5% of total gross value added (GVA) in the EU-27 in 2009. There are, however, significant variations across Member States. The primary sector (agriculture, hunting and forestry) represents 5.5% of the total employment for the EU-27, ranging from 1% in the United Kingdom to around 28% in Romania, 20% in Bulgaria and 13% in Poland.

The importance of the primary sector in the economy of the EU-27 is declining, supported by the significant productivity gains of labour and capital and the sharp decline in relative prices. Between 2000 and 2009, its share in the overall economy diminished by 1.4 percentage points in terms of employment and by 0.7 percentage points in terms of value-added. In the period 2000-2009, the number of jobs decreased by 2.8 million (or -2.3% per year), the highest decreasing rates taking place in Lithuania, Poland and Romania.

Table 4: The importance (share) of agriculture, forestry and fisheries in employment (2007).
Source: Eurostat

CTRY	Predominantly Rural	Intermediate Region	Predominantly Urban	National	Number of Persons (in thousands)
BE	5.6	3.0	1.2	1.9	83.00
BG	28.8	21.5	2.3	19.6	731.60
CZ	5.6	3.2	1.9	3.6	187.60
DK	4.6	2.9	0.3	2.8	83.00
DE	4.6	2.6	0.9	2.1	845.60
EE	9.0	1.4		4.7	30.60
IE	7.9		0.5	5.5	116.90
GR	23.6	13.2	1.1	11.3	545.20
ES	11.9	5.9	1.7	4.5	925.30
FR	6.1	3.3	1.2	3.3	834.30
IT	7.9	4.6	1.3	4.0	1 013.90
CY		4.5		4.5	17.50
LV	16.2	14.4	4.1	9.7	108.40
LT	17.0	7.7	3.3	10.3	157.90
LU		1.7		1.6	5.50
HU	11.2	8.8	0.6	7.6	327.40
MT			2.6	2.4	4.30
NL	5.3	5.3	2.3	3.0	208.30
AT				5.4	2 236.30
PL	27.4	12.0	3.8	14.7	604.20
PT	23.2	13.3	2.7	11.2	2 839.90
RO	38.9	29.6	1.1	30.3	87.00
SI	13.4	6.1		9.0	79.80
SK	5.4	3.0	1.0	3.7	121.80
FI	8.6	4.5	0.6	4.9	100.20
SE	3.8	2.4	0.4	2.1	374.00
UK	7.1	2.4	0.7	1.7	231.30
EU-27	14.2	6.3	1.4	5.8	12 900.80

However, the primary sector still plays a major role in some regions. For example, in 2007 its contribution to the total GVA was higher than 25% in some regions in Bulgaria and at around 20% in regions in Greece. Likewise, its share of employment stood above 50% in some regions in Romania and Bulgaria.



Map 4. Primary sector (agriculture and forestry) employment at Nuts 2 level in Europe.
Source: DG Agri (2010).

Finally, it can be interesting to note the evolution of farms in the EU where most countries have experienced a (sometimes dramatic) reduction in the number of holdings. Notable exceptions are Greece, Poland and the UK where the number of farms have actually increased between 2003 and 2007. As already indicated the majority of farms can be found in Romania, Poland, Italy, Spain, Greece and Hungary. In parallel to this there has been an increased focus on other gainful activities on farms. Figure 23 shows the evolution of number of farms in some selected countries and figure 24 shows the occurrence of other gainful activities in 2007.

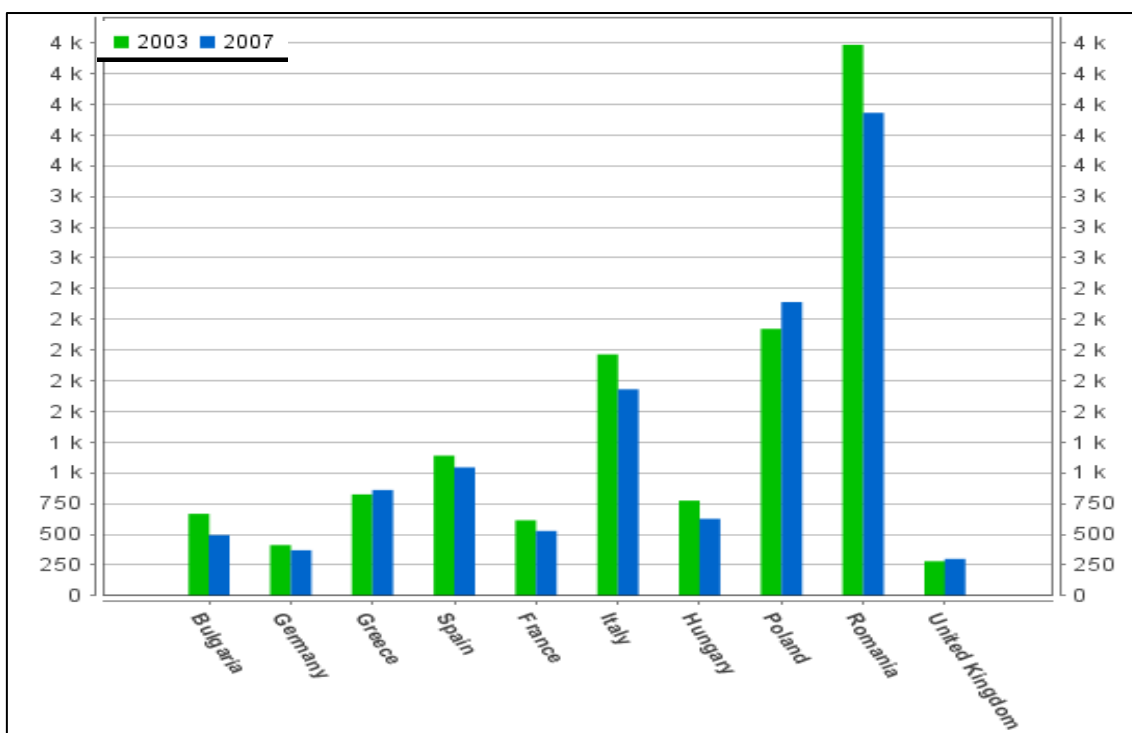


Figure 23. Agricultural holdings (thousands) 2003 and 2005 for selected countries. Source: Eurostat database.

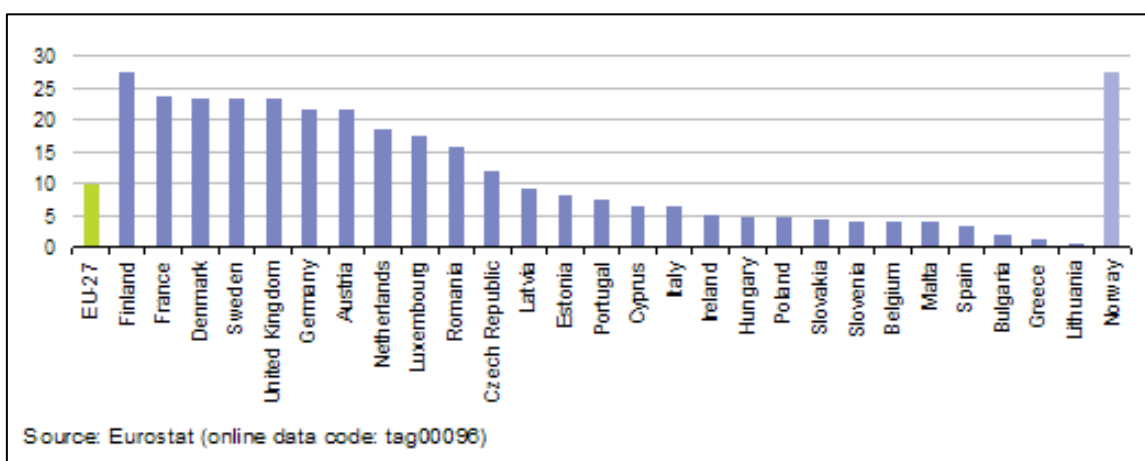


Figure 24. Share of agricultural holdings with another gainful activity, in 2007.

3.1.3. Forestry

With around 129 million ha, the forest available for wood supply represents 72% of the total forest area for the EU-27 (this share of productive forest is much lower in Mediterranean Member States). Forests therefore play a major role not only for the environment but also

for the economy of some Member States and rural areas.

Forests and other wooded land cover more than 40% of the EU's surface area. Expansion of the EU's forest area exceeds the loss of forest land to infrastructure and urban uses. This trend, starting in the 1950s (earlier in some countries), is driven by a range of factors. Several countries have expanded their forest cover by plantation programmes on agricultural land which is no longer cultivated. This positive development sets the EU apart from many other global regions, where deforestation continues to reduce forest resources.

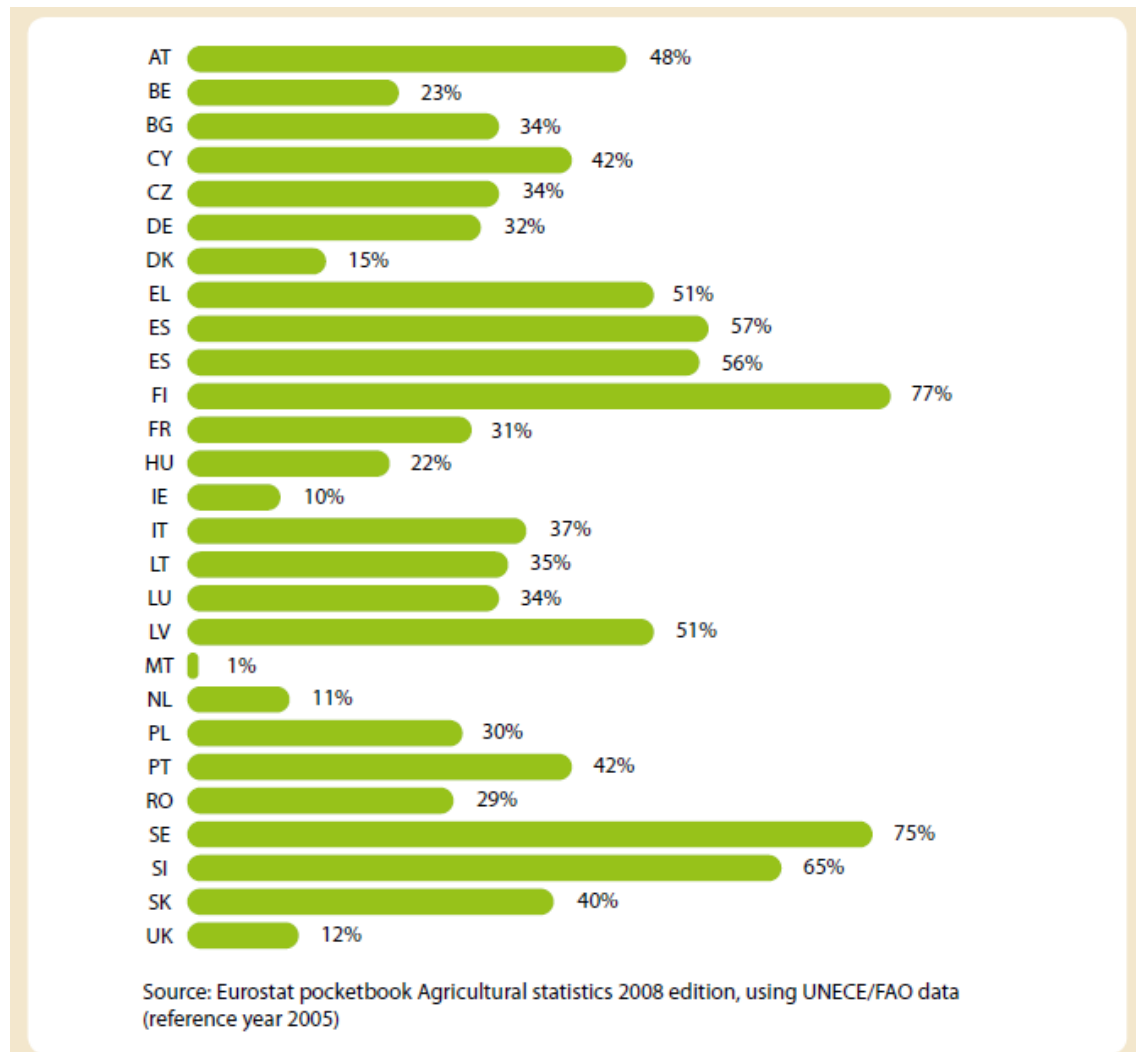


Figure 25. Forest and other wooded area cover in EU member states as percentage of total land area. Source: EU Forest action plan 2007-2011.

Altogether, the EU forest-based industries' production value amounts to close to EUR 300 billion, which represents 10% of the total for all manufacturing. According to official statistics these industries directly employ some 2.6 million people in the EU. The EU is the biggest trader and second biggest consumer of forest products in the world, with a positive trade balance overall. The EU is a net importer of raw materials, mainly roundwood, mostly from central and eastern European countries and the Russian Federation, and wood pulps from North and South America and other regions having high forest growth rates and low costs in timber production. Within certain sectors (quality papers and wood-based panels), where there is a particularly high level of domestic supply, the EU is a prominent exporter,

especially of the more highly value-added products. (EC 2003).

Key facts on Europe's forests in 2010.

	Unit	North	Central-West	Central-East	South-West	South-East	Europe
Area of forest	million ha	69.3	36.9	44.0	30.8	29.9	210.9
Forest as % of total land	%	52.1	26.4	26.8	34.8	23.1	32.2
Forest per capita	ha	2.18	0.15	0.29	0.27	0.25	0.31
Area of forest available for wood supply	million ha	54.5	34.4	33.9	24.8	21.3	168.9
Growing stock per ha	m ³ /ha	117	227	217	81	140	155
Net annual increment per ha	m ³ /ha	4.6	7.8	5.6	3.3	5.9	5.4
Carbon in living biomass	million tonne	3 115	3 410	3 988	1 082	2 038	13 632
Fellings	million m ³	181.1	172.4	114.2	29.3	16.9	513.2
Value of marketed roundwood	million EUR	4 979	7 941	2 596	703	1 524	17 743
Area of forest protected for biodiversity or landscape	million ha	NA	NA	NA	NA	NA	38.4
Share of forests in private ownership	%	71	62	12	72	16	50
Forest sector share of GDP	%	2.2	0.8	1.6	0.8	0.7	1.0
Forest sector work force	1000 FTE	346	925	879	582	406	3 138
Consumption of forest products per capita	m ³ RWE	3.0	1.5	0.8	1.0	0.7	1.2
Net trade (+ = net exports, - = net imports)	million m ³ RWE	+103	-49	+5	-36	-16	+8
Wood energy consumption per capita rural population	tonne	1.45	0.24	0.20	0.20	0.09	0.27

Figure 26. Source: UN (2010).

In 2009 forestry and logging represented only 0.2% of the total GVA at EU-27 level, though the contribution of the forest sector as a whole (i.e. including wood, pulp and paper industries) can be quite important at Member State level. This is the case in Finland and Sweden (3.9% and 2.1% of total GVA respectively) and to a lesser extent in Estonia, Austria, Czech Republic and Slovakia (around 1% of total GVA). At EU-27 level, the forest sector as a whole represents 0.6% of total GVA and this share decreased between 2000 and 2009 in most Member States, especially in Sweden and Finland, whereas this ratio remained stable in Czech Republic, Estonia, Latvia, Lithuania and Romania, following a shift of production and investments from Western to Central and Eastern Europe. The number of employees of the forestry sector decreased over the period 2000-2009 except in Latvia, Sweden and Finland (note that the figure below only show 2008 and 2009).

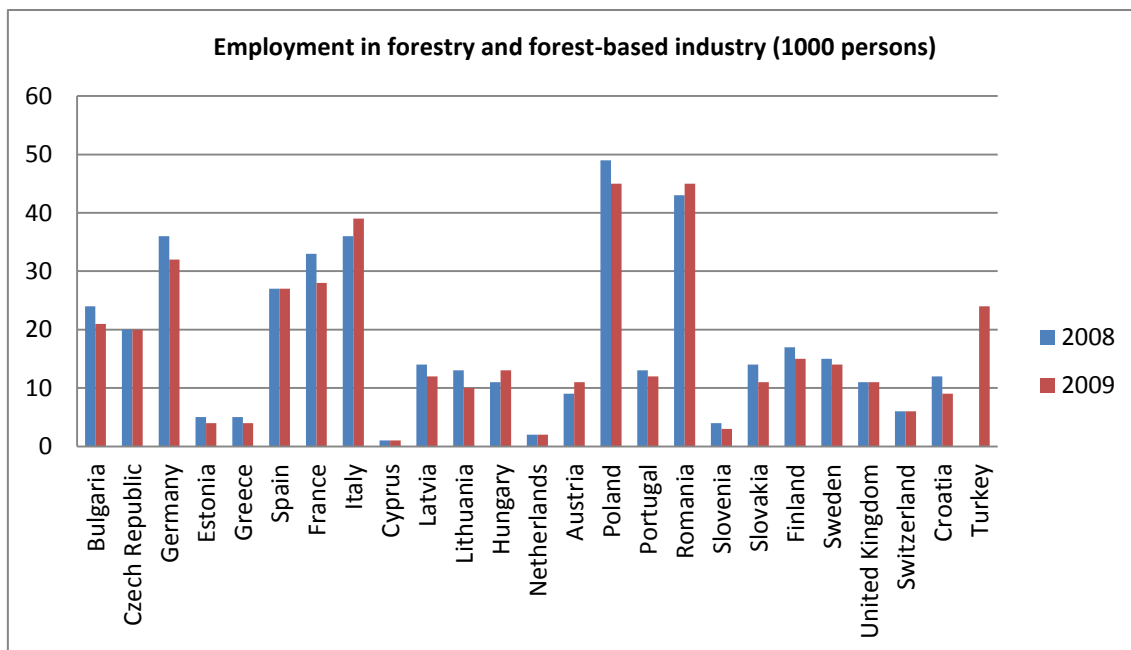


Figure 27.

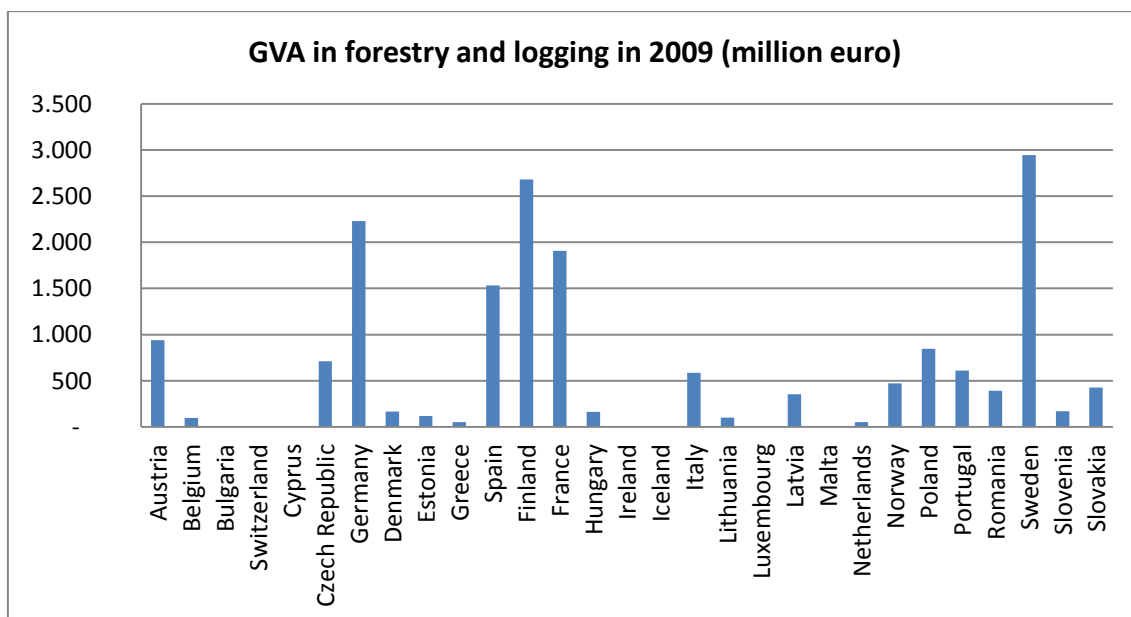


Figure 28.

About 65% of the forest land in the EU is owned by some 12 million private forest owners. Privately-owned forests tend to be highly fragmented and most holdings are smaller than five hectares. Ownership structure, however, varies widely within the EU. In Greece and Ireland, the State owns about two thirds of forest land; in Belgium, France, Germany, Italy, Luxembourg and Spain, local communities play an important role as forest owners, while in the Nordic countries, private holdings are predominant.

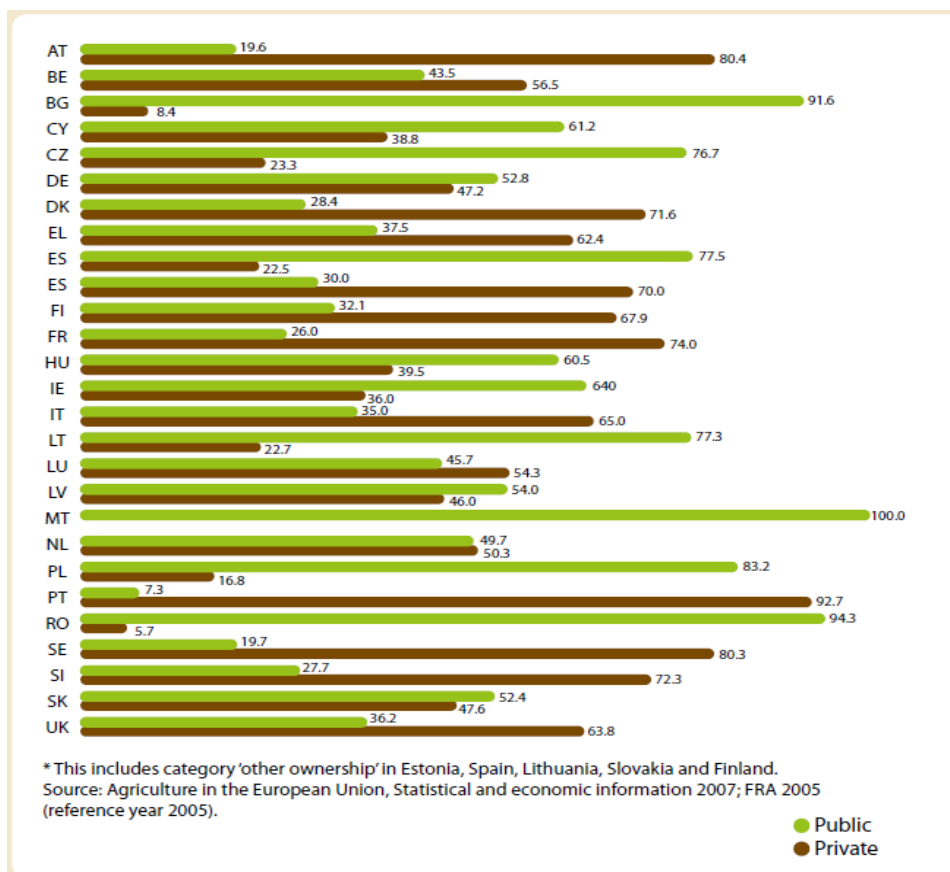


Figure 29. Public and private ownership in different EU countries. Source: EU Forest action plan 2007-2011.

The EU is one of the world's largest producers, traders and consumers of forest products. Forestry and related industries cover several sectors of the economy, for example: manufacture of wood and products of wood and cork (except furniture); production of pulp, paper and paperboard; printing. In 2005, forest-based industries in the EU employed about 3 million people in 350 000 enterprises, with a turnover of about EUR 380 billion, producing added value of around EUR 116 billion. In addition, the construction and furniture industries are important users of forest materials. The total harvest of industrial roundwood and fuel wood amounted to 454 million cubic metres (m³) in 2005. This is 60% of the annual net increment of that year, which means that despite this significant economic use of forest products, the EU's wood resources, as well as the total forest area are growing faster than they are used. However, some of the unused growth may occur in young forests and in forests where accessibility is difficult. The economic value of non-wood goods and services (NWGS) provided by forests is increasing, but often they do not have a commercial value (though in some European regions NWGS provide more revenue than wood sales). NWGS include hosting biodiversity and helping to mitigate climate change, mushroom and truffle gathering, fruit and berry collection, game products, honey, cork, medicinal products, and the seeds of forest tree species. Cork is an important forest product in the EU, with approximately 1.7 million hectares of cork oak forests – the majority in Iberia – accounting for 80% of world production.

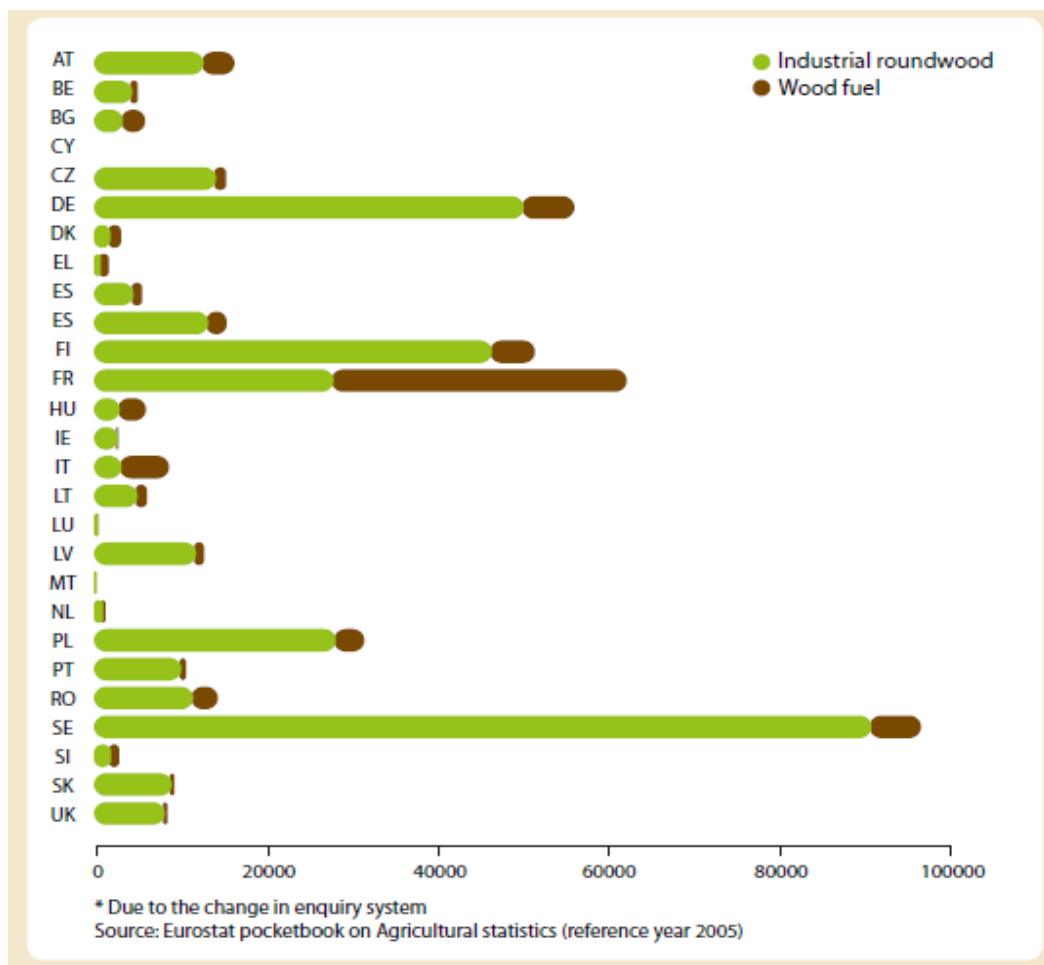


Figure 30. Wood removal in the EU (1000m³ excl. bark)

Source: EU Forest action plan 2007-2011.

3.2 Performance and potentials in relation to “greening”

3.2.1 Performance and potentials of agriculture

In this section we focus on the aspects brought forward in chapter 2 to trace out the current state, performance and potential of green growth in relation to agriculture.

The food and agricultural sector has been successful in providing food to an increasing world population. Productivity growth has been strong and has exceeded the population growth rate. However, the distribution of food and per capita consumption of calories remain uneven across the world and depend ultimately on purchasing power as trade in agricultural commodities increase more rapidly than output. In the fish industry the development is clear with industrial aquaculture now providing more fish than traditional fishing. China is emerging as the number one supplier in farmed fish products.

In recent decades many countries have reoriented their policies towards agriculture and food industries to become less trade distorting and less focused on stimulating production quantities. Coupled payments (such as intervention prices and export subsidies) historically stimulated intensive use of fertilizers, pesticides and machinery and ran counter to the sustainability of these sectors. In recent years many countries have re-tuned their policy packages more towards policies for sustainable farm and land management and agri-environmental measures. Having said this, in many countries the increase in productivity and output is anything but sustainable. In parts of the world there is a growing pressure on and depletion of natural resources (land, water, marine ecosystems, fish stocks, forests and biological diversity).

In this section we will return to the concepts brought forward in chapter 2 and explore to what extent indicators exist for their development in Europe. First, let's have a look at the overall environmental profile of agriculture in Europe.

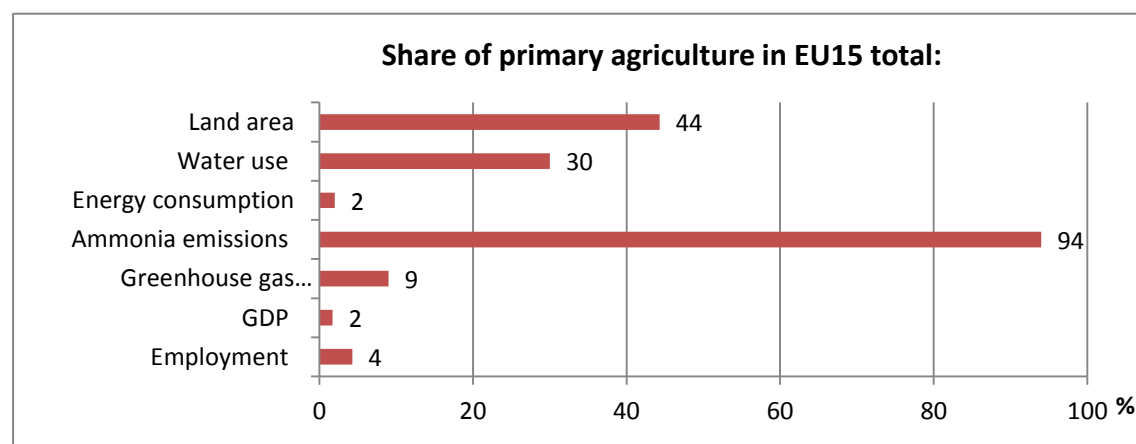


Figure 31. “Agri-environmental profile of EU 2002-2004”. Environmental Performance of

The challenge for the agri-food complex (primary production, fisheries, processing, distribution, etc.) is that production will need to increase substantially over the coming decades to support a population projected to level out somewhat above 9 billion. This means that productivity will have to increase substantially, especially in developing countries. In Europe where productivity is already high and land resources are already exploited to a great extent the build-up of pressure on land, biodiversity, water, landscape as well as the interaction with built areas, will be great challenges. Increasing production and productivity (and sustaining levels of production in already efficient regions) will also have to take place in the light of possible impacts of climate change such as warming, cooling and changes in precipitation and extreme weather events; and the impacts of invasive species and new crop and livestock diseases caused by such change.

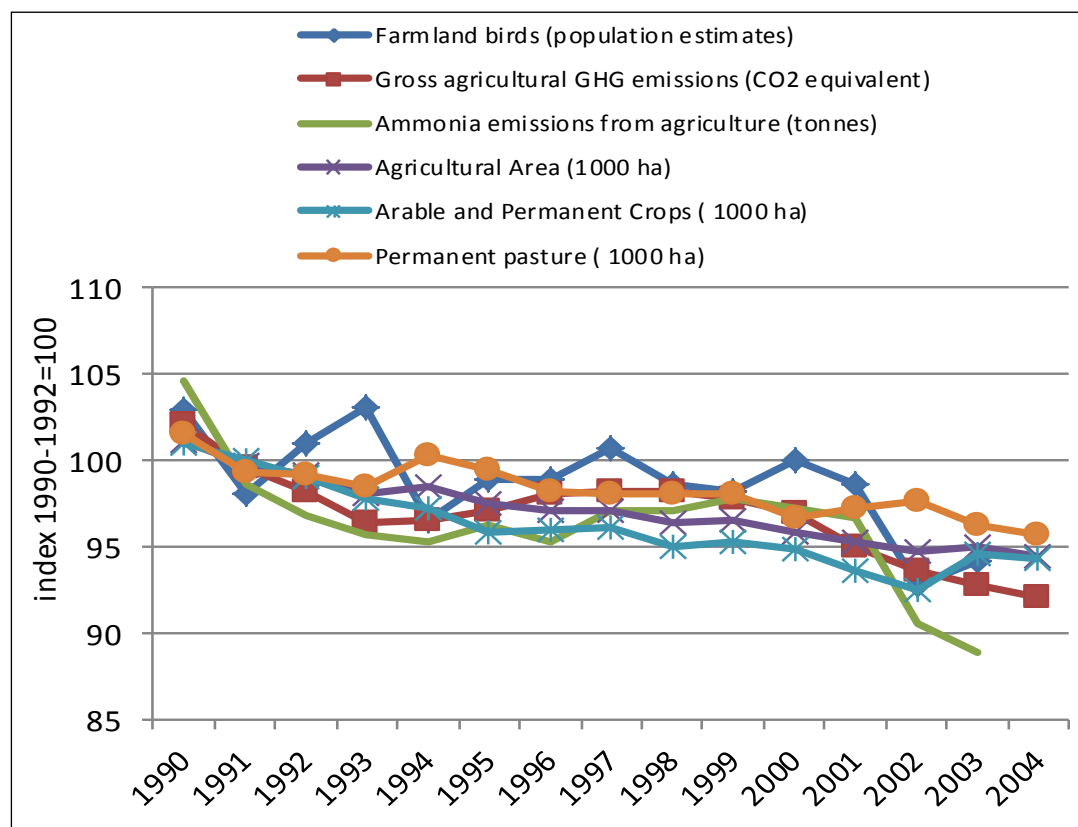
In the global context the projection is that an additional billion tone of cereals and 200 million tons of meat will have to be produced each year by 2050 compared to current levels of production. Higher yields will be one way to reach this but the increase in productivity has been slower in recent decades (1% annually) compared to the period of high increases (3-4%) 1960-1990. Other ways to improve production will be to increase intensity, improve resource efficiency, utilize land not already in production (mainly in Africa and Latin America) and to reduce waste in post-harvest handling, transports, processing and consumption. It is estimated that around 30% of all food produced in developed countries is wasted, most of which in the final stage of consumption at home or in restaurants or other facilities. Irrigation will need to be increased in many parts of the world and this will place increased pressure on the use of water in agriculture. In Europe more intensive production as crops are also used for biofuel will primarily impact on biodiversity and the features of landscapes. OECD (2005) anticipates that the loss in biodiversity will be driven mainly by the conversion of grassland and forests to farmland for production of food and biofuel to answer up to increased demand for both. Irrigation is already important in some parts of the union and will continue to put pressure on water resources as more land is converted. Globally water consumption is estimated to increase by 11%; already today agriculture account for 30% of total water use in Europe.

Today there are no existing indicators for the food and agricultural sector that taken together can track the progress towards green growth. Available indicators can illustrate particular issues such as land use, GHG emissions, use of inputs (fertilizers, pesticides, water, etc.), and nutrient balance. Much of this available information are only available at the national level and take no account of regional variation and geographical context affecting the environmental impact. We have focused on finding evidence for showing the states and trends for the conceptual topics brought forward in chapter 2. First of all some indicators for EU 15, compiled by the OECD, are shown in figure 32. These provide a first picture of the trend over the last 15-20 years for some key environmental indicators showing the impact of agriculture on the environment.

Farmland bird's indexes are used to measure the biodiversity of agricultural landscapes. This is a common index used and is based on visual inspections of birds on various types

of land. There is obviously a variation between years in this index but it is likewise evident that the value has been decreasing since 1990, indicating a less biologically diversified agricultural landscape in Europe. Emissions and use of environmentally damaging inputs (GHG, ammonia, nitrogen (balance) and phosphorous (balance)) have all decreased but can largely be attributed to a decline in the agricultural area, arable and permanent crops and permanent pastures. However agricultural production values have increased (efficiency have increased given the amount of land used) and following this also the use of pesticides and on-farm energy have increased.

Intensity of farming systems is quite diverse throughout the EU. Intensive farming can primarily be found in Be-Ne-Lux, southern-UK, France, Italy and Greece. According to Euorstat data on regional intensity (and changes between 1990-2000), Spain, southern-France, the UK and Greece show signs on intensification and can be assumed to encounter problems in the future due to this process (competition for land, increased use of inputs, emissions, livestock density, etc.). The least intensive farming systems today can be found in Sweden, Spain, Portugal and northern-UK. However, some of these have experienced more than 15 % intensification between 1990 and 2000.



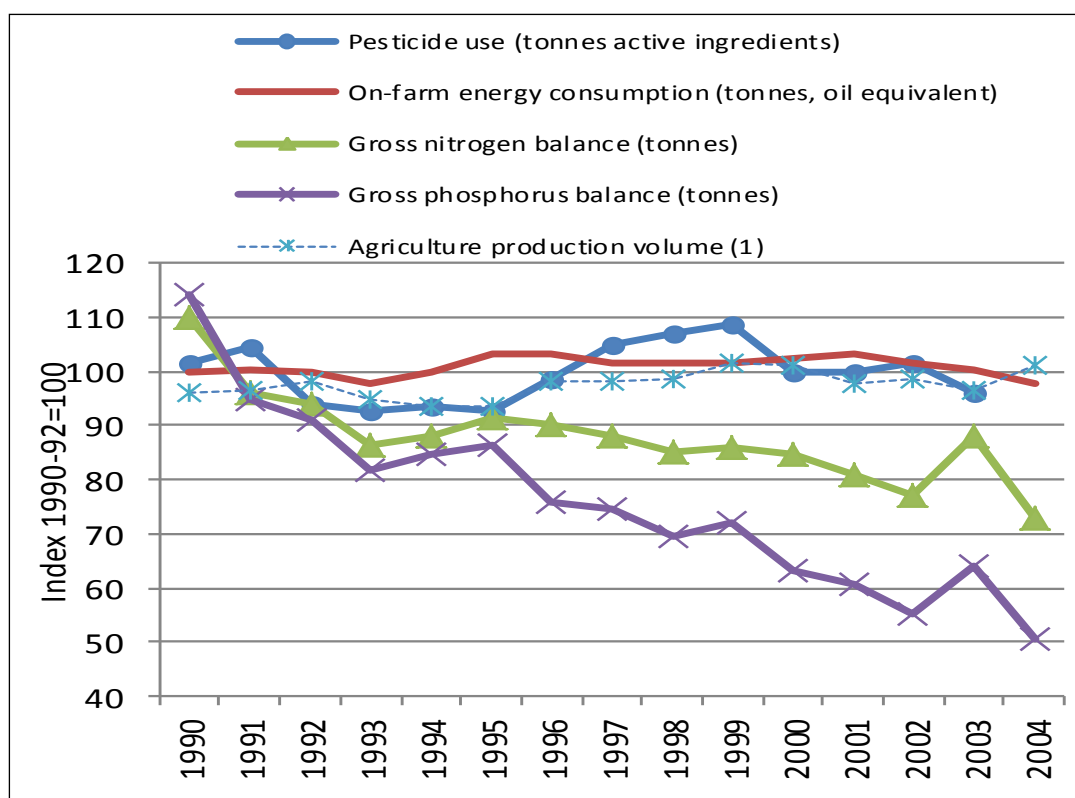


Figure 32. OECD indicators on agri-environmental trends in the EU15, 1990-2004. OECD (2008), Environmental Performance of Agriculture in OECD Countries Since 1990, OECD Publishing.

The IRENA indicators

A quite new initiative is the IRENA operation (Indicator Reporting on the Integration of Environmental Concerns into Agriculture Policy), a joint exercise between several Commission directorates-generals (DG Agriculture and Rural Development, DG Environment, Eurostat and DG Joint Research Centre, and the European Environment Agency (EEA) to develop agri-environmental indicators for monitoring the integration of environmental concerns into the common agricultural policy (CAP) in the European Union (EU-15). It is a response from the European Commission to the request of the Agricultural Council to develop a set of indicators for monitoring environmental integration in the CAP.

The IRENA operation employs the conceptual framework of the DPSIR which is an analytical framework that has been developed at the European Environment Agency (EEA, 1999) in order to describe and understand the inter-linkages between economic activities and the environment. The agricultural DPSIR model is a conceptual model that is meant to capture the key 'factors' involved in the relationships between agriculture and the environment and to reflect the complex chain of causes and effects between these factors. The analytical framework of the DPSIR model is depicted in figure 33 (from the Eurostat webpage).

In the sections below some environmental indicators and assessments are brought forward to provide a picture of the current state and sometimes trends. Some are from the IRENA indicators, some from official communications from the Commission and others from the EUROSTAT database.

Domain	Sub-domain	Nr	Title
Responses	Public policy	1	Agri-environmental commitments
		2	Agricultural areas under Natura 2000
	Technology and skills	3	Farmers' training level and use of environmental farm advisory services
	Market signals and attitudes	4	Area under organic farming
Driving forces	Input use	5	Mineral fertiliser consumption
		6	Consumption of pesticides
		7	Irrigation
		8	Energy use
	Land use	9	Land use change
		10.1	Cropping patterns
		10.2	Livestock patterns
	Farm management	11.1	Soil cover
		11.2	Tillage practices
		11.3	Manure storage
	Trends	12	Intensification/extensification
		13	Specialisation
		14	Risk of land abandonment
Pressures and risks	Pollution	15	Gross nitrogen balance
		16	Risk of pollution by phosphorus
		17	Pesticide risk
		18	Ammonia emissions
		19	Greenhouse gas emissions
	Resource depletion	20	Water abstraction
		21	Soil erosion
		22	Genetic diversity
	Benefits	23	High Nature Value farmland
		24	Renewable energy production
State/Impact	Biodiversity and habitats	25	Population trends of farmland birds
	Natural resources	26	Soil quality
		27.1	Water quality - Nitrate pollution
		27.2	Water quality - Pesticide pollution
	Landscape	28	Landscape - state and diversity

Figure 33. Analytical framework of the DPSIR model, backbone of the IRENA indicators.

Biodiversity

Extensive farming systems are important for maintaining the biological and landscape diversity of farmland, including Natura 2000 sites. Such systems have been threatened, however, by two different trends: intensification and abandonment. The decline in the proportion of 'mixed livestock' farms by about 25 % from 1990 to 2000 is particularly significant since these farms are often associated with high biodiversity and landscape quality and form part of high nature value (HNV) farmland. According to current estimates about 17 % of the habitats in proposed Natura 2000 areas depend on a continuation of extensive agricultural practices. Such management favouring maintenance of biodiversity can be supported via agri-environment schemes and other agricultural policy instruments.

Initial results from the first major 'health check' of species and habitat types protected under the Habitats Directive show that 50% of species, and possibly up to 80% of habitat types, of European conservation interest have an unfavourable conservation status. These results are not surprising, as the decline of species and destruction of habitats has

been ongoing in Europe for many decades and this trend cannot be reversed within a few years. There are positive trends for some of the species and the recovery of some of the large carnivore species is an encouraging indicator. Overall, Europe's common birds have declined by around 15% since 1980. Common farmland birds have declined most severely, by more than 40%, but common forest birds have also declined, by around 10%. Declines have levelled off since the late 1990s.

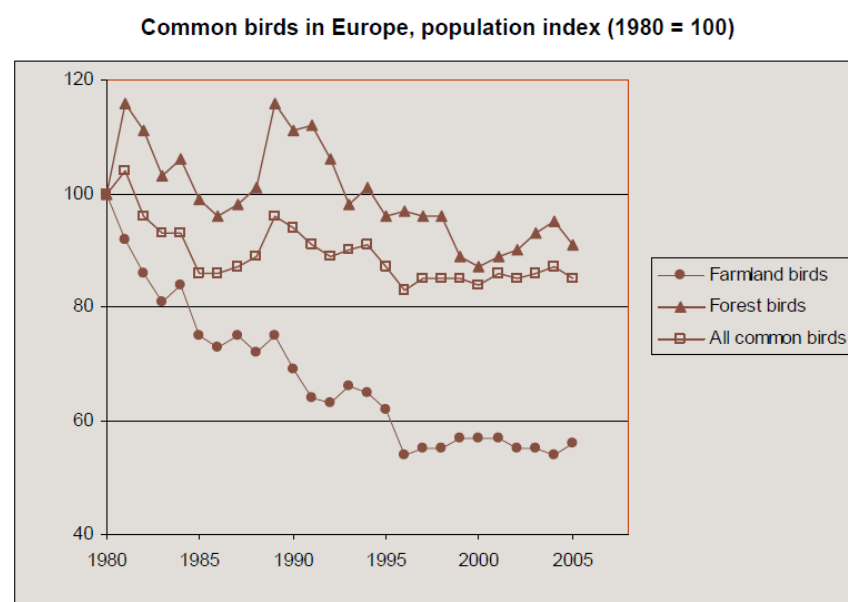


Figure 34. Source: SEBI 2010 Biodiversity Indicators

Biodiversity is mainly affected by land use (intensity, livestock density, mono-cultivation, etc) and input structures. Looking first at the current states of mono-cultivation it is evident from figure 35 that it is only in new member states and eastern European countries that one can find mixed farming systems. In all other countries the farming systems have been defined as either specialised crop or livestock systems. Permanent grasslands are generally considered as the most important from a landscape and nature conservation perspective. This is however most of the time only true for extensively managed permanent grassland that provides habitats for many wild plants and animal species. The quality of these grasslands from a landscape and nature conservation point of view can be roughly assessed by looking at grazing livestock densities in these countries. Total levels of livestock density are highest in Norway, Be-Ne-Lux, the UK, parts of Spain and Italy, and western France. But looking at grazing livestock, impacting on grassland biodiversity, the densities are highest in Greece, northern Italy, some Spanish regions and Be-Ne-Lux. Ireland, Austria and the UK are the primary specialised livestock producers, whereas large countries with specialised crop systems include Italy, Spain and Finland. The regional breakdown of these specialisation indexes are found in maps 5 and 6. Specialisation changes land use towards less diverse cropping and/or livestock patterns, due to more concentration on a limited number of products. A less diverse cropping/livestock pattern may cause a loss of diversity in farmland habitats, as well as in associated flora and fauna, crop varieties and livestock breeds, leading to overall reduction of genetic diversity.

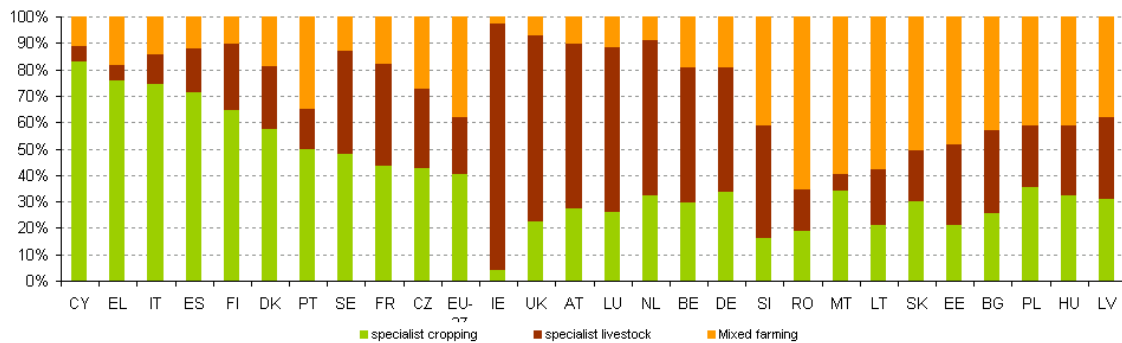
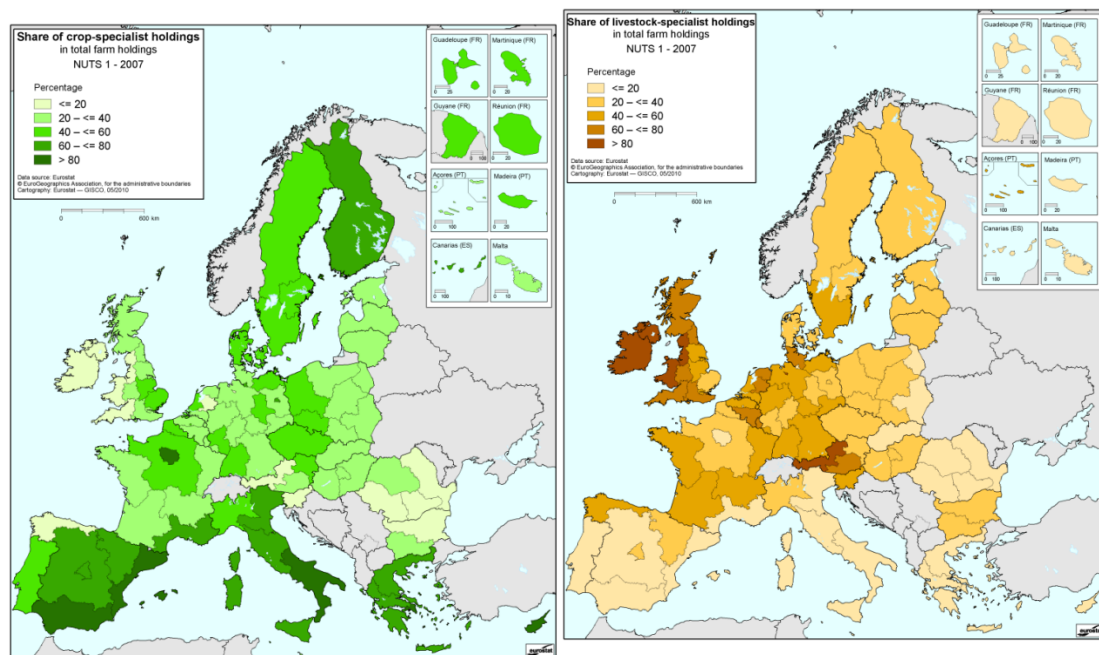


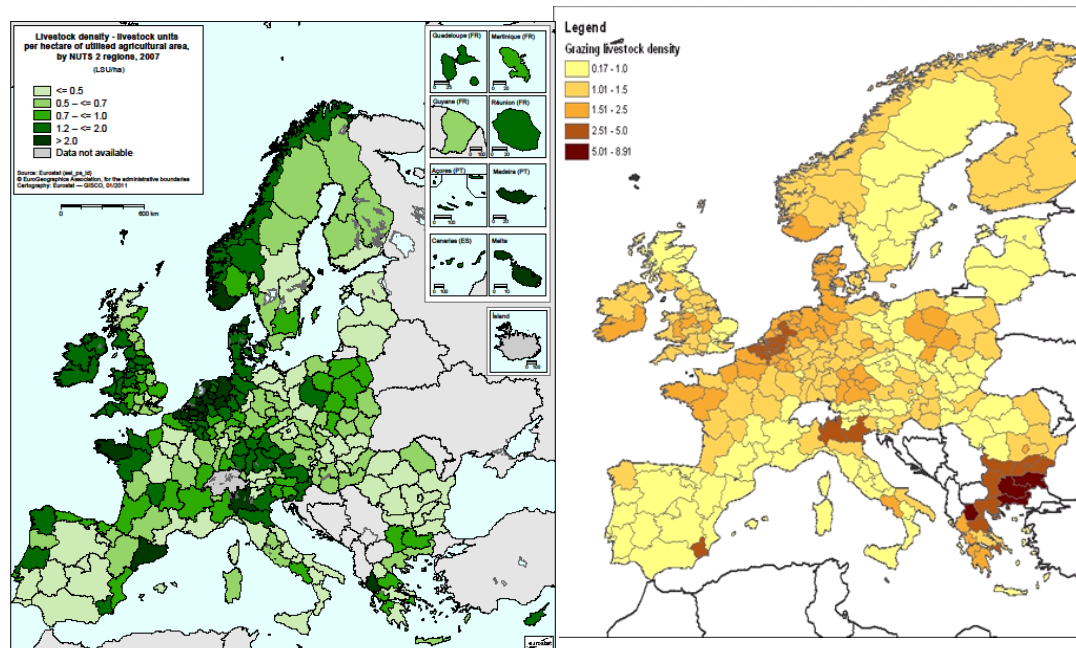
Figure 35. Specialised and mixed farming systems in EU countries.



Maps 5 and 6. Share of crop and livestock specialist holdings. DG Agri (2010).

Livestock patterns are an indicator of the pressure of livestock farming on the environment. Livestock, through manure production, contributes to climate change (greenhouse gas emissions) and nutrient leaching into water and air. A higher livestock density means that a higher amount of manure is available per hectare of UAA, which increases the risk of nutrient leaching. On the contrary, an excessively low livestock density increases the need for industrial fertilisers as well as the risk of land abandonment. The actual impact on the environment of livestock farming does not only depend on the amount of livestock, but also depends on farming practices. Grazing, if not too heavy, can contribute to nature conservation in semi-natural habitats since plants and

animals benefit from the variety of structural features present in lightly or moderately grazed pastures, but heavy grazing eliminates structural diversity.



Maps 7 and 8. Total livestock density and livestock density of grazing animals. DG Agri (2010).

When it comes to input use it is mainly the use of fertilisers and pesticides are detrimental to biodiversity. Specialisation towards crops or livestock may also affect the nutrient balance of a holding. Fertilisers and manure contain large amounts of nutrients (e.g. phosphorus, nitrogen) and crops use these nutrients to grow. However, the amount of nutrients a crop can take up is limited, and the excess can leak into water, soil and air, causing a range of environmental problems. Mineral fertiliser use declined from 1990–2001: total nitrogen (N) fertiliser consumption in EU-15 decreased by 12 % and total phosphate (P₂O₅) fertiliser consumption in EU-15 decreased by 35 %. At the same time, the total estimated amount of pesticides used in agriculture increased by 20 % between 1992 and 1999 according to industry figures (ECPA). The major users of inorganic fertilisers and trend in use can be seen in figure 36. Looking at the picture on fertilisers per hectare of utilised agricultural area (fig 37) gives a different idea of which countries uses much nitrogen, potassium and phosphorus.

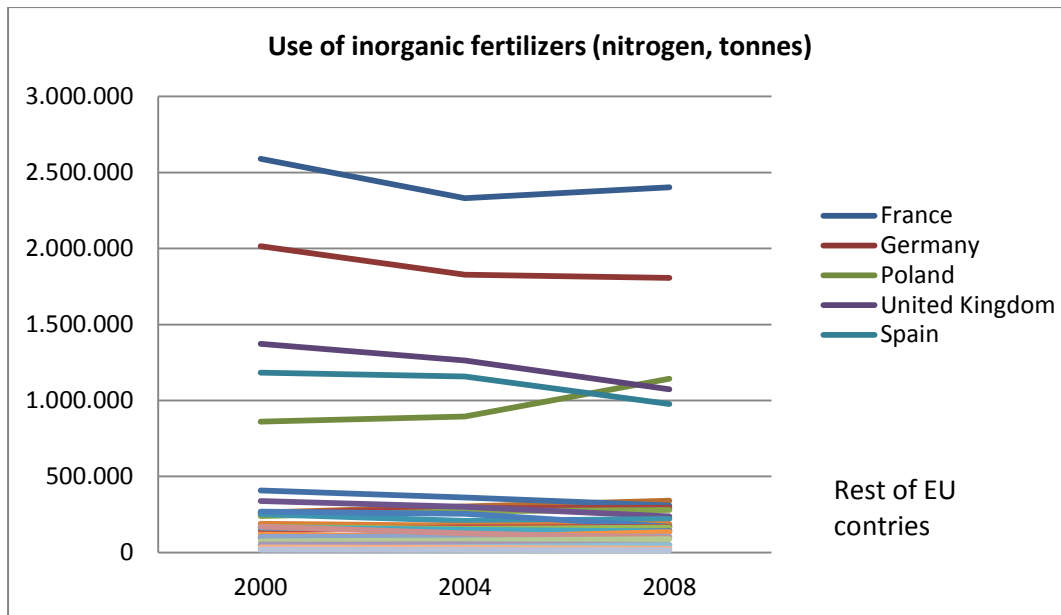


Figure 36. (Data from Eurostat)

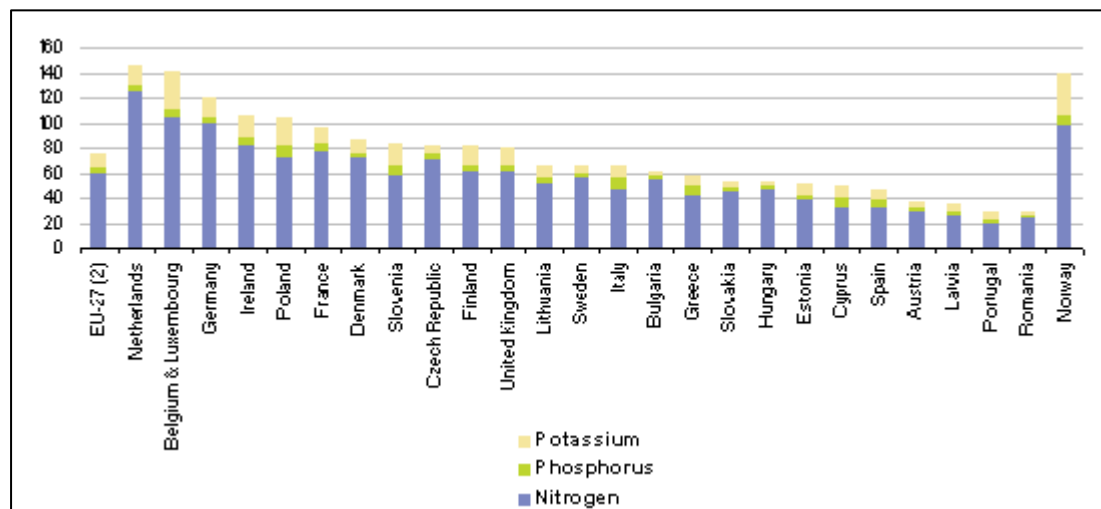


Figure 37. Estimated consumption of manufactured fertilisers, 2009 (1) (kg of nutrient per hectare of UAA)

Water: quality and availability

A third of water use in Europe goes to the agricultural sector. But for many European countries the share of agriculture in total water use is high, as table 5 shows many of the Mediterranean countries use between 60-90% of their water for agriculture. For some countries the total water use for food production has also increased putting extra pressure on already utilised sources. In Turkey, Greece and Portugal water use for agriculture increased substantially between 1990 and 2003. In these countries irrigation

is important and the irrigable area in EU-12 increased from 12.3 million ha to 13.8 million ha between 1990 and 2000, i.e. by 12 %. In the UK irrigation has increased but is still at a low level.

However, in some of these countries (France, Greece and Spain) the irrigable area increased even more; 29 % during the same period. For France however this did not imply an increase in water use which points to the fact that irrigation systems are becoming more efficient (in transmitting water without losses) and that application of water to crops are more efficient in terms of amount, timing and how water is applied physically.

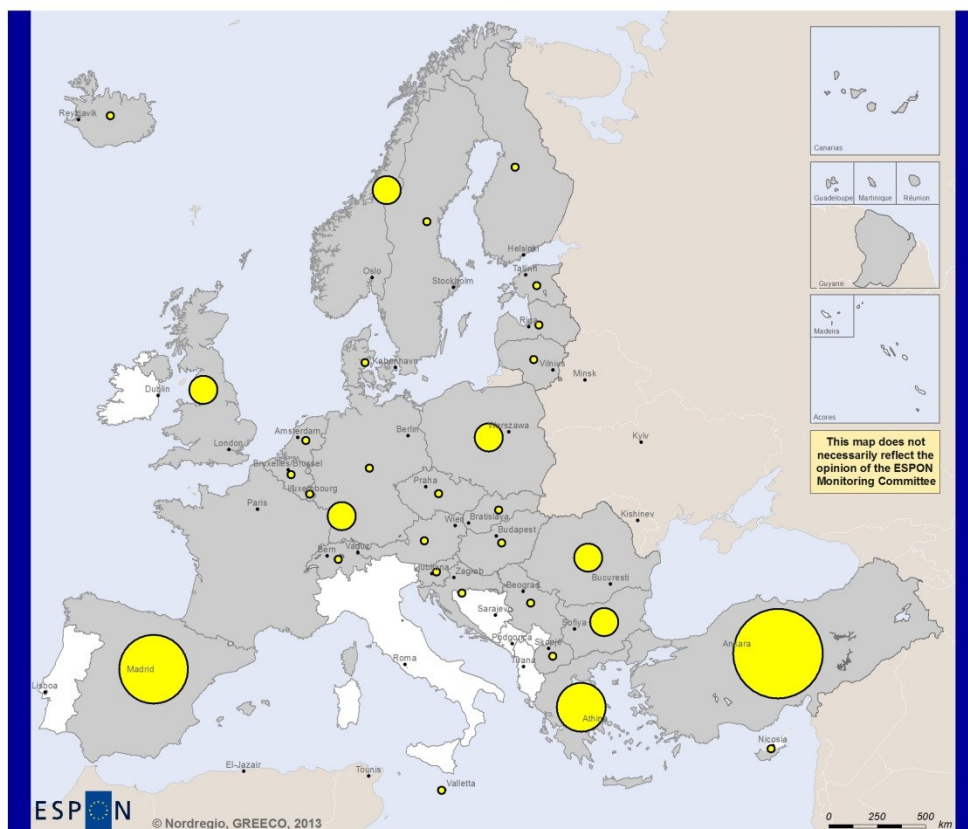
Table 5. Water use in agriculture.

	Agricultural water use			
	Total agriculture water use		Change in total agriculture water use	Share of agriculture in total water use
	1990-92	2001-03	1990-92 to 2001-03	2001-03
	(million m ³)	(million m ³)	%	%
Turkey	18 812	31 000	65	78
Greece	5 694	7 600	33	87
Portugal	5 100	6 178	21	75
United Kingdom	1 347	1 476	10	10
Spain	19 667	21 407	9	60
France	4 901	4 676	-5	14
Austria	100	82	-18	5
Sweden	169	137	-19	5
Germany	1 600	1 140	-29	3
Poland	1 527	1 052	-31	9
Hungary	1 032	694	-33	13
Denmark	383	181	-53	27
Slovak Republic	188	72	-62	7
Czech Republic	93	15	-84	1
Italy	..	20140	..	36

Adapted to EU countries from: OECD (2008), Environmental Performance of Agriculture in OECD Countries Since 1990, OECD Publishing. NB: Footnotes on data and limitations are removed and can be found in the source publication.

Map 9 proved a somewhat more updated picture of water abstraction for agriculture. The map is from Eurostat and makes use of the latest available data for each country. As the table already displayed for 2001-2003 the issue of water abstraction for irrigative use is most important in Turkey, Spain, Portugal and Greece.

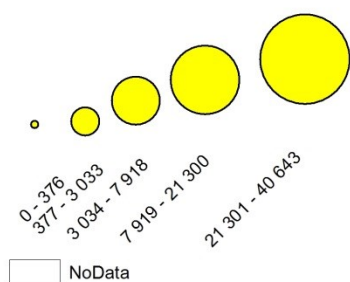
Water abstraction for agriculture 2011



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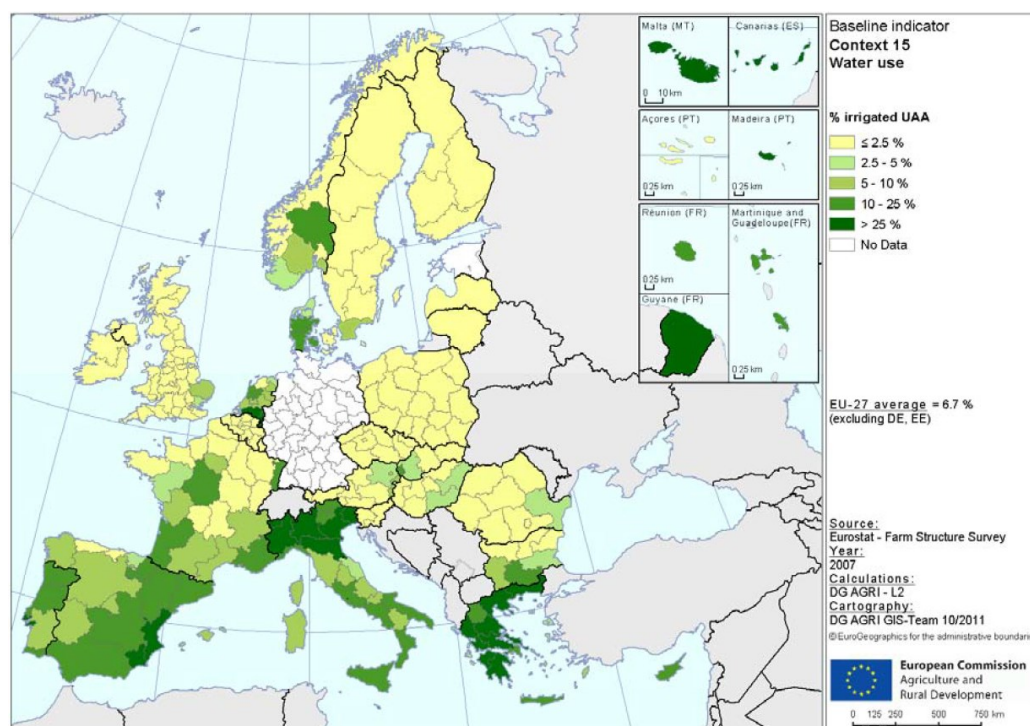
Regional level: NUTS 0
Source: Eurostat, 2012
Origin of data: Eurostat, 2012
© EuroGeographics Association for administrative boundaries

Millions of cubic metres/year



dat for 2011 or latest available year
(DE, ES, FR, LV, NL, SK, SE = 2010;
BE, DK, EE = 2009; LV, MK = 2007;
HU, NO, CH = 2006; FI, IS = 2005;
AT = 2002)

Map 9. Water abstraction for agriculture, millions of cubic metres/year. Source: Eurostat database.



Map 10. Share of irrigated Utilised Agricultural Area. Source: European Commission.

Nutrient surpluses, as measured by gross nitrogen balance, have generally decreased in the EU-15 between 1990 and 2008. Current nutrient surpluses range from below 30 kg N/ha in some member states to above 225 kg N/ha in the Netherlands; mainly reductions have taken place but some eastern European states have increased their balance.

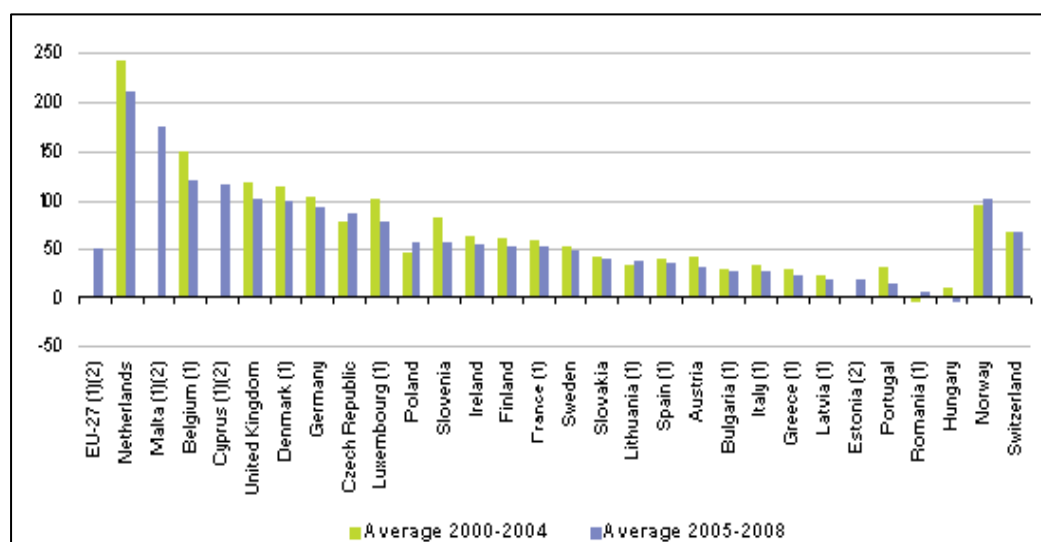


Figure 38. Gross nitrogen balance (kg per hectare of agricultural land). Source: Eurostat online data.

National balances can, however, mask important regional differences in the gross nitrogen balance that determine actual nitrogen leaching risk at regional or local level. Individual Member States can thus have overall acceptable gross nitrogen balances at national level but still experience significant nitrogen leaching in certain regions, for example in areas with high livestock concentrations (see map in previous section of livestock densities).

Energy use and Climate change

While agriculture contributed to around 10 % of total greenhouse gas emissions in EU-15 in 2002 it can also function as a sink for CO₂. The main greenhouse gases emitted by agriculture are nitrous oxide and methane, both of which have a far greater global warming potential than carbon dioxide. Agriculture also consumes fossil fuels for farm operations, thus emitting carbon dioxide. Emissions of greenhouse gases by the agriculture sector — methane and nitrous oxide — have fallen by 8.7 % between 1990 and 2002. Within the EU-15, emissions of ammonia from agriculture have also decreased by 9 % between 1990 and 2002 but the sector still provides more than 90 % of total ammonia emissions.

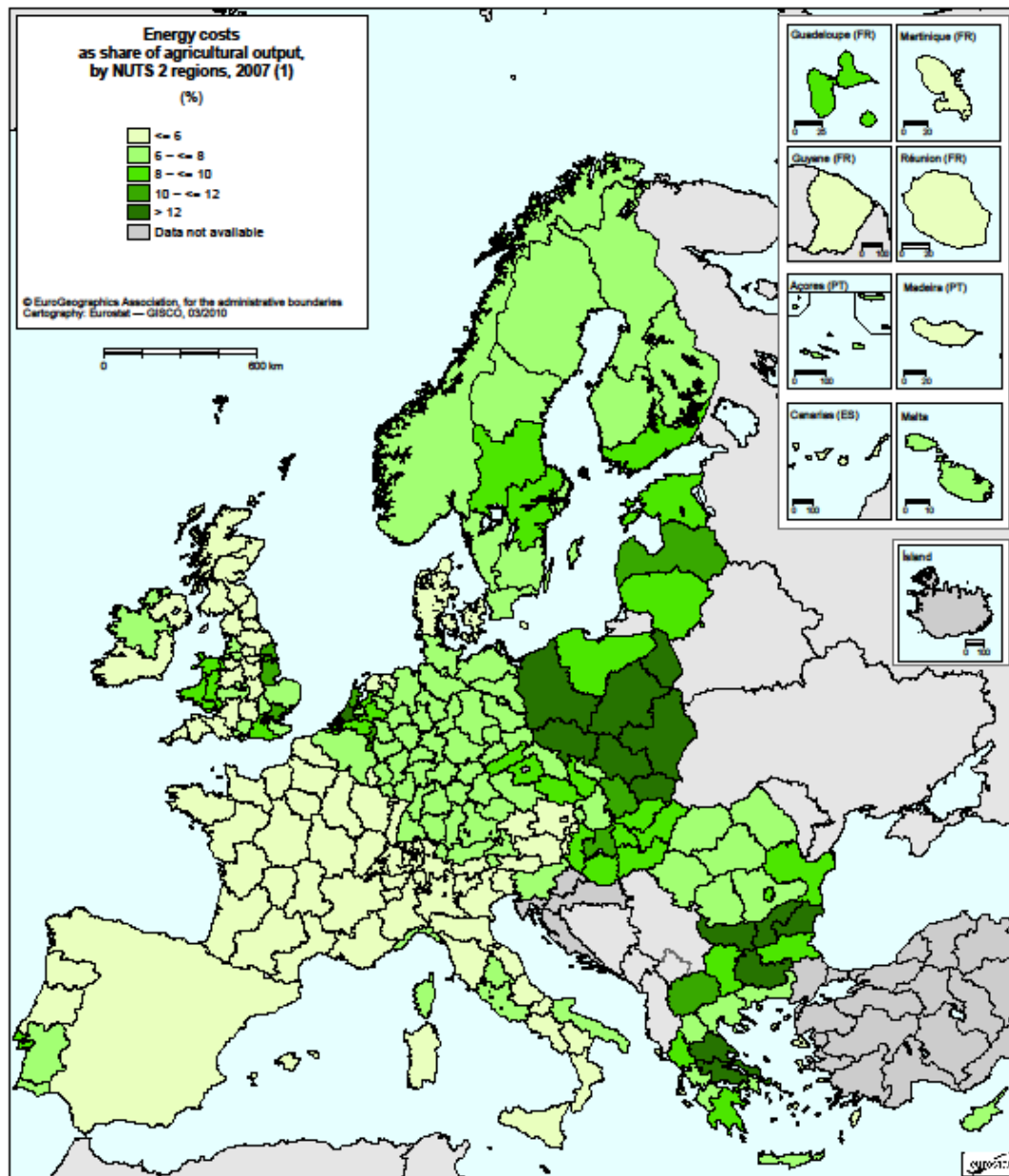
Table 6. On farm energy consumption.

	Direct on-farm energy consumption					
	Average ¹	Average ¹	Change in on-farm	Change in total	Share in	Share in total
			energy consumption	energy	national total	OECD on-farm
				consumption	energy	energy
	1990-92	2002-04	1990-92 to 2002-04	1990-92 to 2002-04	2002-04	2002-04
	(Ktoe ²)	(Ktoe ²)	(Ktoe ²)	%	%	%
Turkey	1 997	3 167	1 170	59	44	5
Spain ³	1 818	2 525	707	39	54	4
Ireland	222	304	82	37	53	0
Poland	3 454	4 463	1 009	29	-4	7
Norway	657	812	155	24	17	1
Luxembourg	13	15	2	17	31	0
Italy	3 011	3 326	315	10	13	5
Greece	1 075	1 186	110	10	36	2
Iceland	287	308	21	7	40	0
Netherlands	3 752	3 927	175	5	16	6
Belgium ⁴	850	795	-55	-6	20	1
France	3 313	3 017	-297	-9	11	5
Finland	870	765	-104	-12	18	1
Austria	715	619	-96	-13	29	1
Sweden	653	554	-99	-15	10	1
Germany	3 349	2 664	-686	-20	1	4
Portugal	586	452	-135	-23	50	1
United Kingdom	1 309	1 000	-309	-24	8	2
Denmark	1 031	779	-252	-24	7	1
Switzerland	203	148	-55	-27	6	0
Hungary	956	631	-325	-34	-2	1
Slovak Republic	666	182	-484	-73	-21	0
Czech Republic ⁵	1 314	250	-1 064	-81	-16	0

Adapted to EU from: OECD (2008), Environmental Performance of Agriculture in OECD Countries Since 1990, OECD Publishing.

1. Data cover total on-farm energy consumption by primary agriculture (for irrigation, drying, horticulture, machinery and livestock housing), forestry, fishing and hunting, except Belgium, Italy, Switzerland and the United Kingdom, where data only include agriculture. 2. Ktoe equals thousand tonnes of oil equivalent. 3. Data energy are drawn from national sources. Data for the year 2004 refer to the year 2003. 4. The average 1990-92 and 2002-04 covers 1990 and 1999-01 respectively. 5. For the Czech Republic, change in on-farm energy use is -81%. Original OECD (2008) reports the sources: IEA (2006); national data for Portugal, Spain and Sweden.

Energy cost as a fraction of agricultural output value is available at the Nuts 2 regional level for the EU and is displayed in map 11. However, this data does not say so much about energy intensity since it also reflects the price level of energy in each country (reflecting taxes and subsidies) and the value of agricultural output produced in each country. In fact, the data shows both the difference in energy efficiency, climate, energy pricing, mechanisation, value of output, and possible many other explanations for the differences. It is for instance evident that countries with a cooler climate and large share of animal husbandry need to keep stables warm during the winter. Obviously for some new member states the picture shows reliance on older less energy efficient machinery and construction, as well as lower values of production combined with high energy prices.



(1) Belgium, Denmark, Spain, Slovenia and Norway, national data; Poland, by NUTS 1 regions and 2005 data; Portugal, 2006 data.

Map 11. Source: Eurostat.

The official EU **SEC (2009) 1093** on climate change mitigation describes that at overall EU level, emissions reported in the agriculture sector are 462 million tonnes of CO₂-equivalent of greenhouse gases in 2007. This represents 9.2 % of total EU-27 emissions (against 11 % in 1990). In addition, in 2007, net emissions from agricultural land use were 57 million tonnes of CO₂. These comprise croplands, which are net sources, and emitted 70 million tonnes CO₂ and grasslands, which are net sinks, and removed 13 million tonnes CO₂.

In addition, agricultural activities also release carbon dioxide (CO₂) from fossil fuel use in buildings, equipment and machinery for field operations, which account for around 1% of CO₂ emissions of all sectors. Following the UNFCCC reporting scheme these emissions

are not accounted in the 'agriculture' category but are included in the 'energy' inventory. Further agriculture-related emissions, such as those from the manufacturing of fertilisers and animal feed, are included in the inventory on industrial processes. The share of agricultural emissions of GHG are depicted in figure 39, for the EU (left) and for individual countries (right).

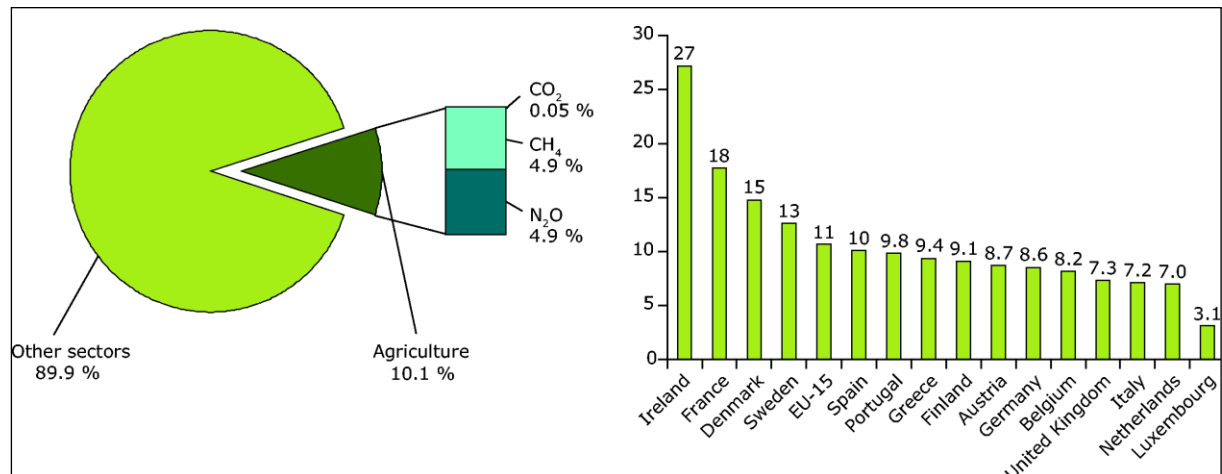
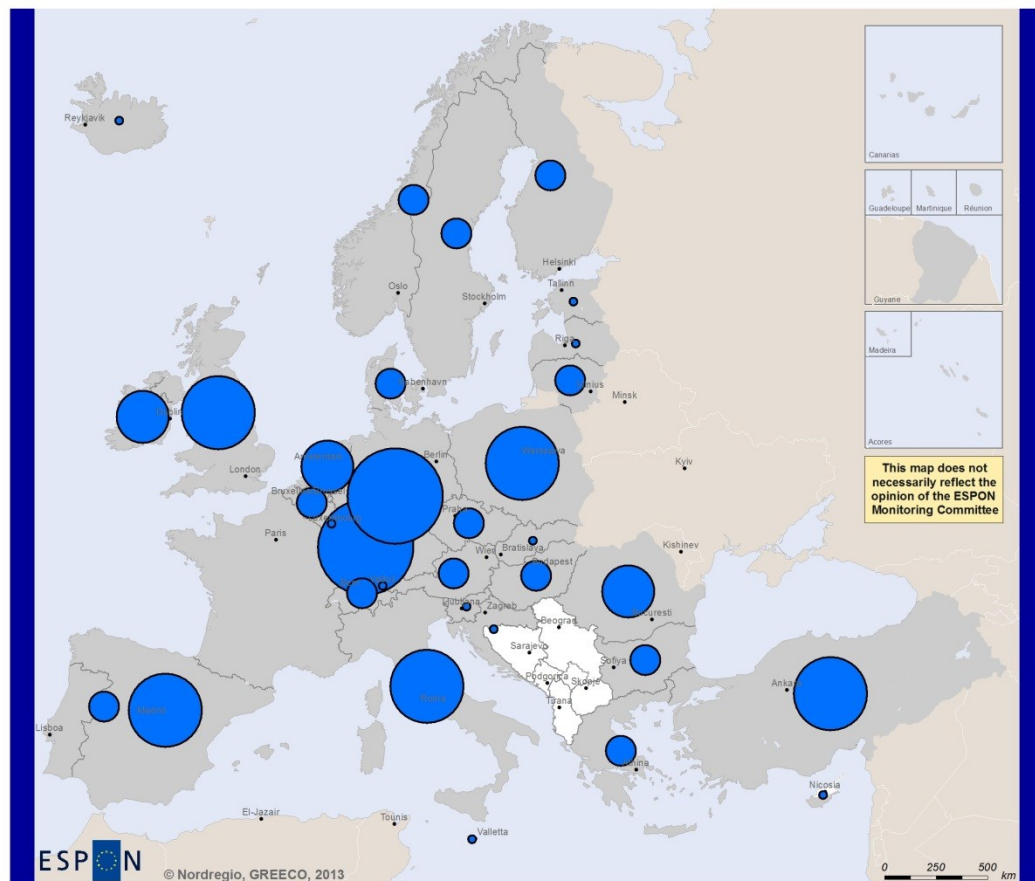


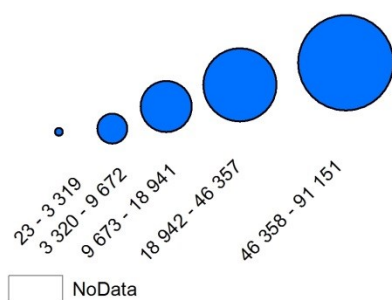
Figure 39. Share of agricultural GHG emissions in total EU emissions and in countries total emissions, in 2007 (CO₂ equivalent) Source: SEC (2009)1093.

Map 12 shows the emissions of GHG CO₂ equivalents for EU countries, it is evident that large producers emit more. As we can recall from above France However, investigating the emissions in relation to production values provides a very different analysis as figure 31 shows.

Greenhouse Gas Emissions (CO2 equivalent) from the Agricultural Sector



Thousands of tonnes - 2011



Map 12. GHG emissions by agriculture by country, thousands of tonne CO2 equivalents (latest available years). Source: Eurostat database.

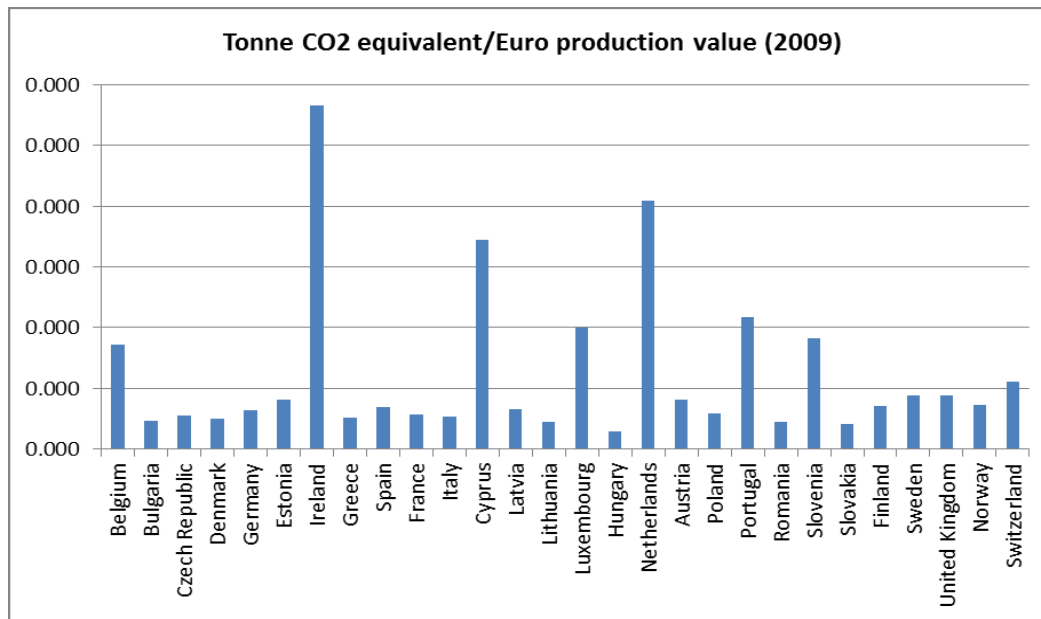


Figure 40. Co2 (equivalents) emissions in relation to production value. Source: Own calculations based on Eurostat database.

EU-27 agricultural emissions of *methane* and *nitrous oxide* declined by 20.2 % in the period 1990-2007. Large reductions occurred in the greatest sources of emissions, nitrous oxide from agricultural soils and methane emissions from enteric fermentation by cattle, which both fell by about 21 %. This trend contrasts to the global situation where farming emissions rose by nearly 17 %, mainly due to increases in developing countries. The downward trend in these emissions is the result of several factors: increases in productivity and decline in cattle numbers, improvement of farm management practices, Methane emissions fell primarily as a result of a significant drop in cattle numbers by about 25% in 1990-2006 following an increase in the animal productivity (milk and meat) and the related improvement in the efficiency of feed use. Nitrous oxide emissions from soils diminished mainly due to reduced use of organic and mineral nitrogen fertilisers. (SEC (2009) 1093). Emissions from cropland have significantly decreased. Main drivers for this trend are the overall reduction of the cropland surface in the new Member States, the introduction of obligatory set aside, and increased protection of permanent grasslands, which has limited the conversion of grassland to cropland. In the same period, agricultural output increased by about 12 % in EU-27. Nevertheless, the trade balance of beef is showing an increasing deficit over recent years, which means that some of the associated emissions have occurred elsewhere. (SEC (2009) 1093)

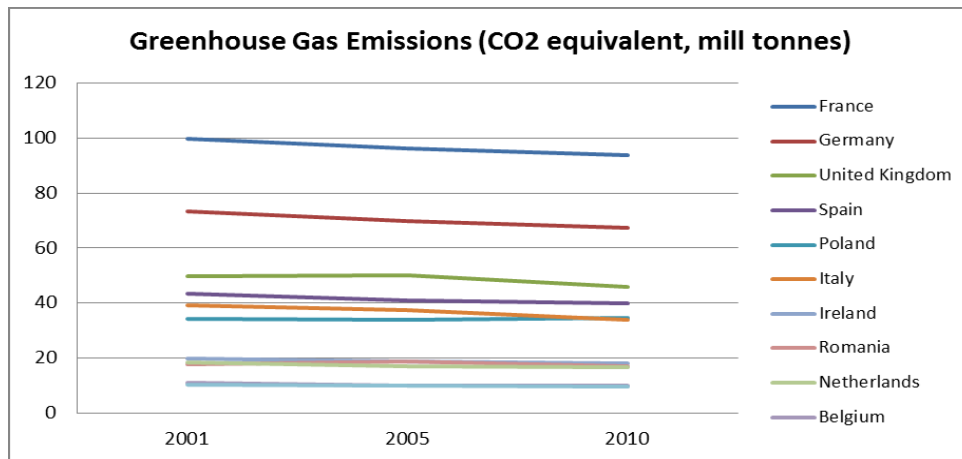


Figure 41. Changes in GHG emissions for the most emitting countries. Own construction based on data from Eurostat database.

Over a longer period, 1990 – 2007, the OECD has related GHG emissions to agricultural production. Although we see that for the last 10 years most countries in Europe has managed a reduction in emissions, this is not the case globally. For some countries the increase in GHG emissions can be explained (over this longer period) by increases in agricultural output. This is perhaps not good, but it is explained by an expansion of the sector. For yet other countries there has been a decrease in emissions while production has increased, this shows that this is a possible scenario and that many “different” types of countries can produce such an outcome (see for instance Turkey, Korea, Austria, Denmark and Iceland). Finally, some countries have reduced their emissions while decreasing their agricultural production.

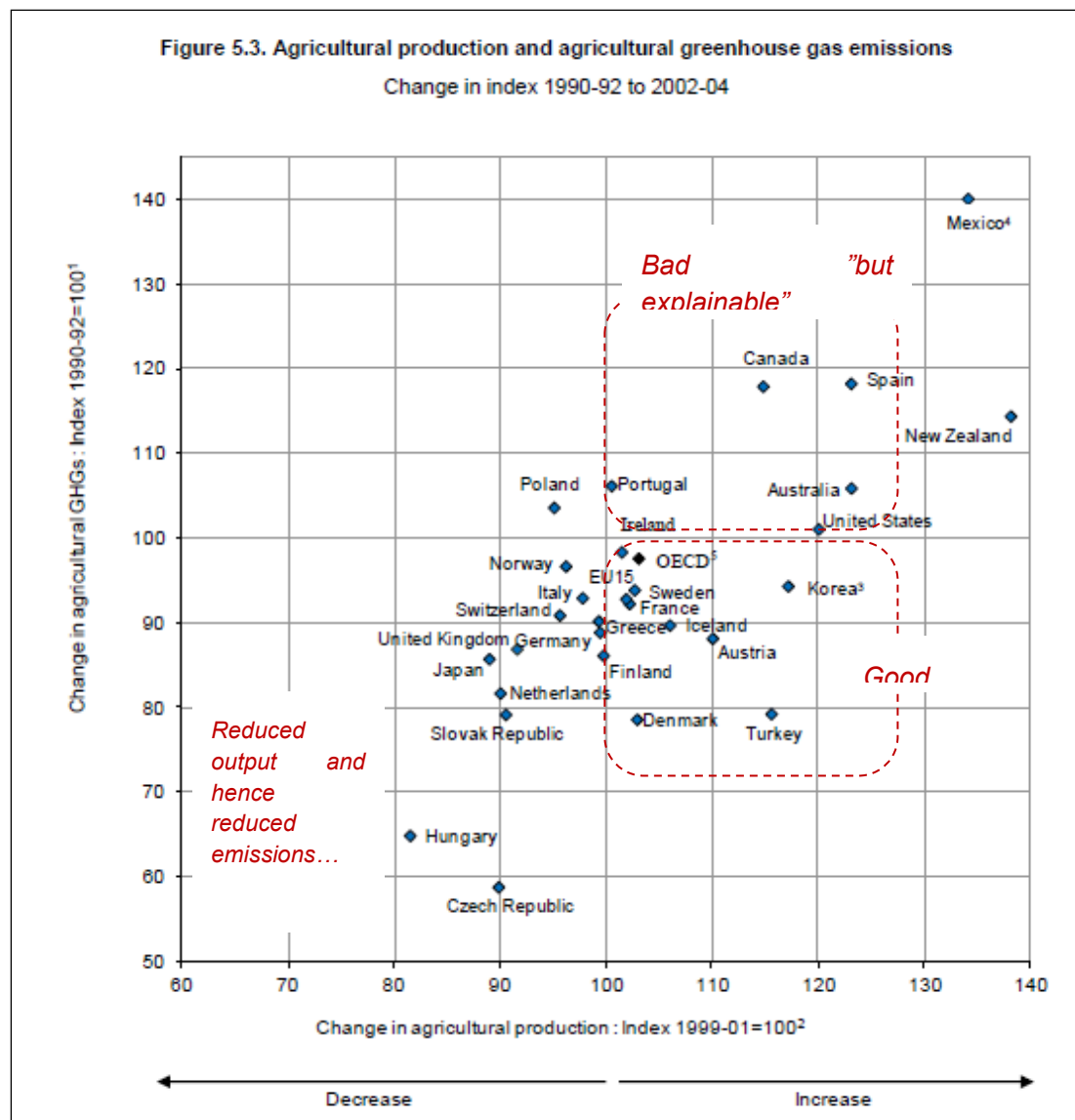


Figure 42. Source: OECD (2008), own text inside the figure to highlight specific aspects.

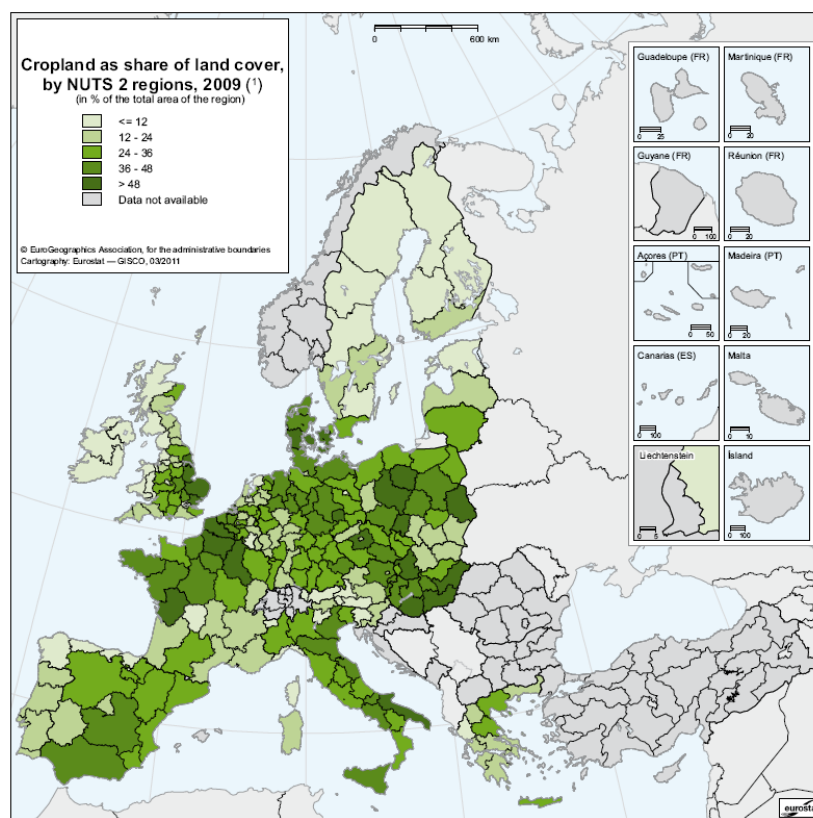
Land use

(From the EC-web) Agriculture is the main land user and the resulting high visibility leads to a widespread perception that "rural" matches with "farming". Across the EU, agricultural land management has created rich landscape diversity, including a mosaic of woodlands, wetlands, and extensive tracts of an open countryside.

Whilst the farming past has shaped the landscape, often the farming activities that helped generating those features have lost their competitiveness. The CAP stresses the importance of preserving the farmed landscape since traditional agricultural landscapes form part of the cultural and natural heritage, and the ecological integrity and the scenic value of landscapes make rural areas attractive for the establishment of enterprises, for places to live, for tourism, and recreation businesses.

The ecological integrity of a landscape is an important element of its attractiveness and perceived value. The fairly recently established concept of High Nature Value Farming recognises the causality between certain types of farming activity and natural values, such as high levels of biodiversity or the presence of species and habitats of conservation concern. Typically farming practices preserving and enhancing biodiversity are associated with low intensity grazing or mowing practices on semi-natural vegetation. But also more intensive agricultural landscapes can be beneficial with respect to biodiversity as certain farmland features can provide for nesting and breeding sites, food sources and migratory corridors. There are also examples of entirely intensively managed farming areas that sustain large populations of species important for nature conservation. The environmental assets of landscapes generated through agricultural land management have the characteristic of public goods. Policy measures are needed to ensure delivery. Policy measures contributing to the provision of valuable landscapes and its associated assets are notably agri-environment measures.

Investigating the agricultural land use in Europe shows that in many Nuts 2 regions the share of cropland is as high as 25-50 %. This implies that the way farmland is managed has an immense impact on the biological as well as visual values of the landscape.



Map 13. Cropland as share of land cover by NUTS 2 regions

The figure 43 below shows the land use intensity in relation to agricultural production volumes. We see that in many European countries the pressure on land as a resource have increased dramatically as the amount of agricultural land has diminished while production has intensified. This goes for the period 1990-2004 for countries such as Spain, Austria, Sweden and Denmark.

At the same time soil erosion is increasing in Europe. As precise estimates are not available owing to the lack of comparable data, it is difficult to assess the total area of the EU affected by erosion. The EEA estimated in 1995 that 115 million ha, or 12% of Europe's total land area, were affected by water erosion and that 42 million ha were affected by wind erosion. It is also estimated that at present water erosion in the Mediterranean region, which is particularly prone to this phenomenon, could result in the loss of 20-40 t/ha of soil after a single cloudburst, and in extreme cases the soil loss could be over 100 t/ha

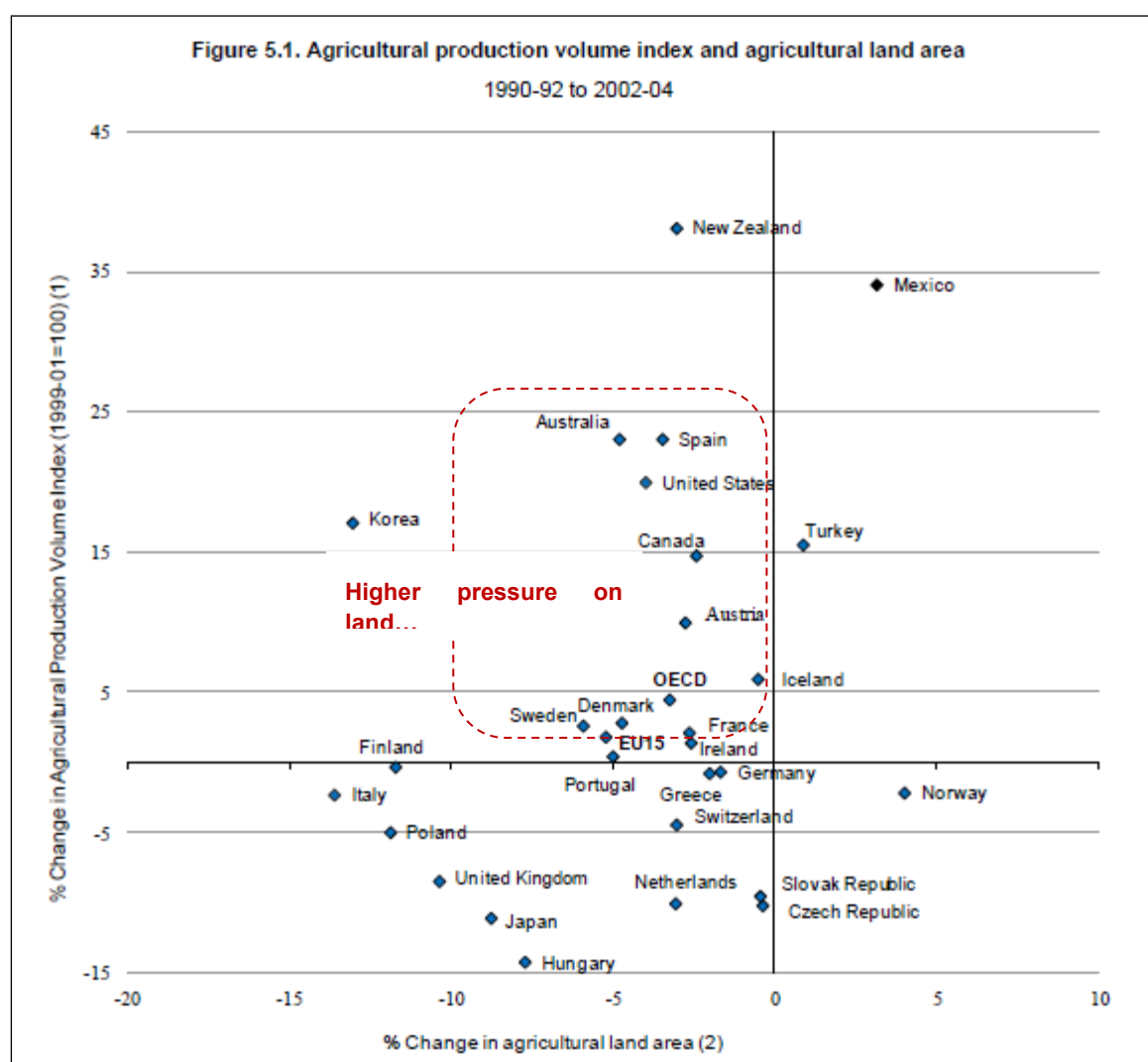


Figure 43. Source: OECD (2008), own text inside the figure to highlight specific aspects.

Organic Agriculture

The area under organic farming reached 3.7 % of the total utilised agricultural area (UAA) of EU-15 in 2002, up from only 1.8 % in 1998. In 2008 the share increased to 4.3%. Organic production accounted for 2 % of EU-15 total production of milk and beef in 2001, but less than 1 % of total production of cereals and potatoes. From the report "An analysis of the EU organic sector" it is evident that the organic sector is developing at a fast pace in the EU. At farm level the rates of growth are rather impressive. Areas have increased by 6.5% per year on average in the EU-27 in the period 2000-2008, animal numbers have increased by the range of 6.1- 22.2% annually in the EU-15 depending on species groups. And in 2008 the organic sector represents a total area of 7.7 million ha with almost 190 000 farms.

Italy has been for a long period the Member State with the largest organic area, exceeding one million ha since the beginning of the 2000s. However it is out performed by Spain in 2008 which reached an impressive 1.1 million ha. Some of the "pioneers" in the sector such as Denmark, Finland, Sweden and Italy seem to have reached a plateau or display only slow growth. Among Southern EU, Greece, Spain and Portugal which have grown fast in the last years.

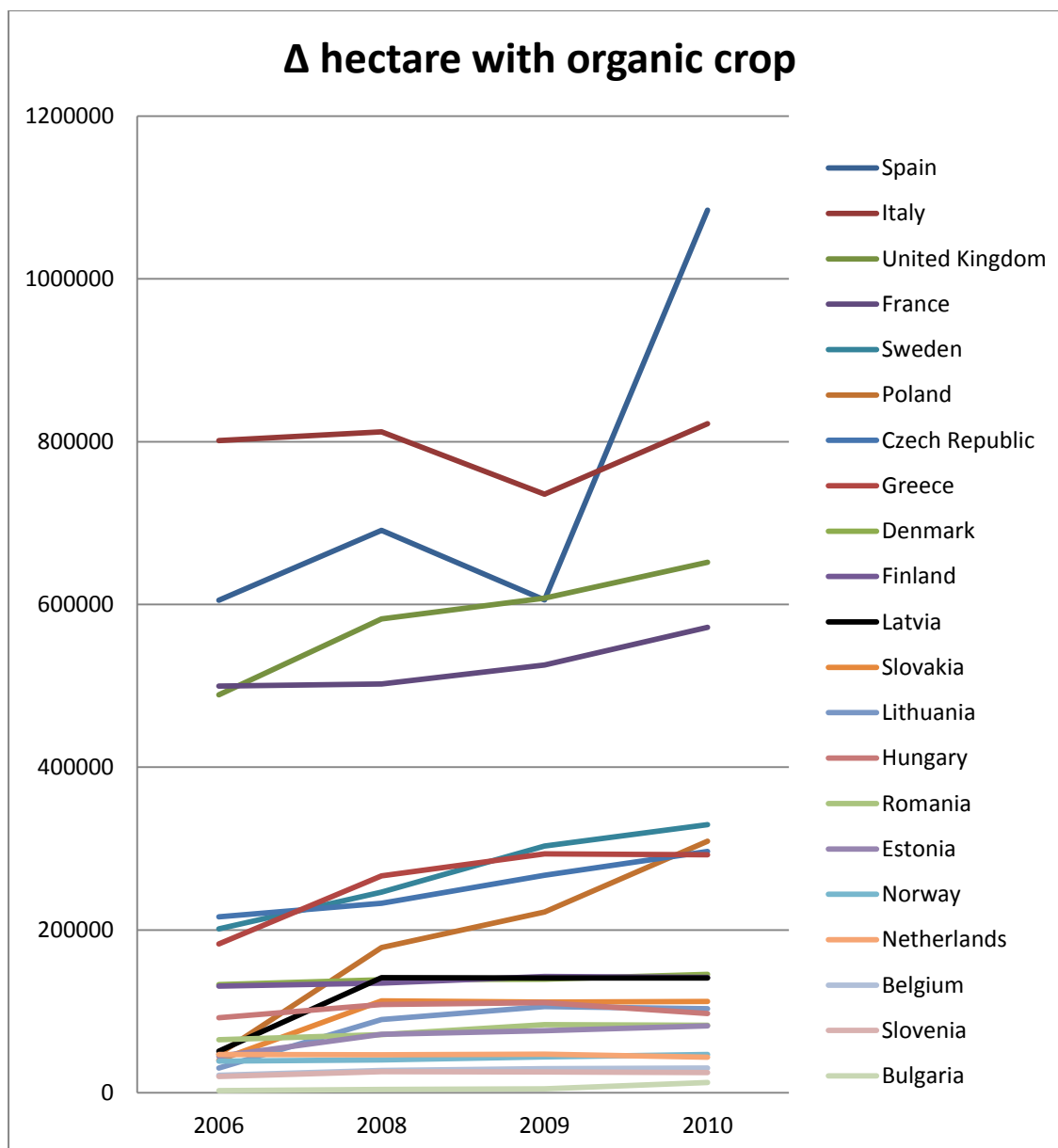


Figure 44. Change in the amount of hectare with organic crop, 2006-2010. Source: data from Eurostat database.

Looking at the share of organic production in each country gives another picture of which countries are developing this type of farming. In countries such as Switzerland, Austria, Finland, Italy, Denmark and Sweden the share of organic land area is between 6-10%. As a contrast in countries growing fast and showing a large amount of hectares, there is still only a low share of land devoted to organic farming; e.g. in Spain (2.4%) and France (1.8%). In large agricultural countries like Greece and Poland the share of certified organic production was only 0.4% in 2004, showing a great potential to increase in the coming years. As figure 45 shows this has taken place in Greece, where in many regions the share is now up to 5-10%. In Poland the picture is the same as in 2004 with many regions still below a share of 1%. Map 14 provides a regional analysis for 2007 showing the share of organic agriculture to all UAA. We see that in more regions the share is now above 10%.

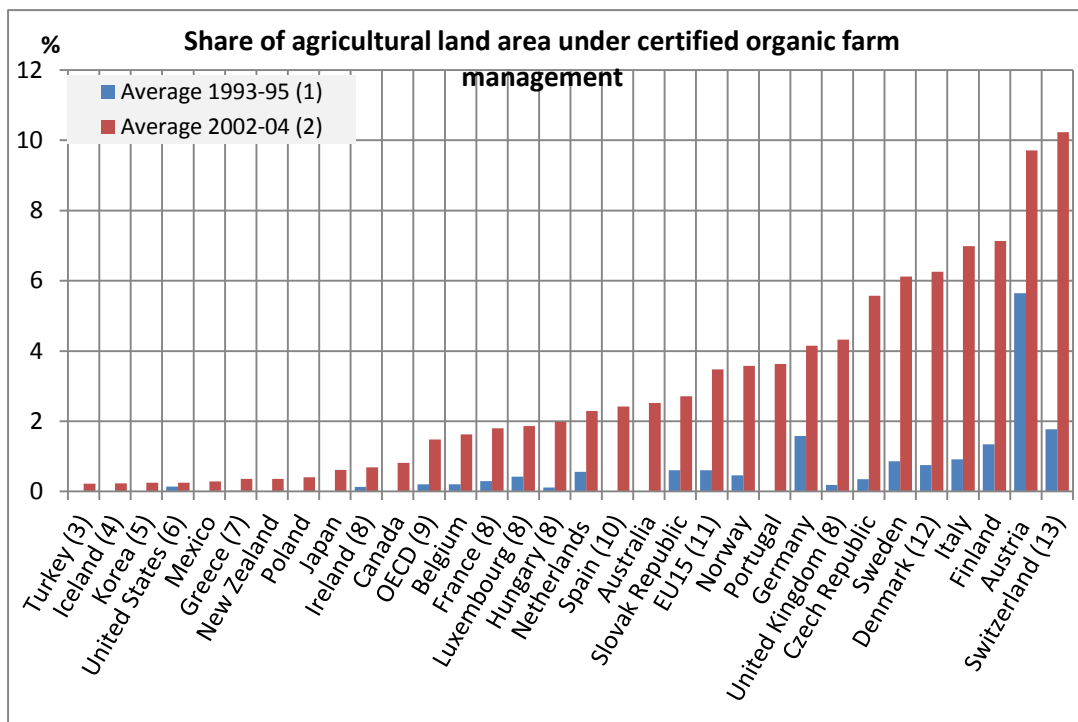
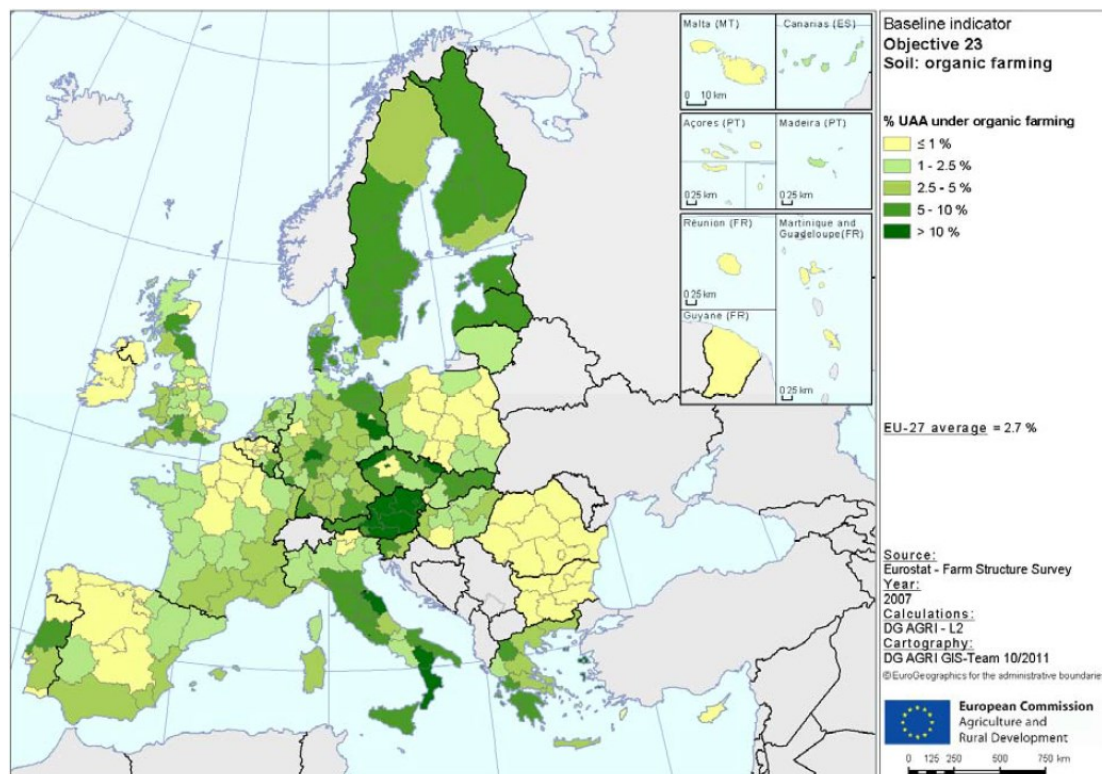


Figure 45. Share of agricultural land area under certified organic farm management. Source: Environmental Performance of Agriculture in OECD Countries Since 1990 - OECD © 2008



Map 14. Share of organic area in total UAA in 2007. Source: Eurostat farm structure

survey.

In the EU-12, the organic sector was, until recently, strongly oriented towards extensive grazing livestock production systems, with permanent pasture areas representing a prominent share of the total organic area. However, even if permanent pastures represent a large part of the organic area in the EU-12 (56.5% in 2006), other types of land use are gaining importance in recent years (e.g. arable crops, permanent crops, etc.). This signals a welcome diversification of the organic sector which could mitigate potential imbalances on the market side.

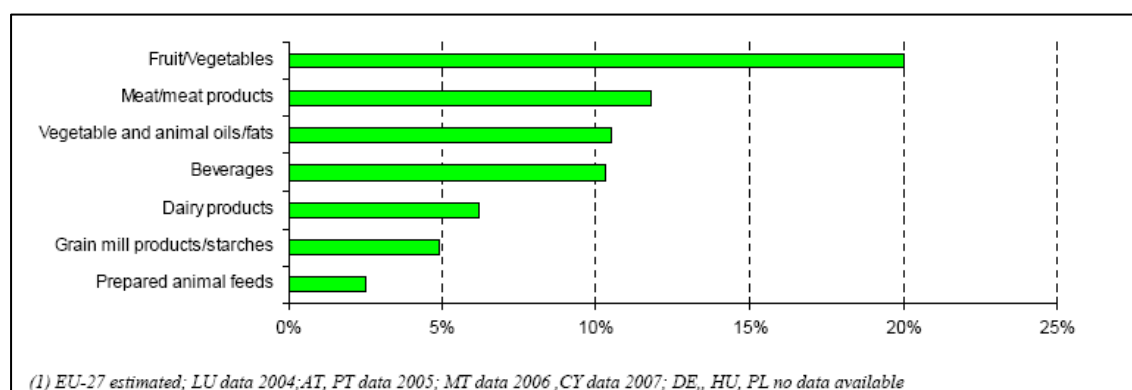


Figure 46. Organic processors by type of economic activity as a % of all organic processors, 2008, EU-27. Source: Eurostat database.

Data from the EU Farm Structure Survey (reported in “An analysis of the EU organic sector”) highlight interesting features of the sector. In general organic farms are larger in than conventional farms. In the livestock sector this is not surprising given lower stocking levels and higher use of extensive grazing. In such specialisation as permanent crops and vegetable production this is more surprising. In addition, contrary to what is often considered, organic holdings seem to be less labour intensive than conventional holdings in most specialisations, even in the permanent crop and vegetable sub-sectors which are both known to be overall labour-intensive.

Finally, it is worth stressing that the age distributions of organic and conventional farmers are very different: farmers older than 55 represent 56% of the conventional sector but only 36% in the organic sector.

Food habits and waste

The problems associated with food waste are certainly important but it is difficult to find anything but isolated studies on the magnitude of this waste in European countries. The issue of food waste have an impact on all other issues associated with a green bioeconomy since producing more food and fibre means more pressure on resources. Alternatively, producing the same amount of biomass, but without waste in the post-

harvest – to – consumption chain, would imply biomass left over to be used for energy production.

The EU food manufacturing sector and households alone waste about 90 million tonnes of food annually or 180 kg per person, not taking into account losses in agriculture and fisheries. Agriculture, forestry, fisheries and aquaculture require several essential and limited resources to produce biomass. These include land, sea space, fertile and functioning soils, water and healthy ecosystems, but also resources such as minerals and energy for the production of fertilisers. Their use also involves significant opportunity costs linked to the depletion or loss of ecosystem services. As competing uses of biomass and the legacy of past exploitation place these resources under severe pressure, the EU needs to produce "more with less" and develop smart sustainable farming, fisheries and aquaculture.

When it comes to food habits it is well known that production of meat products involves a high use of feed, which in turn utilises land, water and other resources in its production. Different types of meat have different protein conversion coefficients relating the amount of protein put into animals and the amount of protein finally available for human consumption of meat. Chapter 2.2.7 already outlined some facts about food consumption and waste in Europe.

3.2.2. Performance and potentials of green forestry

The EU Forestry Strategy and the 6th Community Environment Action Programme consider that the conservation and enhancement of biodiversity in forests are essential to their sustainable management. European public opinion has consistently demonstrated its interest in the long-term survival of Europe's most valuable and threatened species and habitats. This led to the creation of an EU-wide network of Special Areas of Conservation (SACs) – Natura 2000. While the implementation of the network in the forest sector has long been controversial, the overwhelming majority of the required site proposals have now been made and attention is turning towards the long-term operational management of the network. The very existence of Natura 2000 is no longer a subject of discussion because all parties have expressed agreement about the need for concerted action at the European level to protect nature and bio-diversity. It is expected that, ultimately, two thirds of the designated sites will be located in forests or will have forest elements.

The main principles for management of forest Natura 2000 sites are that: if forest management practices do not lead to a decline in the conservation status of habitats or species and are not contradictory to the Member State's own conservation guidelines, then this form of economic use can be continued; if forest management practices lead to a deterioration of the conservation status of the habitats or species, for which a given site was designated or is contradictory to the Member State's own conservation objectives, then forest management targets will have to be adapted. This is best achieved within the framework of management planning, the success of which will frequently depend upon

the full involvement and support of forest owners and users. Nevertheless, only a minor part of the total EU forest area will belong to Natura 2000 (see Figure). (UN, 2010)

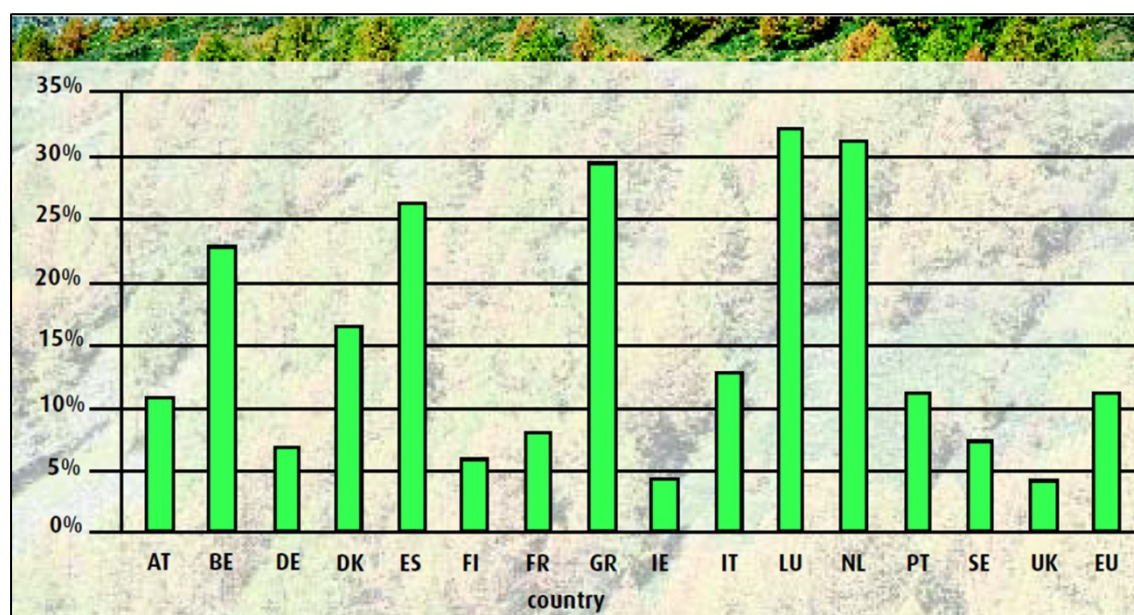


Figure 47. Importance of Natura 2000 areas in the forest sector in 2002. Source: UN (2010).

Certification schemes are one way of measuring current status of greening of the forest sector. One of the large schemers is the PEFC certification. The current state of this certification (2012) is depicted in table 7.

Table 7. Share of PEFC certified forests in European countries.

Country	Share of PEFC certified forest area	Country	Share of PEFC certified forest area
Belarus	99.5%	Switzerland	16.8%
Finland	93.6%	Spain	8.4%
Norway	92.5%	Italy	7.7%
Czech Republic	70.0%	Portugal	3.6%
Austria	67.3%	Belgium	0.0%
Germany	66.8%	Bulgaria	0.0%
Slovakia	63.2%	Greece	0.0%
Poland	62.5%	Ireland	0.0%
Latvia	55.2%	Croatia	0.0%
Denmark	49.3%	Liechtenstein	0.0%
UK	45.6%	Lithuania	0.0%
Sweden	40.0%	Netherlands	0.0%
Estonia	38.5%	Romania	0.0%
Luxemburg	34.5%	Ukraine	0.0%
France	22.9%	Hungary	0.0%

4. Drivers and Enablers

Drivers and enabling conditions can be many different things. In the GREECO project we have identified different types of conditions, structures, economic factors, political aspects and etc. which can be thought to impact on the evolution of green economy within all the sectors we do research on. The dimensions that we have emphasised, and that we think covers the spectrum of drivers and enablers are (without internal ranking of importance):

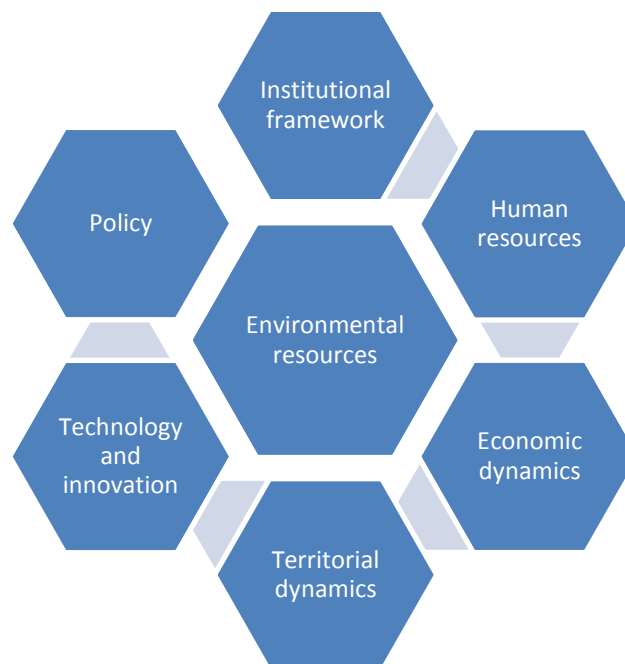


Figure 48. Drivers and enablers.

Obviously, all of these plays a part in the greening of the bioeconomy and in this chapter we go through them all to assess the way they impact the sector today and the way they are envisioned in official strategies to further boost green growth.

The common agricultural policy is the most influential policy when it comes to agriculture (and to some extent forestry as well), and this driver or disabler of green growth within the sector will naturally be a large part of this chapter. Besides that an emphasis within official strategies are on technology and innovation, human resources and environmental resources.

4.1 Policy

4.1.1 Agricultural Policies

From a general perspective, policies include a variety of different instruments that have an impact on the agricultural sector. There are legislative rules, market mechanisms, subsidies, taxes, and charges. Besides that the EU has an ongoing policy work which has to be taken into consideration in the form of communications and working papers of the commission that shows the intention of policies and the strategies for the future. Countries still have their own legislations on many fields, for instance on animal welfare. National energy policies and environmental law also have great impact on agriculture and provides different playing fields throughout Europe. Before we go into the CAP which is the main policy of the EU dealing with agricultural production and markets directly, let's have a look at the OECD framework for which types of policies that have an impact on green agriculture.

Environmental regulations and standards

The idea here is that command and control measures are necessary to make sure that there is no excessive use of e.g. agrochemicals or fertilizers in production. For a greening of the sector there is a continuous need to strengthen rules and standards for water, soil, land, air, animal welfare, etc.

Support measures

To contribute to green growth, support measures should be decoupled from production levels so that there are no incentives to produce more than the market demands, or to intensively using machinery, fertilizers and pesticides. Also, support measures should reward farmers for providing public goods. Also, support measures could target practices that lead to carbon sequestration or support the investment in new technologies that are greener.

Economic instruments

Prices should reflect the scarcity of resources or negative externalities of production, even if markets are not well defined or even exists. Taxes or charges should be used to correct for market failures in a cost efficient way and the OECD also suggests the further implementation of trading schemes for e.g. water rights or carbon emissions. These are cost efficient and dynamic (in the sense that they stimulate the development of new technologies) ways for correcting for market failures.

Trade measures

Well-functioning input and output markets, without export subsidies, tariffs or non-tariff barriers will support the development of green agriculture based on regional specificities and based on real market signals of demand. Export subsidies or tariffs distort incentives and stimulates intensive production and production which is otherwise not in line with the principles of comparative advantage (including in the term also environmental, social,

innovative and other aspects of the dimensions of territorial capital and smart specialisation).

Research and development

OECD states with respect to R&D that public research on sustainable agricultural systems should increase. Besides this, tax credits and grants could be used to stimulate private research and development – and public/private partnerships should be strengthened.

Information, education, training and advice

To promote green agriculture the public awareness of the impact of consumption choices should be strengthened, this can be done via the development of certification schemes and eco-labelling. Sustainability should be incorporated in the entire chain of education and training for those working in the sectors, and advice programs should be designed to promote green agriculture.

According to the OECD there are many different areas where policies impact on a greening of agriculture. These include regulations targeting:

Water quality: ground water controls, pollutant discharge permits, irrigation rules, etc.

Air quality: Emissions standards for air pollutants and particulate matter, etc.

Land use: Limits on waste disposal, soil removal, etc.

Pesticides: Use restrictions, labelling to consumers, etc.

Habitats: Land development restrictions, species protection, etc.

Machinery and equipment: Emission controls, noise limitations, fuel restrictions, etc.

The amount of communications, directives and regulations in the field of green agriculture is large and the table below attempts to capture the most important ones. Some of these stand out as more important for greening of the agricultural sector (for instance, some receive more attention from the commission in the discussion about sustainable agriculture) and those policies are described in more detail both in the table and in following chapters.

Table 8: European policies in the domain of greening of agriculture.

Type of policy	Policy (and short descriptions)
EU Roadmaps	<p>Indicative roadmap on: Regulation of the European Parliament and of the Council on organic production and labelling of organic products – Review of EU political and legal framework for organic production in particular Council Regulation (EC) N° 834/2007 and European Action Plan for organic farming of 2004</p> <p>Indicative roadmap on: New EU Forest Strategy</p> <p>Indicative roadmap on: European Innovation Partnership 'Agricultural Productivity and Sustainability'</p> <p>Indicative roadmap on: The future of the CAP</p>
Thematic strategies	<p>Commission Communication of 22 September 2006 entitled "Thematic strategy for soil protection" [COM(2006) 231 final</p> <p>and Proposal for a European Parliament and Council Directive of 22 September 2006 setting out a framework for soil protection and amending Council Directive 2004/35/EC.</p> <p>The EU thematic strategy for soil protection puts forward measures to protect soil and to preserve its capacity to perform its functions _ in environmental, economic, social and cultural terms.</p> <p>The strategy includes setting up a legislative framework for the protection and sustainable use of soil, integrating soil protection into national and EU policies, improving knowledge in this area and increasing public awareness.</p> <p>The proposal for a Directive is a key component of the strategy, which enables Member States to adopt measures tailored to their local needs. It provides for measures to identify problems, prevent soil degradation and remediate polluted or degraded soil.</p> <p>Risk prevention, mitigation and restoration</p> <p>The measures included in the proposal for a Directive include obligatory identification by Member States of areas at risk of erosion, organic matter decline, compaction, salinization and landslides, or where the degradation process is already underway. This will be done on the basis of criteria set out in the proposal.</p> <p>Member States must then set objectives and adopt</p>

	<p>programmes of measures to reduce these risks and to address the effects they have. They must also take steps to limit soil sealing, notably by rehabilitating brownfield sites and, where sealing is necessary, to mitigate its effects.</p> <p>Soil contamination</p> <p>The proposal for a Directive also provides for Member States taking appropriate measures to prevent soil contamination by dangerous substances.</p> <p>They must draw up a list of sites polluted by dangerous substances when concentration levels pose a significant risk to human health and the environment, and of sites where certain activities have been carried out (landfills, airports, ports, military sites, activities covered by the IPPC Directive, etc.). The proposal contains a list of these potentially polluting activities.</p> <p>When these sites are sold and the transaction is made, the owner or potential buyer must submit a report to the competent national authorities and the other party on the state of the soil. This report is produced by an authorised body or a person authorised by the Member State.</p> <p>Member States must then remediate * the polluted sites in line with a national strategy setting out the priorities. Where it is not possible for the person responsible to sustain the cost of remedying the site, the Member State concerned must make provisions for the appropriate financing.</p> <p>Awareness raising and exchange of information</p> <p>The proposal for a Directive also provides for Member States to raise public awareness on the importance of soil protection and for them to ensure that the public can participate in preparing, amending and reassessing programmes of measures on risk areas and National Remediation Strategies.</p> <p>Member States must send the Commission a set of specific data including the list of risk areas, programmes of measures and their National Remediation Strategies.</p> <p>The Commission also plans to set up a platform for the exchange of information between Member States and stakeholders on risk area identification and on risk assessment methodologies.</p> <p>Integration</p> <p>Member States and EU institutions must integrate soil concerns into sectoral policies that have a significant impact on soil, especially agriculture, regional development,</p>
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	<p>transport and research.</p> <p>In particular the Commission plans to review current legislation, such as the <u>Directive on Sewage Sludge</u> and the <u>Directive on Integrated Pollution Prevention and Control (IPPC)</u>. It will assess whether there are any synergies between the current strategy and the <u>Water Framework Directive</u> and with the <u>Thematic Strategy for the Marine Environment</u>.</p> <p>Research</p> <p>The Commission underlines the importance of pursuing research to close the gaps in knowledge about soil and to strengthen the basis of policies, in particular for soil biodiversity.</p> <p>The <u>seventh Framework Programme for research and technological development</u> (2007-2013) contains a chapter on support for research into soil functions and soil protection.</p> <p>The need for soil protection</p> <p>Soil is generally defined as the top layer of the earth's crust. It is a very dynamic system which performs many functions * and is vital to human activities and to the survival of ecosystems. As soil formation and regeneration is an extremely slow process, soil is considered a non-renewable resource.</p> <p>The main degradation processes to which EU soil is subject are erosion, decline in organic matter, contamination, salinization, compaction, decline in biodiversity, sealing, floods and landslides.</p> <p>Soil degradation is a serious problem in Europe. It is driven or exacerbated by human activity such as inadequate agricultural and forestry practices, industrial activities, tourism, urban and industrial sprawl and construction works.</p> <p>The impact of this includes loss of soil fertility, carbon and biodiversity, lower water-retention capacity, disruption of gas and nutrient cycles and reduced degradation of contaminants. Soil degradation has a direct impact on water and air quality, biodiversity and climate change. It can also impair the health of European citizens and threaten food and feed safety.</p> <p>The impact analysis carried out in line with Commission guidelines using available data shows that soil degradation could cost up to EUR 38 billion per year.</p>
Other important communications	Communication from the Commission of 21 December 2006 entitled "Employment in rural areas: closing the

jobs gap" [\[COM\(2006\) 857 final](#)

Communication from the Commission to the Council and the European Parliament of 10 June 2004 - "European Action Plan for Organic Food and Farming" [\[COM\(2004\) 415](#)

Organic farming is a valuable tool for promoting the environmentally friendly production of high-quality products. Stressing the advantages for the environment, rural development and animal welfare, the Commission sets out its general guidelines on organic farming.

The Commission recognises the dual role played by organic farming in society. It represents a means of production for foodstuffs and has created a niche market for these kinds of food products. It is beneficial for the whole community and especially for the environment.

Developing the market by informing consumers

The Commission believes that the development of organic farming must be based firstly on the interplay of supply and demand. The emphasis must therefore be placed on the expectations of consumers, who need to be better informed about the principles, objectives and benefits of organic farming.

The Commission proposes launching an information and promotion campaign throughout the European Union to promote the Community logo, and other campaigns targeted on certain types of consumer. It also plans to set up an on-line database to allow comparison of Community standards with national and international standards.

In order to increase production capacity, fresh information is required and the collection of statistical data on the production of and the market for organic products must therefore be improved.

Making public support more effective

The Commission urges Member States to make full use of all the Community instruments and measures, such as national and regional action plans, available within their rural development programmes.

Given the need for new technologies with a view to developing the market for organic products, the Commission and the Member States must expand research in this field.

Improving and reinforcing Community standards

	<p>The Commission aims to preserve the integrity of organic farming by making Community rules more transparent and increasing harmonisation so as to reduce obstacles to trade caused by the existence of too many different standards.</p> <p>For the same reason, the Commission proposes developing a multilateral concept of equivalency based on the <u>Codex Alimentarius</u> guidelines and increasing efforts to get non-member countries to subscribe. The Commission underlines that equivalence must take account of differences in climate and farming conditions in each country.</p> <p>Under EU development policy, the Commission proposes supporting capacity-building in developing countries and facilitating trade in organic products from those countries. The Commission plans to establish new import arrangements under Regulation (EEC) No <u>2092/91</u>, involving technical equivalency evaluations by specially designated bodies.</p> <p>It also intends to improve the performance of those bodies and coordination between them and the inspection and enforcement authorities. It plans to develop a specific accreditation system for inspection bodies and publish an annual report from the Member States on their supervision. In addition, it proposes prohibiting the <u>labelling</u> of products containing GMOs as organic.</p> <p>Finally, the Commission proposes asking the Council for a negotiating mandate to reinforce recognition by third countries of EU organic farming standards and inspection systems.</p> <p>Background</p> <p>The action plan demonstrates the EU's willingness to support sustainable development and forms part of the CAP reform launched in 2003.</p> <p>The 2001 Göteborg European Council under the Swedish Presidency wanted a strategic vision of policy in the field of organic food and agriculture and called on the Commission to propose an action plan to meet this objective.</p> <p>The mi-term reform of the <u>common agricultural policy</u> in 2003 subsequently provided a framework for developing organic agriculture and a range of instruments for implementing this strategy, promoting production methods that emphasise product quality and respect for the environment. By favouring soil protection, animal well-being, biodiversity, plant nutrients and water protection (the latter via reduced use of pesticides), organic agriculture plays an important role in achieving the CAP objectives of improving the sustainability of agriculture and the</p>
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	<p>environment</p> <p>Commission Communication of 27 March 2001 to the Council and the European Parliament: Biodiversity Action Plan for Agriculture (Volume III) [COM(2001) 162 final - not published in the Official Journal].</p> <p>Commission Communication of 8 February 2006 entitled "An EU Strategy for Biofuels" [COM(2006) 34 final - Official Journal C 67 of 18 March 2006].</p>
<p>EU Directives</p>	<p>Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.</p> <p>Proposal for a European Parliament and Council Directive of 22 September 2006 setting out a framework for soil protection and amending Council Directive 2004/35/EC.</p> <p>Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.</p> <p>Water pollution by nitrates has been made worse by the introduction of intensive farming methods, with increased use of chemical fertilisers and higher concentrations of animals in smaller areas.</p> <p>Nitrate pollution is causing problems in all Member States. The sources of nitrate pollution are diffuse (multiple discharges which are difficult to locate).</p> <p>The Nitrates Directive is an integral part of the Water Framework Directive and is one of the key instruments for protecting water against agricultural pressures.</p> <p>The implementation of the Directive will be carried out in a number of stages. Member States shall:</p> <ul style="list-style-type: none"> • identify surface water and groundwater affected by pollution or at risk of being so, based on procedures and criteria detailed in the Directive (specifically when the concentration of nitrates in groundwater or surface water reaches 50 mg/l or when the surface water is eutrophic or is at risk of being so); • designate vulnerable zones, which are all known areas of land in their territories which drain into surface waters and groundwater which are affected by pollution or at risk of being so. The Nitrates Directive provides a possibility for Member States to be exempted from the requirement to designate

	<p>vulnerable zones if the action programmes are applied to the whole of their national territory;</p> <ul style="list-style-type: none"> • establish a code of good agricultural practice to be implemented by farmers on a voluntary basis, which shall include the measures detailed in Annex II to the Directive; • set up compulsory action programmes to be implemented by all farmers who work in vulnerable zones. These programmes must contain the measures listed in the good agricultural practice codes, as well as the additional measures listed in Annex III to the Directive, which aim to limit the land application of mineral and organic fertilisers containing nitrogen, as well as land application of livestock manure. <p>The Directive authorises Member States to take additional measures or to reinforce their action programmes in order to achieve the objectives of the Directive.</p> <p>Member States must monitor water quality, applying standardised reference methods to measure the nitrogen-compound content.</p> <p>The Commission has provided Member States with recommendations on monitoring methods and on the information which must be included in their reports on the application of this Directive. These reports shall be submitted by Member States to the Commission every four years.</p> <p>Directive 2000/25/EC of the European Parliament and of the Council of 22 May 2000 on action to be taken against the emission of gaseous and particulate pollutants by engines intended to power agricultural or forestry tractors and amending Council Directive 74/150/EEC.</p> <p>Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration</p>
<i>EU regulations</i>	<p>Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).</p> <p>This Regulation lays down the general rules governing Community support for rural development, financed by the EAFRD. It also defines the aims of rural development and the framework governing it.</p> <p>The Fund contributes to improving:</p>

	<ul style="list-style-type: none"> • the competitiveness of agriculture and forestry; • the environment and the countryside; • the quality of life and the management of economic activity in rural areas. <p>The Fund complements national, regional and local actions, which contribute to Community priorities. The Commission and the Member States are also to ensure that the Fund is consistent and compatible with other Community support measures.</p> <p>Implementing the national strategic plans of the European Agricultural Fund for Rural Development (EAFRD) is carried out through rural development programmes containing a package of measures grouped around 4 axes.</p> <p>Axis 1: Improving the competitiveness of the agricultural and forestry sector</p> <p>Aid for promoting the competitiveness of the agricultural and forestry sector includes:</p> <p>Measures aimed at promoting knowledge and improving human potential through:</p> <ul style="list-style-type: none"> • vocational training and information actions, • schemes promoting the establishment of young farmers (people under 40 years of age setting up for the first time as the head of a holding) and the structural adaptation of their holdings, • early retirement for farmers deciding to cease activities with the aim of transferring their holding to other farmers, and agricultural workers who decide to definitively cease all agricultural activities. In general, beneficiaries must be at least 55 years old, but below the regular age of retirement in the Member State concerned, • the use of advisory services by farmers and forest holders and the establishment of advisory services, farm relief and farm management support services. The use of these services should help assess and improve the performance of their holdings; <p>Measures aimed at restructuring and developing physical potential:</p> <ul style="list-style-type: none"> • the modernisation of agricultural and forestry holdings and the improvement of their commercial performance by, for example, bringing in new technology, • adding value to primary agricultural and forestry production. This means supporting investments aimed at enhancing the efficiency of the processing and marketing stages of primary production whilst simplifying the eligibility criteria for investment support compared to the criteria applicable at present,
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	<ul style="list-style-type: none"> • improving and developing infrastructure related to the development and adaptation of agriculture and forestry, • restoring agricultural production potential damaged by natural disasters and introducing appropriate prevention schemes; <p>Measures aimed at improving the quality of production and products:</p> <ul style="list-style-type: none"> • assist farmers in adapting to the demanding rules laid down in EU legislation, partly offsetting the additional costs or loss of revenue resulting from these new responsibilities, • encourage farmers to participate in schemes that promote quality food and that give consumers assurances of the quality of a product or production method, providing added value to primary products and boosting trade opportunities, • support producer groups in their information and promotion activities for products covered by food quality schemes; <p>Provisional measures are also planned for the new Member States, regarding:</p> <ul style="list-style-type: none"> • aid for semi-subsistence holdings * undergoing restructuring, • aid for the establishment of producer groups, • aid for agricultural holdings undergoing restructuring, including diversification into non-agricultural activities. <p>Axis 2: improving the environment and the countryside</p> <p>Regarding land management, the support is to contribute to sustainable development by encouraging farmers and forest holders to employ methods of land use compatible with the need to preserve the natural environment and landscape and protect and improve natural resources. The main aspects to take into account include biodiversity, the management of NATURA 2000 sites, water and soil protection and climate change mitigation. Against this backdrop, the Regulation provides, in particular, for support for mountain regions with natural handicaps and other disadvantaged areas (defined by the Member States on the basis of common objective criteria) and for agri-environmental or forest-environmental payments, which only cover commitments that go beyond the corresponding obligatory standards. Assistance also covers support for non-productive investments linked to the achievement of agri or forest-environmental commitments or the achievement of other agri-environmental objectives, as well as measures aimed at improving forestry resources with an environmental objective (support for the first afforestation of agricultural land, establishment of agroforestry systems or restoring forestry potential and preventing natural</p>
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	<p>disasters).</p> <p>Axis 3: quality of life in rural areas and diversification of the rural economy</p> <p>Regarding the diversification of the rural economy, the Regulation contains measures on:</p> <ul style="list-style-type: none"> • diversification towards non-agricultural activities, support for the establishment and development of micro-businesses, promotion of tourism and the protection, development and management of the natural heritage that contributes to sustainable economic development; • improving the quality of life in rural areas, with particular focus on renovating and developing villages and preserving and making the best use of the rural heritage; and • acquiring skills and running activities in order to prepare and implement the local development strategy. <p>Axis 4: LEADER</p> <p>The aid allocated under the LEADER axis relates to:</p> <ul style="list-style-type: none"> • the implementation of local development strategies through public-private partnerships called “local action groups”. The strategies applied to clearly designated rural territories must achieve the objectives of at least one of the three preceding axes; • the local action groups also have the option to implement inter-territorial or transnational cooperation projects. <p>Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers, amending Regulations (EC) No 1290/2005, (EC) No 247/2006, (EC) No 378/2007 and repealing Regulation (EC) No 1782/2003.</p> <p>Council Regulation (EC) No 1083/2006 of 11 July 2006 laying down general provisions on the European Regional Development Fund, the European Social Fund and the Cohesion Fund and repealing Regulation (EC) No 1260/1999.</p> <p>Council Regulation (EC) No 510/2006 of 20 March 2006 on the protection of geographical indications and designations of origin for agricultural products and</p>
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	<p>foodstuffs.</p> <p>This Regulation sets out provisions on agricultural products and foodstuffs (excluding all wine-sector products, except wine vinegar) from a defined geographical area. If there is a link between the characteristics of certain products and their geographical origin, they may qualify for either a protected geographical indication (PGI)* or a protected designation of origin (PDO)*. The use of corresponding EU symbols on the labels of such products provides consumers with clear and concise information on their origin. The introduction of these two terms also benefits the rural economy, since it boosts farmers' income and maintains the population in less favoured or remote areas.</p> <p>Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91</p> <p>Production rules</p> <p>According to the general rules for organic production, genetically modified organisms (GMOs) are prohibited in all their forms. Rules concerning the labelling of food allow operators to ensure compliance with this prohibition. Treatment by ionising radiation is also prohibited.</p> <p>Those wishing to operate both types of agricultural production (organic and non-organic) must ensure that animals and land for these two activities are separated.</p> <p>Organic plant production must comply with certain rules concerning:</p> <ul style="list-style-type: none"> • ground treatment, which must preserve life and the natural fertility of the ground; • the prevention of damage, which must be based on natural methods but which can make use of a limited number of plant protection products authorised by the Commission; • seed and plant propagation material, which must be produced using organic methods; • cleaning products, for which authorisation must be requested from the Commission. <p>Wild plants collected in some areas are also classified as organic products if they comply with certain conditions relating to their harvest and provenance. Seaweed may also be considered as an organic product as long as its area of production and harvest comply with certain conditions.</p> <p>Organic livestock production must comply with certain rules concerning:</p>
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	<ul style="list-style-type: none"> • the animals' origin - they must have been born and reared in organic holdings; • livestock husbandry practices, which, inter alia, relate to certain features of animal housing; • animal breeding methods, generally natural; • animal feed, which must be organic; • the prevention of disease; • cleaning and disinfection, involving the exclusive use of products authorised by the Commission. <p>Similar specific rules apply to aquaculture animals.</p> <p>The Commission authorises the use of a limited number of products and substances in organic farming. These products may be for plant care, animal feed and the cleaning of buildings used for livestock and plant production. The Commission may also set certain limits and conditions for the application of these products.</p> <p>Holdings which are entering into a new organic farming activity must comply with a conversion period. The rules laid down in this Regulation also govern this conversion period.</p> <p>Organic processed feed must contain organic raw materials and may not be processed using chemical solvents. Processed food must contain mainly ingredients of agricultural origin. Other ingredients are permitted if authorisation has been requested from the Commission. Organic yeast must be produced from organic substrates and other authorised ingredients.</p> <p>The Commission may make exceptions to provisions concerning objectives, production rules and labelling. These exceptions will be limited in time and apply to certain particular cases.</p> <p>Labelling, advertising or commercial documents may use terms such as "eco" and "bio" to describe an organic product, its ingredients, or raw materials.</p> <p>The labelling of an organic product must be clearly visible on the packaging and contain a reference to the control body that certifies the product concerned.</p> <p>From 1 July 2010, the use of the <u>European Union logo</u> on organic food products will be mandatory, as will an indication of the provenance of raw materials used in the product. This indication must be shown in the same field of vision as the Community logo.</p> <p>Regulation (EC) No <u>2003/2003</u> of the European Parliament and of the Council of 13 October 2003</p>
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	relating to fertilizers.
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Also, the commission is running an awareness program to promote the increased consumption of organic products among EU consumers. This falls into another category of instruments.

Type of instrument	Short description
Awareness programmes	Organic farming: Website on organic production/consumption. The website is an initiative of the Directorate General for Agriculture and Rural Development of the European Commission as part of a campaign to increase awareness of organic farming throughout the European Union. It is the focal point of the campaign. Its general content is tailored towards consumers. The website also contains the latest news and listings for events concerning organic farming and links to other sources of information and members of the sector

In what follows we focus more specifically on some policies taken up in the previous table. Most important in shaping the agricultural sector is the CAP so we devote some time to explaining this policy and its evolution into more agri-environmental measures.

The Common Agricultural Policy (CAP)

For the past 60 years, agriculture in Europe has been heavily influenced by the CAP. Although many other forces and influences have shaped agriculture (mechanisation, crop and animal modification, globalisation, etc.), it is widely accepted that specialisation, productivity increases, territorial distribution and many other aspects of European farming are heavily affected by this policy and its successive reforms. The CAP originated out of the need to feed Europe and support European farming and rural areas after half a century of wars. The initial objectives of the policy were to improve agricultural productivity, ensure the availability of safe food at a reasonable price and improve and sustain a fair standard of living in rural areas. The main features of the CAP during the twentieth century were a combination of intervention prices, import restrictions, export subsidies and EC preferences. Together with targeted research and development activities, mechanisation and extension services, this increased productivity and led to production well beyond any internal demand. At the same time, European prices were above world market prices for many commodities and products had to be either destroyed, kept in storage or 'dumped' on markets outside Europe, with the aid of export subsidies. This has been referred to as the productivist era in European agriculture (Wilson, 2001). It involved a rationalisation of farming and high use of pesticides and nutrients and resulted in a farm sector that was shaped by policies rather than consumer demand. In this process the farm sector became less integrated in rural areas with regard to input resources, which were purchased to a larger extent from outside the rural areas, with regard to labour use, which diminished as farming became more mechanised, and with regard to the link between producer and consumer, with farmers producing for large

wholesale customers and consumers interacting with supermarkets. Furthermore, this period saw high costs for agricultural intervention and criticism from world trade organisations and third world nations as markets were distorted by subsidised European agricultural exports². At the same time, the standard of living increased in Europe and the emergence of environmental concerns together with the recognition of high costs of the CAP initiated a fundamental change in policy through the MacSharry reform in 1992 and Agenda 2000.

Agenda 2000 explicitly established economic, social, and environmental goals within a new reformulated set of objectives for the CAP consistent with the requirements of the Amsterdam Treaty. This had the aim of giving concrete form to a European Model of Agriculture and preserving the diversity of farming systems spread throughout Europe, including regions with specific problems, in the years ahead. These objectives involved more market orientation and increased competitiveness, food safety and quality, stabilisation of agricultural incomes, integration of environmental concerns into agricultural policy, developing the vitality of rural areas, simplification and strengthened decentralisation.

The regular and consistent adjustment of the CAP to pressures from European society and its evolving economy was again illustrated by the new set of reforms initiated in 2003 and continued in 2008 with the Health Check, which aimed at enhancing the competitiveness of the farm sector, promoting a market-oriented, sustainable agriculture and strengthening rural development policy (both funds and policy instruments). Income support has now become almost fully decoupled from production activity, thus allowing EU farmers to make their economic decisions on the basis of market signals. On the other side, income support is linked to the respect of standards on environment, food safety and quality and animal welfare that society requests and that EU Member States have implemented through cross-compliance.

The introduction of a second 'pillar' to the CAP clearly signalled the new rural and environmental ambitions. Hence, during recent decades, 'non-commodity' outputs generated by agricultural production have been increasingly recognised, both locally and in the political arena; not only within the EU. Open and diversified landscapes, cultural heritages of different kinds, environmental services and animal welfare are examples of such non-commodity outputs or public goods. The rural development policy for the 2007-2013 period focuses on three core objectives, namely the improvement of the competitiveness of the farming and forestry sectors, the improvement of the environment and the countryside through support for land management, and the improvement of the quality of life in rural areas and the promotion of diversification of economic activities. *A full list of currently available measures to implement in EU countries can be found in*

² High cost accrued to intervention prices, which paid farmers to produce commodities that were not in demand within the European Union. At the same time, high tariffs and quotas limited imports and kept internal prices high. To reduce the need to store or destroy these goods, the EU exported to countries outside the union, but could only do so due to high costs of production, by using export subsidies. Besides the internal pressure to cut costs and reform the CAP, these export subsidies also flooded export markets and pushed down world market prices for other (often developing) countries. The pressure to reform the CAP was therefore also mounting within the World Trade Organisation (WTO).

Annex 3.

Today, the CAP absorbs around 41% of the EU budget (as compared to over 60% in 1989). However, another number which is often used to illustrate that this large budget share can be nuanced is that today 0.45% of the EU GDP is spent on supporting EU farmers and rural areas. The evolution of the CAP can be seen in the two figures below, showing the evolution of the CAP both conceptually and in terms of budgetary breakdown.

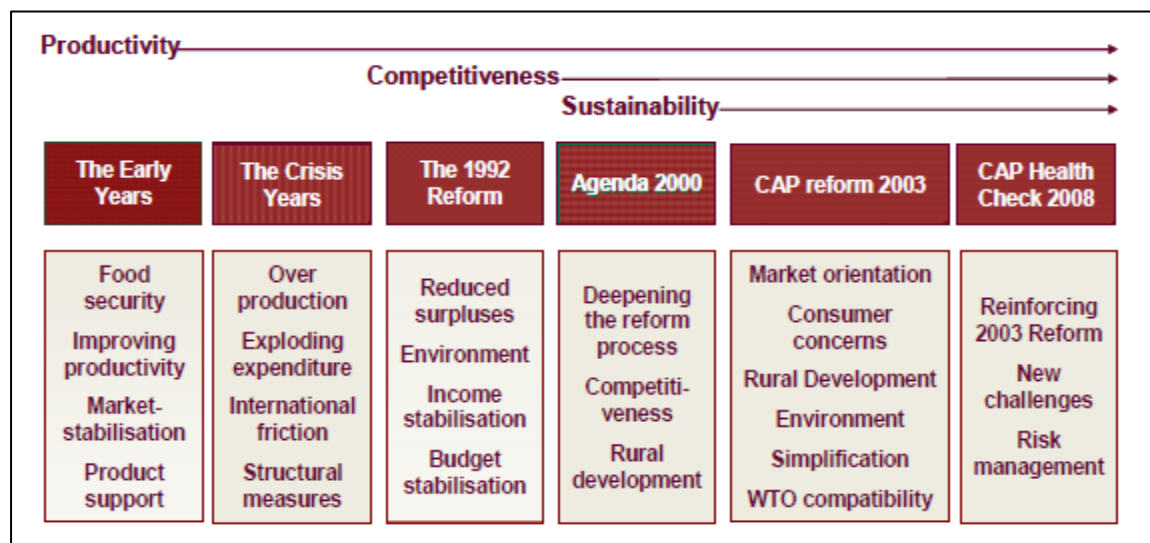


Figure 49. Evolution of the CAP. Source: European Commission, EC (2010).

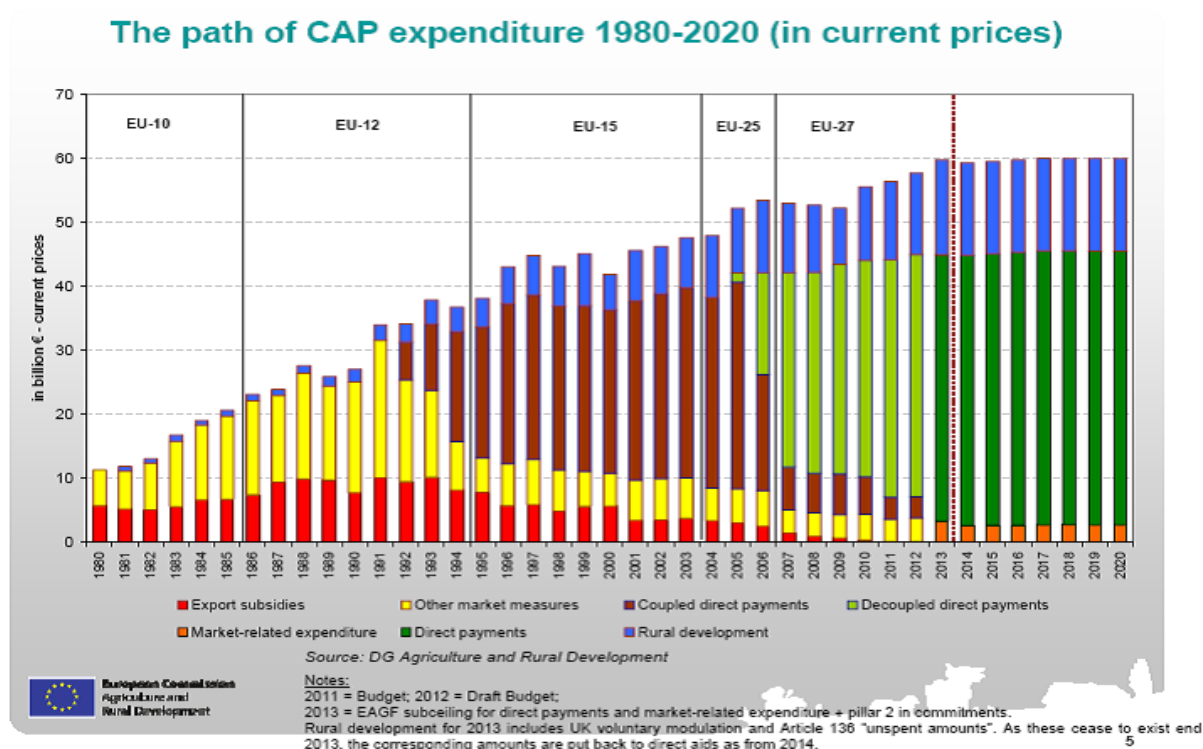


Figure 50. The evolution of CAP budget 1980-2012 (and projections to 2020). Source: European Commission, EC (2010).

The breakdown on the most important measures within the Rural Development Program is shown in figure 51 and indicates the importance of the agri-environmental payments, investments for modernisation and "Less Favoured Area" payments.

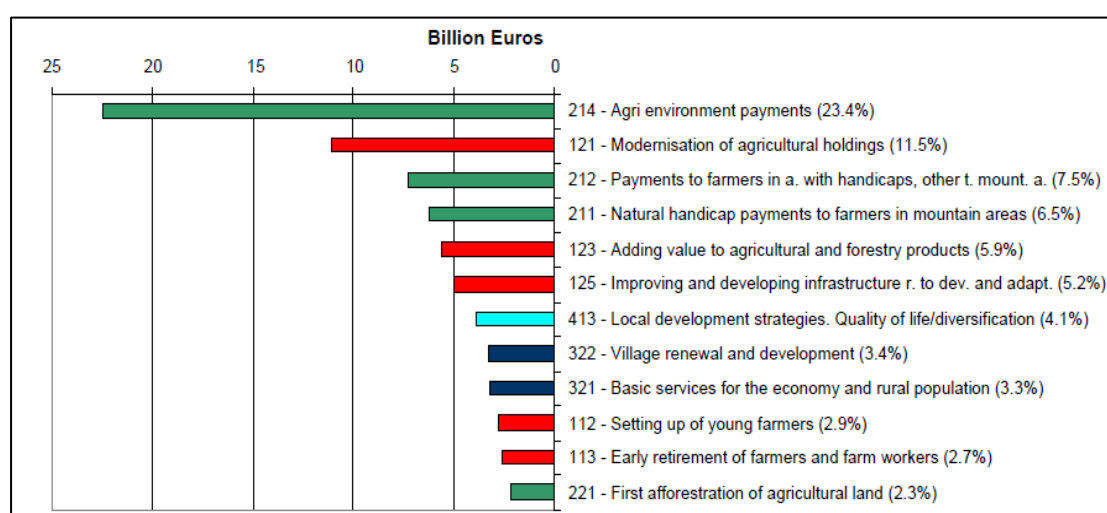


Figure 51. Main RD measures of the 2007-13 program period (all EU27). Source: European Commission.

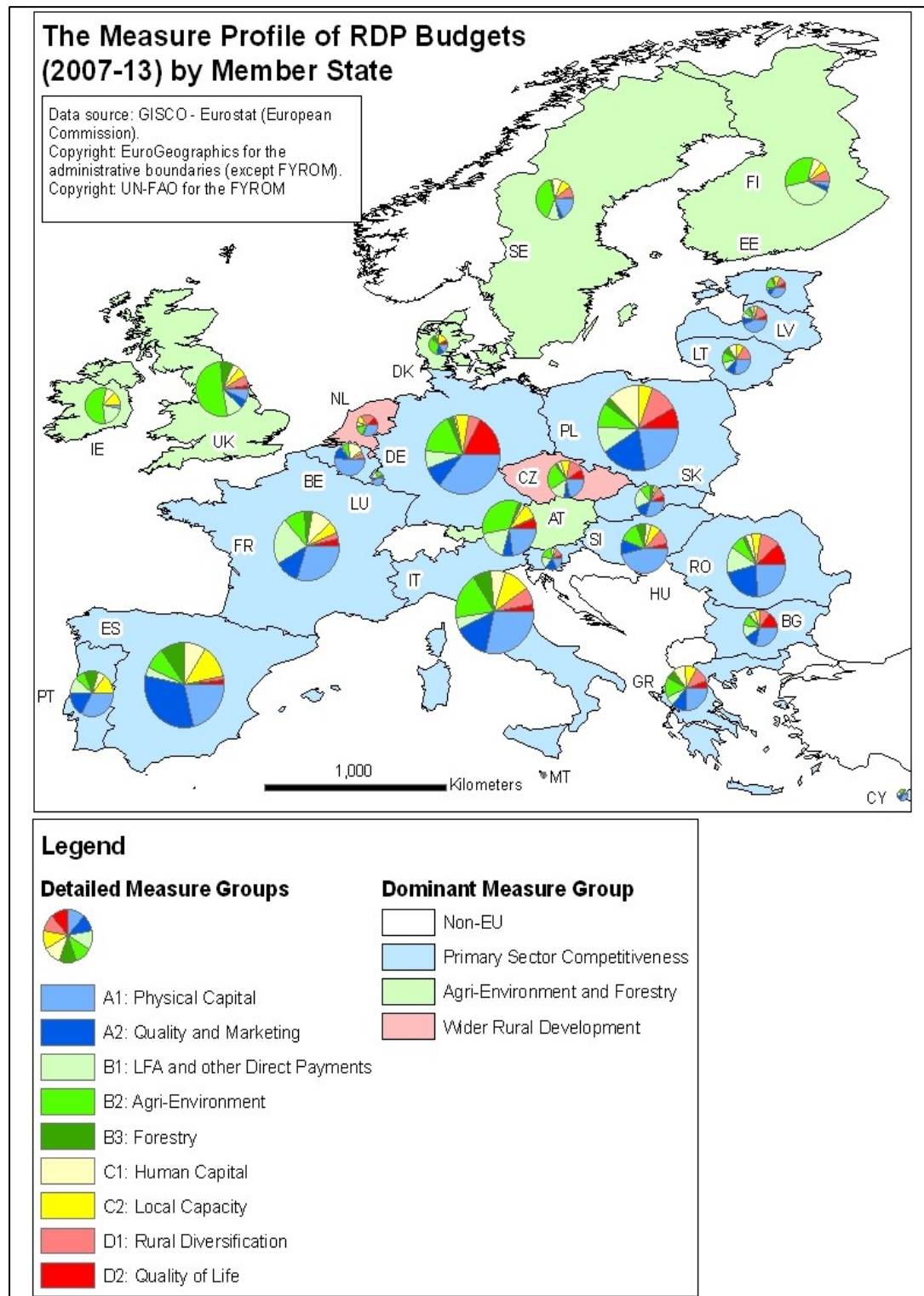
Agri-environment measures are a key element for the integration of environmental concerns into the Common Agricultural Policy. They are designed to encourage farmers to protect and enhance the environment on their farmland by paying them for the provision of environmental services. Farmers commit themselves, for a minimum period of at least five years, to adopt environmentally-friendly farming techniques that go beyond legal obligations. In return, farmers receive payments that provide compensation for additional costs and income foregone resulting from applying those environmentally friendly farming practices in line with the stipulations of agri-environment contracts. Agri-environment measures play a crucial role for meeting society's demand for environmental outcomes provided by agriculture. Agri-environment payments encourage farmers to adopt agricultural activities or levels of production intensity that deliver positive environmental outcomes, while not being necessarily the first choice from the point of view of profitability. Examples of commitments covered by national/regional agri-environmental schemes are:

- environmentally favourable extensification of farming;
- management of low-intensity pasture systems;
- integrated farm management and organic agriculture;
- preservation of landscape and historical features such as hedgerows, ditches and woods;
- conservation of high-value habitats and their associated biodiversity.

Agri-environment measures may be designed at the national, regional, or local level so that they can be adapted to particular farming systems and specific environmental conditions. This makes agri-environment a targeted tool for achieving environmental goals. Within the CAP pillar II, the so called Rural Development Programmes for each member state contain also payments for primary sector competitiveness, primary sector diversification and wider rural development (such as LEADER). The pillar II measures (annex 3) have been given a varying weight in different countries and the FP 7 project RuDi (Assessing the Impact of Rural Development Policies) investigated this based on the allocation of national budgets. The map 15 (below) is from their final report and highlights the countries that spend much of their money on environmental measures (green), primary sector competitiveness (blue) and wider rural development (red).

The same policy package is available at the European scale for all countries, but they have a very high degree of autonomy in applying these schemes at the national level. In some countries the focus has been more on renewal in the agricultural “conventional production” and on developing enterprises from a competitiveness perspective. In other countries the focus has been on agri-environmental measures and providing funding for provision of environmental and cultural public goods. This will provide a large different for what prerequisites that have been created in regions during the last 10-15 years for how to respond to the challenge of greening the agricultural sector. In countries that have invested in environmental payments there might be a scope for utilising such features now in the development of greener agriculture – for instance in Sweden the evaluators of the RDP have stressed this aspect of utilising such values and resources in the future sustainable development of farm enterprises. In countries that have focused on primary sector competitiveness there might be a larger scope for developing new products, marketing schemes, adopting new technologies, etc. Wider rural initiatives could give a

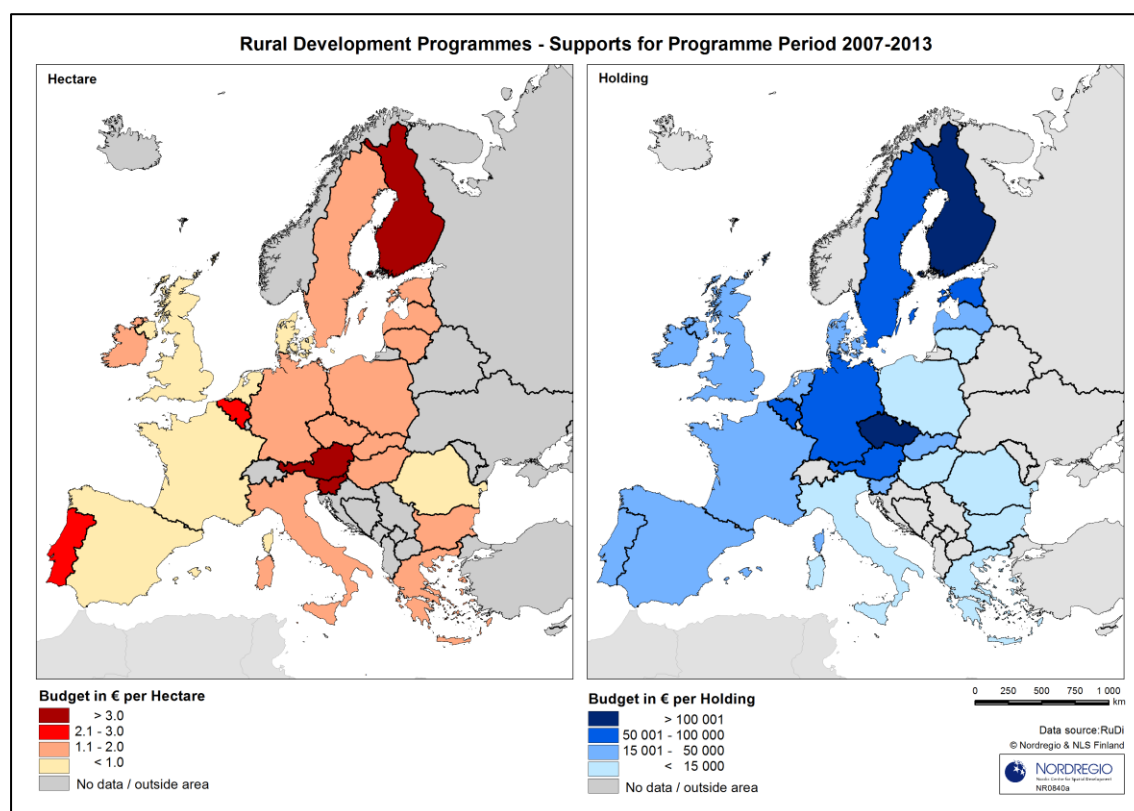
local capacity to work together, and integrate strategies for local greening of many strands of society.



Map 15. Source: Copus (2010) (RuDi project).

It might also be interesting to reflect upon the magnitude of CAP support in different

countries and map 16 shows the distribution both with respect to hectares and with respect to holdings.



Map 16. Source: Nordregio construction based on data from the RuDi project.

Water policy

(This entire section is right now taken from: "water for agriculture", an article on EEA webpage)

Policy plays a crucial role in inducing the agricultural sector to adopt more efficient irrigation practices. In the past, for example, water-pricing policies in some European countries did not necessarily require farmers to use water efficiently. Farmers rarely had to pay the true price of water reflecting the environmental and resource costs. In addition, agricultural subsidies obtained through the CAP and other measures were indirectly encouraging farmers to produce water-intensive crops as intervention prices guaranteed a market regardless of over-production. In the province of Cordoba, for example, the efficiency of cotton irrigation increased by approximately 40% after subsidies was partially decoupled from cotton production (volumes) in 2004. A water pricing structure favouring efficient users and the removal of adverse agricultural subsidies is likely to lead to significant reductions in the quantity of irrigated water used in agriculture.

In addition to modified irrigation techniques, gains in water and cost savings can also be

obtained through training and knowledge-sharing programmes that educate farmers on more water efficient practices. In Crete, for example, water savings of 9-10% have been achieved through the use of an irrigation advisory service. The service informs farmers by phone of when and how to apply water to crops based on daily estimates of the conditions affecting the crops.

Changing agricultural practices can also improve the quality of the water available for other water users in a cost-effective way. Using inorganic and organic fertilisers and pesticides, for example, can address many of the water pollution problems from agriculture. In addition, there is significant potential to improve water quality throughout Europe with little or no impact on profitability or productivity by, for example, reducing pesticide use, modifying crop rotations and designing buffer strips along water courses.

Through the use of wastewater in agriculture, more fresh water resources can be made available for other needs, including for nature and households. If the quality of the reclaimed water is properly managed, treated wastewater can provide an effective alternative for meeting agriculture's demand for water.

The use of treated wastewater for agriculture is already providing significant water management benefits for some European countries. In Cyprus, for example, the recycled water targets for 2014 correspond to approximately 28% of the 2008 agricultural water demand. In Gran Canaria, 20% of water used across all sectors is supplied from treated wastewater, including the irrigation of 5,000 hectares of tomatoes and 2,500 hectares of banana plantations.

For a future where there is enough water available to meet the needs of our ecosystems with sufficient resources left for our consumption requirements, we need to provide the right policy packages to support efficiency measures. The EU's Water Framework Directive (WFD) has contributed to this achievement through an encouragement of changes to agricultural practices that can improve both water quantity and quality in Europe, but further development of the CAP and national water pricing structures are still needed to ensure they also support the WFD objectives. The Blueprint to safeguard Europe's water resources, to be published by the Commission by the end of this year, will focus on possibilities to increase water resource efficiency and on corresponding policy options. Water management in agriculture would certainly benefit from a stronger focus in the CAP on resource efficiency and ecosystem services.

Organic farming – policy intention

COM (2004) 415: "European Action Plan for Organic Food and Farming"

Organic farming is a valuable tool for promoting the environmentally friendly production of high-quality products. Stressing the advantages for the environment, rural development and animal welfare the Commission sets out its general guidelines on organic farming. The Commission recognizes the dual role played by organic farming in society. It represents a means of production for foodstuffs and has created a niche market for these kinds of food products. It is beneficial for the whole community and especially for the environment.

The Commission believes that the development of organic farming must be based firstly on the interplay of supply and demand. The emphasis must therefore be placed on the expectations of consumers, who need to be better informed about the principles, objectives and benefits of organic farming. The Commission proposes launching an information and promotion campaign throughout the European Union to promote the Community logo, and other campaigns targeted on certain types of consumer. It also plans to set up an on-line database to allow comparison of Community standards with national and international standards. In order to increase production capacity, fresh information is required and the collection of statistical data on the production of and the market for organic products must therefore be improved.

The Commission urges Member States to make full use of all the Community instruments and measures, such as national and regional action plans, available within their rural development programmes. Given the need for new technologies with a view to developing the market for organic products, the Commission and the Member States must expand research in this field.

Under EU development policy, the Commission proposes supporting capacity-building in developing countries and facilitating trade in organic products from those countries. The Commission plans to establish new import arrangements under Regulation (EEC) No 2092/91, involving technical equivalency evaluations by specially designated bodies. It also intends to improve the performance of those bodies and coordination between them and the inspection and enforcement authorities. It plans to develop a specific accreditation system for inspection bodies and publish an annual report from the Member States on their supervision. In addition, it proposes prohibiting the labelling of products containing GMOs as organic. Finally, the Commission proposes asking the Council for a negotiating mandate to reinforce recognition by third countries of EU organic farming standards and inspection systems.

4.1.2 Policies in the forest sector

The overall principles of the EU's Forestry Strategy, e.g. multifunctionality and sustainability are reflected in the rural development policy of the EU by bringing together economic, social and environmental objectives into a coherent package of voluntary measures and thus giving added value to the implementation of forest programmes of the Member States in their regions. The pieces of the policy puzzle are depicted in the picture below.

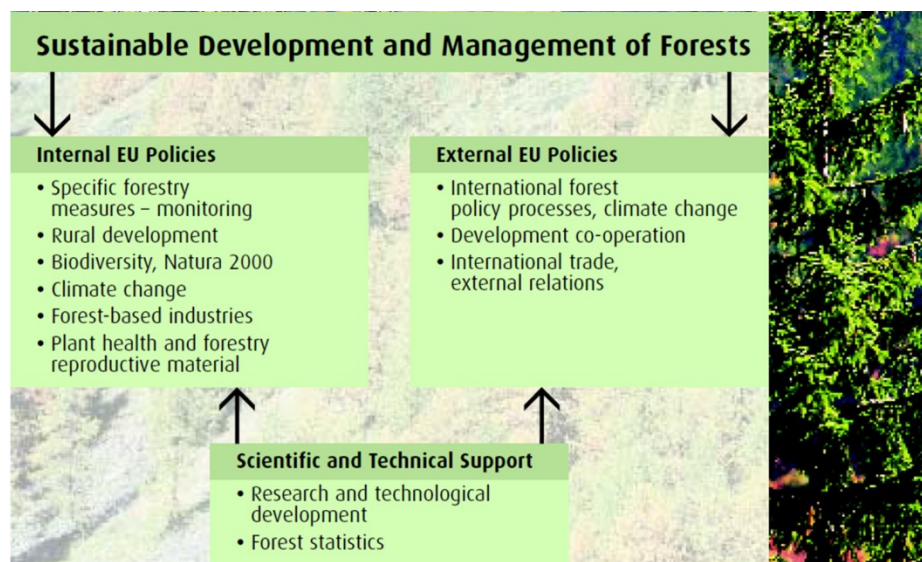


Figure 52. Policy packages in the EU forest policy. Source: EC (2003)

Some brief information on EU forest policy

In the European Union the formulation of forest policies is the competence of the Member States within a clearly defined framework of established ownership rights and with a long history of national and regional laws and regulations based on long term planning. Although the Treaties for the European Union make no provision for a common forest policy, there is a long history of EU measures supporting certain forest-related activities, coordinated with Member States mainly through the Standing Forestry Committee.

The EU Forestry Strategy adopted in 1998 puts forward as its overall principles the application of sustainable forest management and the multifunctional role of forests. The Strategy was reviewed in 2005, and the Commission presented an EU Forest Action Plan in 2006.

Forest Policy in the European Union

1995 The Thomas Report of the environmental committee of the European Parliament gave a series of recommendations for the development of an European Union (EU) Forest Policy.

The European Commission presented a Communication on a Forestry Strategy for the EU
1998 The EU Council adopted a Resolution on a Forestry Strategy for the EU. This document is considered to be the basic political charter for Community involvement in forest issues.

The Commission has presented to the Council and the European Parliament
2005 a Communication reporting on the implementation of the EU Forestry Strategy accompanied by a detailed Staff Working Document.

The EU Forest Action Plan was adopted on 15 June 2006. It builds on the report
2006 on implementation of the EU Forestry Strategy and consequent conclusions by the Council.

2010 The Commission adopted the Green Paper on forest protection and information.

The Arsenis Report of the environmental committee of the European
2011 Parliament gave a series of recommendations on the follow up of Commission's Green Paper on forest protection and information.

However forests are affected by a broad array of EU policies and initiatives arising from diverse EU sectoral policies. For several decades now, environmental forest functions have attracted increasing attention mainly in relation to the protection of biodiversity and, more recently, in the context of climate change impacts and energy policies. In public perception, apart from the traditional production of wood and other forest products, forests are increasingly valued for their role as public amenities, biodiversity reservoirs, regulators of climate and local weather, sources of clean water,

protection against natural disasters and renewable energy sources.

Source: http://ec.europa.eu/environment/forests/home_en.htm

The latest EU **Forest Action Plan (2007-2011)** focused on the following topics for sustainability in the forest sector.

Climate change mitigation. Forests can help mitigate the effects of climate change. Plants absorb CO₂ through photosynthesis and use captured carbon to build organic matter. The storage of organic carbon in soils and above-ground biomass offers considerable potential to remove CO₂ from the atmosphere. Significant amounts of carbon can also be built up and stored through afforestation of farmland, agro-forestry systems, and use of carbon-conscious forest management practices. EU forests are also affected by changing climatic conditions. Global warming is likely to intensify the risk of forest fires and pest outbreaks. In the longer term it will influence the kind of tree species that will grow and timber production capacity as well as biodiversity, though the impacts will vary regionally. Extreme weather events, such as high winds, storms, and prolonged heat waves, floods and droughts will also affect the EU's forests. Heavy storms have already caused severe damage to forests in recent years and are becoming more frequent. Over time, climate change might jeopardise the capacity of EU forests to perform economic, social and ecological functions.

Forests, biomass and energy. The EU has adopted an ambitious energy and climate policy which aims by 2020 to reduce energy consumption by 20%, with a similar cut in CO₂ emissions, while raising the share of renewables in the EU's energy mix to 20%. More than half of the EU's renewable energy already comes from biomass, 80% of which is wood biomass. Wood can play an important role as a provider of biomass energy to offset fossil fuel emissions, and as an environmentally friendly material. There has recently been higher demand for wood from the energy sector in addition to rising demand from the established wood-processing industries. Many experts consider that significantly more wood could be mobilised from EU forests than is currently the case. However, the cost at which this can be done is the key factor.

Biodiversity. The EU has taken a major step to preserve biodiversity through the creation of the Natura 2000 network (an EU-wide network of nature protection areas established under the 1992 Habitats Directive³). Almost 30% of designated Natura 2000 sites comprise forest habitats and another 30% partly contain woodland elements and related species.

Fire and pollution. EU measures to support the protection of forests against fires and atmospheric pollution have strengthened cooperation between EU countries in these areas. However, these threats continue to be a major concern. Forest fires are the most important damaging factor in Mediterranean countries, where between 300 000 and 500 000 hectares of forests and other woodland burn each year. While EU legislation has led

to considerable improvement of air quality in Western Europe over the past 20 years, deposition of air pollutants (such as acid rain) is still a problem in European forests.

Plant health. Plant health and the quality of forest reproductive material are of vital importance for the wellbeing of the EU's forests. Over the last few years, the EU has adopted legislation on a number of key aspects concerning the marketing of forest reproductive material. Wood imported from third countries can sometimes be a source of harmful pests and diseases. Accordingly, stringent provisions to address these risks have been introduced.

The Forest action plan [COM(2006) 302] has set four main objectives to be implemented in order to optimise the sustainable management and multifunctional role of the EU's forests:

- improving long-term competitiveness;
- improving and protecting the environment;
- contributing to a better quality of life;
- fostering communication and coordination in order to increase consistency and cooperation at various levels.

These objectives translate into a series of 18 key actions, which the European Commission and the Member States will implement jointly. The action plan also provides for additional measures, which the Member States can implement depending on their specific characteristics and their priorities, in some cases with the aid of existing Community instruments.

Improving long-term competitiveness

The competitiveness of forestry is essential. The sector has great potential to develop new products and services of high quality in response to growing demand as a source of renewable raw material. The Commission proposes five key actions for this objective:

- **Key action 1:** The Commission will carry out a study on the effects of globalisation on the competitiveness of EU forestry in order to identify the main factors influencing developments in the EU forest sector and to underpin discussions on further action to be taken to enhance the competitiveness and economic viability of the sector;
- **Key action 2:** Encourage research and technological development to enhance the competitiveness of the forest sector (including through the 7th Research Framework Programme);
- **Key action 3:** Exchange and assess experiences on the valuation and marketing of non-wood forest goods and services: the aim is to quantify the total value of forests and their functions, in order to introduce instruments to compensate for non-marketed goods and services;
- **Key action 4:** Promote the use of forest biomass for energy generation;
- **Key action 5:** Foster cooperation between forest owners and enhance education and training in forestry.

Improving and protecting the environment

The overall objective is to maintain and appropriately enhance biodiversity, carbon

sequestration, integrity, health and resilience of forest ecosystems at various geographical scales. In this regard, the Commission proposes the following key actions:

- **Key action 6:** Facilitate EU Member States' compliance with the obligations on climate change mitigation of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol and encourage adaptation to the effects of climate change;
- **Key action 7:** Contribute towards achieving the revised Community biodiversity objectives for 2010 and beyond;
- **Key action 8:** Work towards a European Forest Monitoring System, following completion of the Forest Focus monitoring scheme;
- **Key action 9:** Enhance the protection of EU forests.

In addition, Member States may - with the support of the EAFRD and the instrument Life+ - promote measures in favour of forests (Natura 2000), agri-forestry systems, support restoration of forests damaged by natural disasters and fire, support studies on the causes of forest fires, awareness-raising campaigns.

Contributing to a better quality of life

The Commission considers it important to preserve and support the cultural and social dimension of forests. To do so, it has identified the following key actions:

- **Key action 10:** Encourage environmental education and information;
- **Key action 11:** Maintain and enhance the protective functions of forests;
- **Key action 12:** Explore the potential of urban and peri-urban forests.

In addition, Member States may - with support from the ERDF - enhance investment and sustainable management of forests for better prevention of natural disasters.

Fostering coordination and communication

While forest policy is a matter for the Member States, many initiatives with an impact on forest management are carried out at European level. This therefore requires improved coherence and cross-sectoral cooperation in order to balance economic, environmental and socio-cultural objectives at different organisational and institutional levels.

- **Key action 13:** Strengthen the role of the Standing Forestry Committee *;
- **Key action 14:** Strengthen coordination between policy areas in forest-related matters;
- **Key action 15:** Apply the open method of coordination to national forest programmes;
- **Key action 16:** Strengthen the EU profile in international forest-related processes;
- **Key action 17:** Encourage the use of wood and other forest products from sustainably managed forests;
- **Key action 18:** Improve information exchange and communication. *Inter alia*, the European Commission will develop a website devoted to forest management at the Europa Internet site.

In addition, the Member States are encouraged to organise visibility events, such as a "Forest Week" or "Forest Day", to raise awareness of the benefits of sustainable forest management.

Table 9 below summarises some of the most important policy aspects of the green

economy in the forest sector.

Table 9: European policies in the domain of greening of forestry.

Type of policy	Short description
EU Roadmaps	Indicative roadmap on: New EU Forest Strategy
Other important communications	<p>Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions of 17 October 2008 “Addressing the challenges of deforestation and forest degradation to tackle climate change and biodiversity loss” [COM(2008) 645 final – Not published in the Official Journal].</p> <p>Forests cover roughly 30% of the world's land area and offer major environmental benefits: they are amongst the most important habitats for biodiversity and provide crucial services by contributing to erosion prevention, water purification and the storage of Carbon Dioxide (CO₂). The livelihoods of 1.6 billion people in the world depend on forest resources.</p> <p>Forests are under threat from deforestation. According to the United Nations Food and Agriculture Organisation (FAO), 13 million hectares of forests are lost every year. The main direct causes of forest destruction are changes in land use and badly controlled infrastructure development.</p> <p>Proposed EU objectives</p> <p>Protecting forests is an effective means of combating global warming. The action proposed by the European Union (EU) aims to halt global forest cover loss by 2030 at the latest and to reduce tropical deforestation by at least 50 % by 2020 compared to current levels. This Communication sets out the main lines of the action proposed by the European Commission, invites contributions from all stakeholders and sets in motion a series of initial actions that will provide the foundations for a global response to deforestation.</p> <p>The Commission considers that the battle against deforestation must be fought on several levels:</p> <ul style="list-style-type: none"> • by strengthening forest governance and institutions at local and national level; • by rewarding the value of the services provided by forests and making them more economically attractive than the benefits

	<p>which can be derived from deforestation;</p> <ul style="list-style-type: none"> • by taking account of demand and the responsibility of consumers; • by taking into account the work of the United Nations Convention on Biological Diversity (EN) and international climate negotiations; • by improving means for forest monitoring and assessment in order to obtain high-quality information to support decision-making. <p>Contribution of Community policies</p> <p>Many European policies have indirect impacts on deforestation and the EU can help promote sustainable forest management, in particular through:</p> <ul style="list-style-type: none"> • Forest Law Enforcement, Governance and Trade (FLEGT); • work carried out under the framework of the Global Climate Change Alliance (GCCA); • green public procurement policies; • promoting eco-labelling and forest certification. <p>Furthermore, the Commission highlights the existing link between demand for agricultural commodities and land use. It stresses the need to increase agricultural production without further deforestation, which requires substantial investment, particularly in agricultural research to increase productivity in this sector in developing countries. Vigilance is also needed to ensure that an increase in demand for biofuels does not jeopardise efforts to protect forests. In the future, the Commission will assess the impact on deforestation of European and international initiatives and the consumption of imported food and non-food commodities into the Community, and will continue with the review on policy coherence for development.</p> <p>Mechanisms and funding</p> <p>Combating deforestation in developing countries requires additional funding (between 15 and 25 billion Euros per year will be needed to halve deforestation by 2020). A major portion of funding could come from proceeds from the auctioning of allowances within the Community's emissions allowance trading scheme (ETS). Indeed, the proposed amendment of the scheme, presented in January 2008, provides for at least 20% of the auction proceeds to be devoted to climate objectives, deforestation in particular.</p> <p>Furthermore, the Commission proposes creating a Global Forest Carbon Mechanism (GFCM). As part of this framework, a pilot phase could be envisaged to test the</p>
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	<p>inclusion of “deforestation credits” (avoided deforestation credits) in carbon markets. Governments could use these credits to achieve the targets allocated to them for the period post-2012 concerning the reduction of emissions. The possibility of authorising companies to use “deforestation credits” to offset a portion of their emissions could be considered after 2020.</p> <p>Communication from the Commission to the Council and the European Parliament of 27 February 2008 on innovative and sustainable forest-based industries in the EU - A contribution to the EU's Growth and Jobs Strategy [COM(2008) 113 final – Not published in the Official Journal].</p> <p>The European Union (EU) is home to a competitive forest-based sector, which has a turnover of around 365 billion euros per year and generates value added of around 120 billion euros. It employs more than three million people in 344 000 enterprises, many of them in rural areas. Small and medium-sized enterprises (SMEs) play an important role in the wood and printing sectors.</p> <p>Whilst moving towards a low-carbon economy, the industries in the forest-based sector have to remain competitive. The sector must continue to prosper whilst tackling the issues of climate change, innovation, access to non-European markets and higher energy costs.</p> <p>The Commission is proposing several measures to make the forest-based sector in the EU even more competitive, based on the following aspects:</p> <ul style="list-style-type: none"> • access to raw materials; • combating climate change; • innovation, research and technological development; • trade and cooperation with third countries; • communication and information. <p>Access to raw materials</p> <p>Increasing demand for raw wood for renewable energy, biodiversity requirements and recreation all lead to greater competition, and the gap between supply and demand is leading to higher costs. It is important to promote the domestic supply of unprocessed wood in order to guarantee availability. Wood, as a raw material, is the single largest cost for many industries in the forest-based sector, representing more than 30% of the total cost of paper production and almost 70% for sawmills.</p> <p>The Commission advocates asustainable management of</p>
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	<p>forests. It encourages the Member States, industries and forest owners to:</p> <ul style="list-style-type: none"> • promote tree planting and reforestation; • use biomass in a balanced way, not reserving it exclusively for the production of renewable energies, so as to ensure that the forest-based sector has a reliable supply of raw wood, thus bringing about a better match between supply and demand; • encourage the development of the recycled paper and wood markets, also by promoting the participation of the industry, with the aim of increasing the use of recycled paper and wood; • continue their efforts to reduce illegal felling and the sale of products derived from illegally felled wood. <p>Combating climate change</p> <p>Forests and forestry products absorb carbon dioxide, and this carbon storage is the sector's contribution to combating climate change. More intensive recycling of wood and paper, rather than disposing of them in landfill, prolongs their ability to retain carbon. The Commission will be examining the advantages and disadvantages of the idea of including in its policy the storage of carbon in forestry products.</p> <p>Higher gas and electricity prices are threatening the competitiveness of the forest-based sector. Even though some branches of this sector (e.g. plants for the manufacture of chemical pulp) are net producers of energy, others (e.g. paper plants) consume large amounts of energy. The Commission is focusing on the plan of action for 2007-2009 "An Energy Policy for Europe" with a view to creating a really competitive internal market in gas and electricity.</p> <p>The Commission is focusing on future activities in the area of climate change and, in the context of the Community greenhouse gas emission trading scheme, will continue to evaluate the specific situation of energy-intensive industries and the risk of seeing production moved abroad to countries where the emission limits are less strict ("carbon leakage").</p> <p>Innovation</p> <p>The Commission reiterates the importance of innovation, research and technological development to support the competitiveness and ensure the sustainable management of the forest-based sector. The 7th Research Framework</p>
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	<p>Programme provides a framework for the study of biofuel and wood-based organic chemical production methods. An approach based on the establishment of innovation centres will be adopted with a view to promoting competitiveness within the forest value chain.</p> <p>Trade and cooperation with third countries</p> <p>The Commission will be continuing its efforts to guarantee access to raw materials on the world market and to eliminate tariff barriers. Dialogue with third countries will be launched to this end.</p> <p>Information and communication</p> <p>Awareness of forest-based products and the forest-based sector must be improved. The Member States, regional authorities, universities and educational institutions will be invited to work together in multinational networks to analyse and report on long-term changes in the sector.</p> <p>Commission Communication of 8 February 2006 entitled "An EU Strategy for Biofuels" [COM(2006) 34 final - Official Journal C 67 of 18 March 2006].</p> <p>Communication from the Commission to the Council and the European Parliament of 15 June 2006 on an EU Forest Action Plan [COM(2006) 302 final - not published in the Official Journal].</p> <p><i>[This action plan has been described in the text above]</i></p>
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4.2 Technology and innovation

(This entire section is right now taken from: "OECD (2011), *Food and Agriculture*, OECD Green Growth Studies, OECD Publishing")

Ikerd (1993) defined sustainable agriculture as —capable of maintaining its productivity and usefulness to society indefinitely. Such an agriculture must use farming systems that conserve resources, protect the environment, produce efficiently, compete commercially and enhance the quality of life for farmers and society overall. What is increasingly clear is that no one farming system can be identified as sustainable, and there is no single path to sustainability. All farming systems — from intensive conventional farming to organic farming to something that falls between the two extremes — have the potential to

be environmentally-sustainable.

Developing an environment favouring innovation can contribute to green growth in food and agriculture. Notable examples of innovation include:

- New science and generic technologies with green potential: Specific technologies and generic platform technologies that may have significant transformation potential. Biotechnology, Information and computing technology and bioproduction are examples in this mode.
- Farming systems innovations: Farming systems innovations with green potential - different ways of organizing agricultural production -may involve the use of one or more specific technological innovations as defining characteristics, or it may be purely to do with how production and marketing is organized, or a combination of the two. Organic farming, Integrated Pest Management and the Systems of Rice Intensification are example of this.
- Integrated national green regimes: Specific technologies or agricultural production systems operate as part of national (or regional) green agenda. Examples include biofuels in Brazil, organic states in India, agritourism, and the potential for renewable energies in agriculture.
- Post farm innovations: Technologies that reduce food waste, improve transport and handling logistics, improved packaging and shelf-life.

COM (2012) 60: Innovating for sustainable growth: A bioeconomy for Europe

The Europe 2020 Strategy calls for a bioeconomy as a key element for smart and green growth in Europe. Advancements in bioeconomy research and innovation uptake will allow Europe to improve the management of its renewable biological resources and to open new and diversified markets in food and bio-based products. Establishing a bioeconomy in Europe holds a great potential: it can maintain and create economic growth and jobs in rural, coastal and industrial areas, reduce fossil fuel dependence and improve the economic and environmental sustainability of primary production and processing industries. The bioeconomy thus contributes significantly to the objectives of the Europe 2020 flagship initiatives "Innovation Union" and "A Resource Efficient Europe".

Global population growth by 2050 is estimated to lead to a 70% increase in food demand, which includes a projected twofold increase in world meat consumption. The Bioeconomy Strategy will contribute to a global approach in meeting this challenge by developing the knowledge-base for a sustainable increase in primary production, taking into account all options from cutting-edge science to local and tacit knowledge. It will also encourage changes in production and consumption patterns and the development of healthier and more sustainable diets.

The EU's bioeconomy sectors are worth € 2 trillion in annual turnover and account for more than 22 million jobs and approximately 9% of the workforce. However, in order to remain competitive and maintain jobs in the light of major societal challenges and rising markets in the developing world, the European bioeconomy sectors need to innovate and further diversify. Significant growth is expected to arise from sustainable primary production, food processing and industrial biotechnology and biorefineries, which lead to new bio-based industries, transform existing ones, and open new markets for bio-based products. New high skilled jobs and training options need to be developed to meet labour demands in these industries, as well as in agriculture, forestry, fisheries and aquaculture. It is estimated that direct research funding associated to the Bioeconomy Strategy under Horizon 2020 could generate about 130 000 jobs and € 45 billion in value added in bioeconomy sectors by 2025.

The bioeconomy requires continued and increasing support from public funding and private investment and must contribute to better coherence between national, European and global research and innovation efforts. Research and the application of its results are often disconnected due to an information and knowledge gap and institutional and conceptual barrier between researchers, innovators, producers, end-users, policy-makers and the civil society. Knowledge transfer networks, knowledge and technology brokers, as well as social enterprises, embedded in broader citizens and stakeholder initiatives, can bridge these gaps.

Many promising research results also remain unexploited due to pending legislative issues and patenting. Furthermore, more investment is needed for demonstration and scale-up activities and the development of entrepreneurship and advisory services for the whole supply chain.

4.3 Human resources

In agriculture as in other sectors, active labour market policies including skills training are essential for helping workers make structural transitions. The adaptive capacity of labour markets in agriculture may be more limited than in other sectors owing to the narrower focus of farming and also location-specific factors. Safety nets for farmers and farm workers should be in place. Public initiatives to train rural workers in green skills such as retro-fitting buildings, landscape and habitat preservation, and renewable energy production are needed. Farmers will generally benefit from vocational training and gaining basic business skills in human resource management, networking and market development. In the fisheries sector, government efforts to facilitate adjustment have tended to focus on short-term efforts to finance alternative employment for redundant workers. These are generally introduced as an adjunct to capacity adjustment programmes given that vessel reduction is usually the main focus of policy reform. A longer-term issue is to ensure that governments develop broader and coherent set of policy signals for fishing communities so that adjustment occurs smoothly and largely

autonomously in the future. Such policies are an essential complement to ensuring that the adaptability and resilience of fishing communities are strengthened over time. The management arrangements for fisheries will also play a major role in ensuring the resilience of the fishing sector as it is essential that fisheries management policy and labour market policies are mutually supportive.

4.4 Economic dynamics

From the report: An analysis of the EU organic sector

One part of the dynamics of development of the sector can be attributed to the pulling effect of a robust demand for food organic products. Another part appears to be linked to the support which is provided to it through the Common Agricultural Policy of the EU and especially through dedicated Rural Development measures (agri-environment payments). Regarding the first Pillar of the CAP, it is necessary to stress that CAP reforms have gradually put the two types of farming on equal footing since the early 1990s. In the EU-12, where organic food consumption is still very low and less of a driver of the organic sector as in the EU-15, the remarkable development of the sector owes primarily to the support provided to the sector and probably also to a favourable context of deep restructuring and reform of the agricultural sector since the beginning of the 1990s (new farming structures, new public/private institutions, new agricultural policy support with level playing field between organic and conventional agriculture). Yet, the fact that sizeable numbers of producers revert to the conventional sector every year in the EU reveals a certain fragility of the sector. In this context, several questions arise regarding the way support is provided to the sector:

- Whether it is stable and predictable, hence allows the establishment over several years of the necessary building blocks of the supply chains (facilitating not only agricultural production but allowing for processing and marketing channels to develop, etc.);
- Whether it consists only in stand-alone measures or is part of a comprehensive framework which pays sufficient interest at research, extension services and demand pull instruments;
- Whether it takes proper account of the demand for organic products in the food market. The time when supply of organic products (e.g. organic milk) could outpace in some Member State the development of consumer demand, leading to great difficulties for the producers, seems to be gone. Organic food demand is increasing at sustained rates in the large EU-15 markets and seems to be quite resilient in the current difficult economic context. Demand is also developing in the EU-12, yet it stands at very low levels and faces the constraint of household income.

However, an overall increasing demand does not preclude that, in some specific sub-

sectors or Member States, organic products may not immediately find appropriate marketing conditions due to a lacking or sluggish demand (or absence of supply chain). In the EU-12, difficulties of this sort may arise owing to current constraints to domestic demand or the absence of functioning marketing channels to transfer the products where the demand exists. Hence, as applies for any support measures which endeavour to enhance the development of any sector, proper attention to market demand is of primary importance.

All these elements stress the utmost importance of the adoption by concerned stakeholders and public authorities of multifaceted strategies which combine supply development policies with the establishment of a comprehensive institutional framework (including extension services, research) and demand-pull strategies (such as communication on organic products). This is necessary to achieve a balanced development of the sector. This necessity was stressed at the EU level with the European Action Plan for Organic Food and Farming released in 2004.

The demand for organic food products, which has been robust in recent years, has a pulling effect on the organic farming sector, whose response is delayed for several reasons. This growth should provide proper conditions for the development of the EU organic sector in the medium term and ensure the maintenance of price premiums which contribute to the profitability of the sector. On the other hand, the fact that an important part of demand growth originates in unspecialised large retail chains whose procurement practices may differ from the more traditional forms of organic retailing (higher leverage power due to economic size and more global sourcing), may as well impact the organic price premiums. The economic recession of 2009 may have affected strongly the growth of demand for organic products, although data are available only for few Member States. Whereas organic food consumption has been affected strongly in the United Kingdom (decline by 13.6%), it would have shown better resilience in Germany, France and Italy where it remained stable (Germany) or continued growing (France and Italy). Overall, organic food consumption appears robust and is likely to resume (or accelerate) growth when the economic crisis will be terminated.

The principles and rules which frame the organic sector demand high technical skills and an interest for innovative solutions by the concerned farmers. The organic sector is now extending beyond a mere "niche agriculture" and reaching a certain critical mass. This is also reflected by an increasing body of dedicated research, which will probably increase further in the medium term. Hence, it is likely that more solutions will be provided to the farmers to better cope with the framework set for organic agriculture, be it with better suited varieties, improved agronomic practices or pest management practices. One should not forget that, in a context where sustainability and environment protection are important aspects which apply to the whole EU agricultural sector, the benefits of organic research (agro-ecological innovations) have a good chance to extend beyond the remits of the organic sector itself.

Renewable energy as a driver?

(Much of this section from the EU commission webpage on sustainable agriculture)

Agriculture can contribute to the production of renewable energy by production of conventional agricultural crops (grains, sugar beet and sugar cane, oilseeds) which are then transformed into biofuels, or into biogas. Alternatively, the sector can produce dedicated (non-food) energy crops. Thirdly, the input from the sector can be in the form of agricultural wastes and residues, whether of crop or animal origin, and forest residues. This is currently severely under-exploited as a source of renewable energy relative to the enormous potential. Fourth, agricultural land can be used (instead of or in parallel to) for e.g. wind and solar energy. Although these outputs do not rely on any biological transformation process, they can fall within the decision-making sphere of the farmer, contribute to farm income and may have implications for the farm's fixed resources. The competition for land between food crops and bioenergy feedstocks raises the possibility of higher food prices and deepening food security concerns. In fact, land diverted from food production will have to be replaced by net additions to cropped land elsewhere unless recently abandoned agricultural land can be reclaimed for cropping and/or growth rates for crop yields accelerate to much higher levels than observed in past years. However, when land lost from food crop production is replaced by bringing new areas under cultivation there may be damaging consequences in terms of green-house gas emissions if this land formerly stocked more carbon than is typically stocked by an annual food crop. Also, if rapeseed areas are replaced by imported palm oil from the tropical areas there have emerged problems with peat land being drained releasing GHG emissions and creating ecosystem distortions.

A successful strategy for rebasing economic growth on green energy requires policy makers to be aware of the entire supply chain for each form of energy, from the supply of raw energy resources by primary sectors right through to the supply of usable energy onto markets for final energy consumption, and to the interactions – competitive or complementary – between these supply chains. Stimulating bioenergy production will heighten the trade-offs with other market demands and societal goals, and may risk distorting or disrupting a number of other markets. When reviewing agriculture's potential contribution to green energy production, these competing claims on potential energy resources and on the land used to produce them, have to be kept in view.

The European Environmental Agency (EEA) estimated in a 2006 study EU primary energy requirement at 1.8 billion tonnes oil equivalent (toe) in 2020 and projected biomass to be able to contribute with 13 % or 236 million toe, compared to 69 million toe actually provided in 2003 (figure 53 below provides the evolution since then).

An almost identical projection is reproduced in the Commission's Impact Assessment of the Renewable Energy Roadmap where the higher scenario results in a biomass potential of 230 million toe, the lower being 195 million toe. Based on current knowledge it is thus reasonable to assume that biomass could account for two-thirds of the renewable energy target in 2020. For this to become reality biomass use will roughly have to double.

Production of energy from EU forestry and agriculture, million tonnes oil equivalent

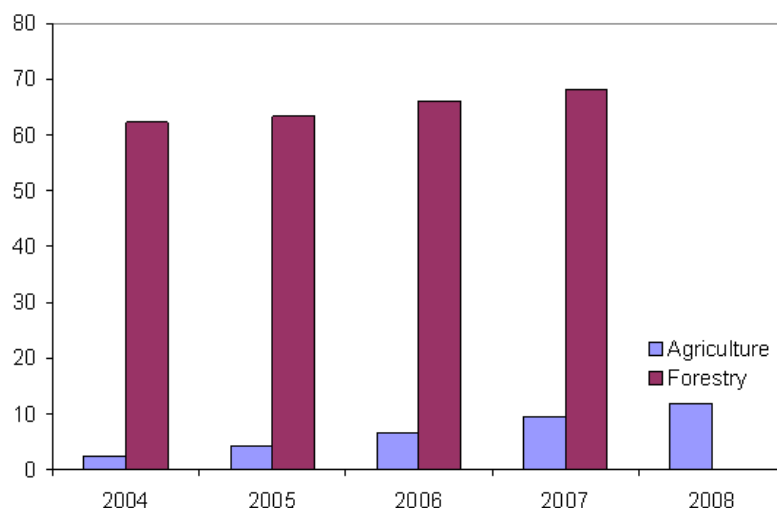


Figure 53. (Source EEA).

COM (2011) 112: A Roadmap for moving to a competitive low carbon economy in 2050

The Commission's analysis shows that by 2050 the agriculture sector can reduce non-CO₂ emissions by between 42 and 49% compared to 1990. The sector has already achieved a significant reduction. More reductions are feasible in the next two decades. Agricultural policies should focus on options such as further sustainable efficiency gains, efficient fertiliser use, bio-gasification of organic manure, improved manure management, better fodder, local diversification and commercialisation of production and improved livestock productivity, as well as maximising the benefits of extensive farming.

Improved agricultural and forestry practices can increase the capacity of the sector to preserve and sequester carbon in soils and forests. This can be achieved, for instance, through targeted measures to maintain grasslands, restore wetlands and peat lands, low- or zero-tillage, to reduce erosion and allow for the development of forests. Agricultural and forestry are also providing the resources for bio-energy and industrial feedstocks, and this contribution is bound to increase further.

After 2030, the rate of emission reductions in the agricultural sector could slow down, in part because of increased agricultural production due to the growing global population. However, it is important to note that, by 2050, agriculture is projected to represent a third of total EU emissions, tripling its share compared to today. Its importance in terms of climate policy is, therefore, set to increase: if it does not achieve the projected emissions

reductions, other sectors would need to reduce even more, which would come at a high cost. The farming sector is also potentially at some risk of carbon leakage, so changes in production and trade patterns should not in the longer-term undermine global reduction of emissions.

The dual challenges of global food security and action on climate change need to be pursued together. In order to cope with these increased land use requirements in the EU and on a global scale sustainable increases in the productivity delivered by diverse agricultural and forestry systems (both intensive and extensive) will need to continue at rapid pace, not least in developing countries. Any negative impacts on other resources (e.g. water, soil and biodiversity) will need careful management. Accelerating climate change could endanger these productivity improvements in a world of insufficient action on climate change.

This also underscores the need to consider all land uses in a holistic manner and address Land Use, Land Use Change and Forestry (LULUCF) in EU climate policy. The Commission is preparing an initiative on this issue later this year. In addition, paper and wood products should be reused and recycled more to reduce pressure on land use. The analysis took account of global trends towards a greater share of animal products in nutrition. Reversing existing trends of food waste and re-orienting consumption towards less carbon intensive food would be desirable.

4.5 Territorial dynamics

4.5.1 Territorial dynamics in green agriculture

This section aims at tracing out the territorial dimension of a greening of the agricultural sector. It is based on an analysis of the concept of green agriculture as well as the current state, policy framework and other dimensions (e.g. markets, innovation, etc.) presented above. It also builds on the GREECO definition of territorial factors and the understanding of what dimensions can be important in the territorial dynamics of an evolution of the sector into cleaner and more sustainable production and consumption patterns.

The GREECO dimension of the territorial dimension states that *territorial Factors are territorial perspectives that condition the development of regions based on greener activities. Generally speaking, they are **non-uniformly distributed and are place-based** (because they are 'located in space'); which means that they account for the basis of how European regions differ in both their "pre-conditions" and their "possible effects" for a transition towards a green economy.*

These factors **can be founded, and can interact between, the *physical/material/spatial* side** of green production and consumption (for instance, as physical infrastructure, or distribution of land-based resources); but also ***socially*** (for instance, as consumer and producer cultures; tacit versus coded and formalized knowledge); ***in terms of information*** (for instance, through communication and information services); ***economically*** (for instance, as consumer-driven versus producer-

driven), **or politically** (for instance, through the goals of territorial cohesion, or the interplay between different levels of multi-level governance for policy making/implementation). But, not least, these factors can act as *drivers* of the green economy in some or all sectors, *hindrances* to it in some or all sectors, and/or have *differential effects between sectors*.

In the table (10) that follows, these factors have been applied to the agricultural sector to try and trace out the intrinsic ways in which the place, or a territory (and the interaction between territories) impact on greening.

Table 10. Assessment of the territorial dimension of green agriculture.

Are the following <i>territorial factors</i> important in relation to greening of agriculture?		
1. Settlement types	y/n	Why? Why Not?
i. Urban areas	Y	<p>Most agricultural production is taking place in rural areas – but not far from urban areas. In most countries the major share of production and farms are situated on countryside which cannot be categorized as remote-rural. Farms are dependent on urban areas for processing of farm output, for deliveries of inputs (farms are much more relying on cross regional and international input purchases than before) and for services such as veterinaries, financial and technical extension. For farms that are following a diversification strategy based on broadening the closeness to urban areas for consumers and day to day interaction with markets is important.</p> <p>But, urban areas are also competing with agriculture for land, and land take is an important problem for society in the long run when it comes to food, recreation and energy.</p> <p>[To the extent that some sub-set of greening of agriculture could be relying on restructuring into more efficient and industrial units, which can sustain a high level of investment and innovation, the sector would rely on linkages to urban areas for labour and service as well.</p> <p>Urban areas and their structure can have an impact on food waste and not least the possibility to utilize food waste for energy or heat production. This includes the possibilities to collect such waste.</p> <p>Urban areas are where consumers are, and consumers have a great power in transforming the sector. Obviously this is true for most sectors. Some problems need to be addressed by policies due to asymmetric information and missing markets, but in</p>

		general an awareness of change in consumer willingness to pay can have a great impact on greening of agriculture.
ii. Rural areas	Y	<p>Rural areas are the base for most of agricultural production and therefore this is where the “restructuring” of the sector will need to “physically” take place. The transformation of rural areas has been tremendous in itself, now other types of small firms (in all sectors of the economy) are usually more important than agriculture or forestry. Besides this, people are living in rural areas and commutes for work in urban areas. This, impacts on the possibility of agriculture to “attract” resources, e.g. capital, land, labour, to transform the sector and grow. That is, there will be competition for these resources with other types of economic activities in rural areas. For some areas this will not be as important as for others. In some regions land is still an available asset and extensification and less intensity is possible. And, agriculture is still one of the few economic activities that are tied to the land and place. This should impact on the decisions of policymakers for strategic development of rural areas. In 2007 there were approximately 13.7 million of agricultural holdings in the EU, representing a decrease by -9% compared to 2003 (15 million holdings in 2003). Hence 1.3 million holding disappeared in this period, some integrated into larger holdings and others abandoned, both options with great impact on rural areas.</p> <p>Attractiveness of rural areas (settlement, accessibility, service, culture, etc.) impact on the possibility to attract skilled labour, or skilled new farm operators, which is needed for a re-structuring of agricultural production. Rural areas can also act as a factor of attractiveness (place of origin) in branding or on farm selling of processed or un-processed commodities.</p>
iii. Urban-rural interactions	Y	<p>The interaction between urban and rural areas, the closeness, open up for recreational visits to nearby farms and farm shops. This impact on the understanding of rural areas, farming, green agriculture, impact of food production. It facilitates farming in some areas because of the possibility to diversify into tourism or shops. This requires a market which is not present for farms in more remote rural areas, unless for some seasonal diversification. Also, the provision of renewable energy can be seen as an urban-rural interaction between supply and demand.</p> <p>Over time, the distance between production and consumption has had a profound impact on agriculture and the state of processing in which agricultural commodities are sold.</p>
2. Land and land-based	y/n	Why? Why Not?

resources		
i. Land consumption or dependence	Y	<p>Around half the EU's land is farmed and farming is hence an important factor shaping the natural environment, aesthetics and social aspects of many EU regions. In fact agriculture and forestry together represent 78% of European land cover in the EU-27, ranging from 50% in Malta to 95% in Poland. Agriculture and forestry therefore continue to play a major role in maintaining natural resources and cultural landscapes as a precondition for other human activities in rural areas. Farming and nature influence each other as farming is dependent on many ecological services for its production; and at the same time heavily influences nature by adapting land and using resources and sinks. Even though industrial farming uses more and more resources produces outside the area of the farm (feed, chemicals, pesticides, machinery, knowledge, etc.) a substantial link will always exist between farming and "the place". The same is true for forestry which provides many services to animals and humans, while being ultimately dependent on natural environments for the growth and wellbeing of trees. Agriculture and forests cover the vast majority of our territory and play a key role in determining the health of (predominantly) rural economies and landscapes.</p> <p>Land consumption and intensity of land use is important factors for greening of the sector. Intensity can reduce the spatial use of land, but places more pressure on the land that is used. Less intensive farming is often defined as "extensive" farming, and for e.g. animal husbandry this implies less density and use of larger physical areas. So, there is a dimension of amount of land used and intensity of land used in the greening of agriculture.</p> <p>Arable and animal based production both consumes vast areas of land. Conflicts with land use for buildings, recreation, golf courses, conservation, infrastructure, etc. are one important aspect of agricultural production and interaction with society. Agriculture has a huge impact on the quality/state of land and land characteristics are important for biodiversity as well as human valuation of land.</p> <p>There are different categories of land consumption in Europe between early -90s to 2002-04, some countries increase production whereas land use is reduced, implying a higher pressure on the land being still used. But it also implies less land is consumed. Other countries have reduced both agricultural production and the use of land (Poland, Italy, UK). Norway and Turkey have increased the land area, Turkey with an increase in production and Norway with a small</p>

		<p>decrease.</p> <p>Between 1990 and 2000, urbanization has led to the loss of agricultural land especially in the major centres of population. This shift is partly offset by a conversion of forest and semi-natural land to agriculture.</p>
ii. Material Consumption or dependence	Y	<p>Material consumption is a really important aspect of greening of agriculture. Primarily this is so because of the energy intensity/and emissions embodied in resources such as fertilizers, machinery and obviously fuel. New and energy efficient buildings and machinery would substantially reduce the impact of agriculture, but would in the short run require material consumption (investments) and replacement of existing "capital". Investments in new equipment (and energy solutions) can reduce demand for fuels and energy but would obviously imply higher material consumption in the short run.</p>
iii. Energy consumption or dependence on specific energy types or systems	Y	<p>Maybe the most important aspect of greening of the sector. Agriculture uses primarily fossil fuels. There is a scope for energy to be a driver in the greening of the sector with development of on-farm bio-energy facilities (both for heating and fuel), integration of wind mills and solar panels with existing structures, and with new electric engines for tractors and other equipment (driers, etc.).</p> <p>There is a large difference between countries in the share of energy costs to agricultural output. In Eastern countries this share can be as high as >12% whereas in Southern countries it is below 6%. In general in the EU15, over 60% of energy comes from petroleum products, 14 from electricity and 19% from gas. Only 4% are from renewable sources.</p>
iv. Management of ecosystem services (types of ecosystems/landscapes; spatial characteristics of ecosystems; options for maintaining and developing these services)	Y	<p>Management of ecosystem services is one of the dimensions of green agriculture. It is rather an output of greening of the sector, but it goes both ways. Functional ecosystems are a precondition for agriculture, but it is also a precondition for many of the diversification strategies that are envisioned for future agriculture (green or more related to wider rural/regional development strategies)</p>
3. Market relations (Production; consumption; export, import) and innovation	y/n	Why? Why Not?
i. Local/regional markets	Y	<p>Local or regional markets don't really exist anymore for agricultural products, Some products produced in regions are for sure sold in those regions, and some with certification and origin as specific attributes. But in general it is large firms dominating the food product</p>

		markets (such as Nestle and retail brands) and therefore it is difficult to envisage that local market relations could impact to a larger extent on the greening of the sector in particular regions.
ii. National markets	Y	More important than local. Nationally a large share of the food consumed is domestic (or at least around 50% in small open economies like Sweden and larger share in larger economies like France and Germany). Hence, national markets can impact more.
iii. EU markets	Y	Consumption and production patterns are quite diverse across Europe. This implies that as far as greening of agriculture is a consumer driven process it will have to be really different at different places.
iv. Global markets	Y	This is where it becomes really complicated because much of the environmental work taking place in Europe just “moves” the emissions, land use, degradation, water use, etc. somewhere else on a global scale.
4. Inter- and intra-territorial relations	y/n	Why? Why Not?
i. Within territories (place based; local cultures; relating to territorial/national policies)		
ii. Between territories (networks; competition)		
iii. Across territories (cross-border supply and demand)		
5. Place-based factors	y/n	Why? Why Not?
i. Competitiveness through strong local economies	Y	<p>Possibility for regions with “weaker” economic development, and weaker traditional conditions for industrialized agriculture to find a niche in green agriculture. Regions might have the area and knowledge to develop extensive farming or organic production, and even though regional economies are seen as weak they might have the right mix of firms to support farm diversification within a network of other firms focusing on recreation, experience, food, etc. (acting within a cluster is a possible development trajectory for farm diversification).</p> <p>Regions where agriculture has been marginalized, or which are weak in general on a global competitive market, “might” gain advantages due to inherent local qualities which are important for sustainable development (rather than traditional growth paradigms). But we really can’t see any direct evidence for this in the desk-sector analysis. Stronger local economies can on the other hand combine already existing sectors and economic activity in many</p>

		<p>sectors to develop many aspects of the greener economy, also agriculture and energy provision from bioeconomy.</p> <p>It should also be acknowledged that the return on an investment (whether it is in conventional agriculture or targeting a greening of the sector) is closely related to the place where the investment is made, as the rate of return can often vary considerably from one place to another. Theories of international direct investment (IDI) have long recognised that IDI gravitates to those areas where the expected return is highest. This is determined by numerous factors, such as the size of the market; the political and social stability of the place; the quality of its infrastructures and labour force; and the various incentives that it may provide. The same holds true for territorial units within countries, for it is now recognised that each area has a specific capital — its “territorial capital” — that is distinct from that of other areas and is determined by many factors that have been successively highlighted by various theories.</p>
ii. Multi-functionality	Y	<p>Can be a factor for green agriculture, but agriculture can be green even though not multifunctional. That is, if we consider that it is production of food (and in some times fiber) that should be greened, a windmill on the farm might be seen as a part of the green economy (producing renewable energy) but agriculture production on this farm is per se not any greener. But, if this energy is eventually used on the farm it could be argued that multifunctional land use has made the agricultural production greener.</p>
iii. Tacit/experiential knowledge	Y	<p>The knowledge about the ways that agriculture can be greener is researched at traditional “knowledge intensive institutions” and governmental research organisation. Knowledge intensive institutions can in this place be understood also as firms doing research in new crop or livestock varieties. But also, it is the local knowledge of farmers that can impact on many of the local environmental problems identified within the traditional paradigm of industrial agriculture. Many of the measures of the CAP (agri-environmental measures) are in fact focusing on these local issues, such as landscapes. And changing the behaviors of day-to-day practice of farmers is one important aspect of those measures. The farm organisation across Europe has also engaged in various campaigns towards environmental problems, incorporating the knowledge of their members, in order to change practice (recent examples are reducing nitrogen leakage from nutrients).</p>
iv. PROXIMITY	Y	<p>Proximity to what? To consumers? If consumers are closer to production it could be a hypothesis that they are more aware of the impacts of their choices when it comes to food. Especially for local environmental problems. For global problems, such as climate change and water use somewhere else to produce</p>

		feed, this link is much weaker and public awareness in other ways that proximity is needed. But, proximity can play a role for e.g. public procurement, large scale buyers can also put more pressure on a single producer (compared to individuals).
6. Consumer relations	y/n	Why? Why Not?
i. Are development and innovation consumer-demand driven?	Y	Organic production has started to become consumer driven. From the outset it was more policy and output driven. One question is what to expect with improving living standards, more organic consumption? OR is it rather a question of awareness – and income increases might not improve that and increased income is spent on other forms of consumption? As for the fish sector, the development in the agricultural sector has been dependent on consumers expecting low price products, and as a consequence the supply has been cutting costs and removed partly the base for high quality, locally sold, products.
ii. Are development and innovation producer driven?	Y	Yes, farmers are facing a “cost-price” squeeze and need to become more resource efficient and also find ways to improve margins on their products. One way is to find niche markets to be able to diversify compared to the global market. Farmers also diversify because they need alternative sources of income now that world markets are fluctuating more than ever. Hence, some activities defined as green (energy production, organic production, tourism) are producer driven, This is perhaps development more than innovation.
iii. Are development and innovation based on well-defined territorial conditions or on open access?		
7. Accessibility and mobility	y/n	Why? Why Not?
i. Transport connections (transport of materials; transport of labor)	Y	Transport has always been important for agriculture, because of the spread out structure of farms, to get resources to the farms and commodities from the farms to processing. It is difficult to judge whether or not transport connections will be <i>more</i> important for green agriculture or not. But it will be important.
ii. Regional Accessibility (access to markets; access to supply of materials; access to public services)	Y	Access to markets is always important for food products, and if there is a favorable combination of “green and local” to be utilized the access to local markets will be even more important.
iii. Information connections (use of communication and information services; need of interaction; questions of consumer	Y	(Physical and using internet: connections in a broad sense). Interaction between consumers and producers is starting to emerge more in agriculture (again). It is not common, but for a niche of consumers it is important. For farmers information connections are

and producer cultures)		important for keeping in touch with markets and trends, policies, certification schemes, etc. Also, methods and know how is transmitted thorough interaction and information services.
8. Policy and governance by territorial level	y/n	Why? Why Not?
i. Scale of sector-based policy support		
<ul style="list-style-type: none"> From the EU Level 	Y	EU level is really important. It makes up the bulk part of support for greening processes through the CAP and through targeted research in the framework programs.
<ul style="list-style-type: none"> From the national level 	Y	National policies for environmental protection might impact on greening of agriculture, but there are almost no national policies directly targeting agriculture at the national level. Rather national support are commonly in the form of research and extension activities. This has always been really important for the sector because of the structure of smaller units (farms operated by families or one person) and a lack of possibilities to do research and innovation within individual firms. Also, much of the extension work has been to improve the entire sector to the benefit of society. This is also the case with practices and technology for greening. Today the concepts of such extension is broadened to include also marketing and consumer relations in relation to new farm products and diversification strategies.
<ul style="list-style-type: none"> From the regional level 	Y	Similar to national level.
<ul style="list-style-type: none"> From the local/municipal level 		
ii. Role of other EU policies with territorial dimension		
iii. Private versus public sector – led development. Are consumer organizations advocating for developing the green economy. At what political scale are they located?		

To assess the concept of territorial outcomes of greening of each sector the GREECO project has proposed the following definition. *Territorial outcomes are existing or new territorial phenomena that are accentuated in one way or another by pursuing various sector-based developments of the green economy in European regions. These outcomes are directly based on sector developments in that they seek to answer the question: for achieving some greening of the economy in this sector, what overall*

territorial outcomes can be expected to take place? As such, they discuss the most relevant territorial-bound patterns, processes, perspectives that are forecast to influence the development of greener economies either positively or negatively. Hence, table 11 below tries to analyse these outcomes for the agricultural sector.

Table 11. Assessment of the territorial outcomes of greening of agriculture.

Territorial outcomes of greening of agriculture	
<ul style="list-style-type: none"> Inter- and intra-territorial relations 	<p>It was difficult to find out what are the impact of this territorial dimension on the greening of the agricultural sector. Hence it is difficult to say anything about it from an “outcome” perspective.</p>
<ul style="list-style-type: none"> Settlement types 	<p>There might be an argument to be made about the long term settlement patterns that could emerge in the long run if we cannot continue to produce our food in the way that we do today. If food would have to be produced in a less intensive way and with more labour, rather than energy, it would impact on the amount of people that would have to live (or at least work) in rural areas. But this is not really the focus of the programs for greening of agriculture as it stands today. The processes are more about being even more productive based on research and innovation, and produce more, with less inputs, and as little labour as today. Hence it is difficult to assert any major impact to settlement types due to a greening of the agricultural sector as it has been understood and found to be defined in the major sources of this sector report.</p>
<ul style="list-style-type: none"> Land and land based resources 	<p>Improvement of land quality/management and land based resources are the major impact (outcome) of a greening of agriculture. All environmental and land based aspect of the green concept of agriculture could be mentioned here as this is the major benefit of sustainable production processes and less damaging inputs and outputs. Greening of agriculture implies for land and resources for instance:</p> <p>Restoring and enhancing soil fertility through the increased use of naturally and sustainably produced nutrient inputs ; diversified crop rotations; and livestock and crop integration;</p> <p>Reducing soil erosion and improving the efficiency of water use by applying minimum tillage and cover crop cultivation techniques;</p> <p>Reducing chemical pesticide and herbicide use by implementing integrated biological pest and weed</p>

	<p>management practices; and</p> <p>It would improve biodiversity due to less intensive land use and more diverse structures.</p> <p>It would improve the quality and availability of water through more efficient irrigation techniques, specifically in the Mediterranean countries.</p>
<ul style="list-style-type: none"> Market relations (Production; consumption; export, import) and innovation 	<p>Market relations can play a vital role in driving agriculture towards greener production processes – but is there a relational outcome as well? There might be a wider impact on markets if consumers start to consume more locally produced food products, and hence start to acknowledge/gain interest in consuming also other items locally. Innovation is a process, and regional innovation in agriculture might obviously spill over on other sectors and have a larger impact in a region.</p> <p>One thing that should be considered is that green agriculture requires “getting the prices right” which implies internalizing the cost of externalities in the form of emissions or use of scarce resources. This means higher prices for output commodities, and higher prices in the entire production chain. It could also impact on other sectors that use the same damaging inputs if these “correct prices” are enforced on a wider sectoral scale. E.g. the cost of GHG emissions, rules for emissions, tradable permit schemes for water use, etc. etc.</p>
<ul style="list-style-type: none"> Place-based factors 	<p>Will a greening of agriculture have an impact on place based factors? Well, it was evident that place based factors have an impact on the greening of the sector – but what is the opposite impact?</p> <p>The factors brought forward from a territorial dimension were “competitiveness through strong local economies, multi-functionality, tacit/experiential knowledge, and proximity” As a greening of the sector primarily impacts on the environment there might be some impact on the quality of a region from this perspective and the use of regional quality as input to other sectors (not only tourism gain from a nice environment but also other sectors that require input, labour, etc.). To say if a greening impact on the knowledge and proximity of a region is difficult – to say the least.</p>

<ul style="list-style-type: none"> • <i>Accessibility and mobility</i> 	<p>It is difficult to assert any major impact to accessibility and mobility due to a greening of the agricultural sector as it has been understood and found to be defined in the major sources of this sector report.</p>
<ul style="list-style-type: none"> • <i>Policy and governance by territorial level</i> 	<p>There can probably be a feed-back effect of greening on the policy and governance of a region. Perhaps we are used to thinking in the opposite direction – that policy and governance are the drivers or enablers of such a development. But for sure, if greening is impacted by market (e.g. consumer awareness) or by production side forces (such as innovation or need to adapt) there might be a feed-back on policy and a pressure to implement local policy. Also, greening of agriculture on a large (EU or National) scale could stimulate local groups or associations to act locally – hence having an impact on the local (governance aspect).</p>

In relation to territorial dynamics the issue of future impacts of climate change should also be mentioned. Climate change is perhaps a hindering condition, or a new dimension to complicate the development of a green bioeconomy. For agriculture for instance, changes will add to the complexity of reforming the sector as new conditions will emerge in all regions. Hence the sector must both restructure to become greener (and in this process mitigate climate change) but at the same time adapt to climate change related conditions and phenomena. Figure 54 from the commission highlights some of the anticipated changes. Not all of these changes are negative, for instance a longer growth season in the Nordic countries are beneficial to biomass production, but also impose the introduction of new invasive species and pests. Hence, climate change will be an important aspect to take into consideration in developing regional green growth strategies for agriculture, forestry and fishery.

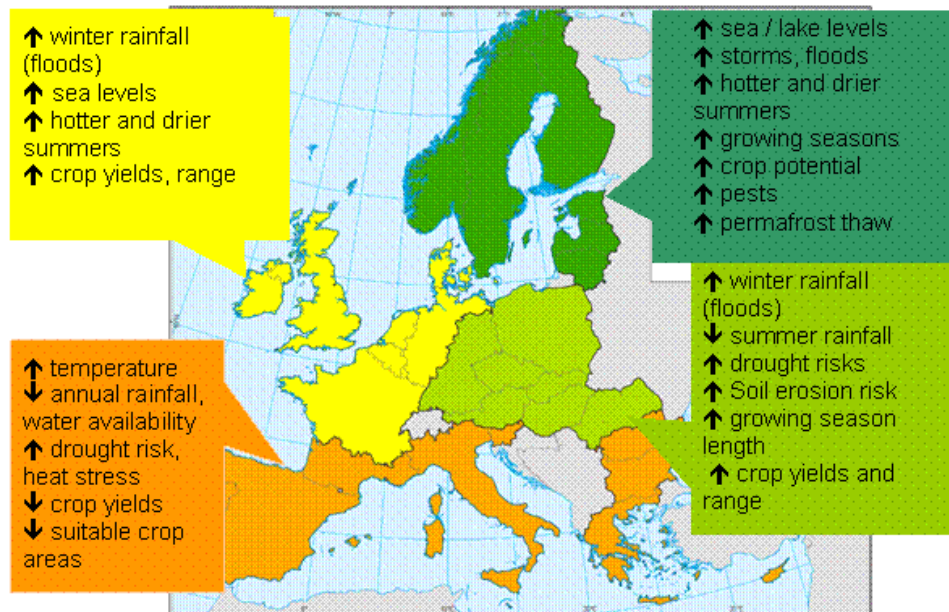


Figure 54. Possible impacts of climate change for Agriculture in Europe (EU Commission)

5 Concluding remarks

What is greening of agriculture and forestry; conceptually?

According to a UNEP report (Towards a green economy: Agriculture investing in natural capital) the greening of agriculture refers to the increasing use of farming practices and technologies that:

- Maintain and increase farm productivity and profitability while ensuring the provision of food on a sustainable basis;
- Reduce negative externalities and gradually lead to positive ones; and
- Rebuild ecological resources (i.e. soil, water, air and biodiversity “natural capital” assets) by reducing pollution and using resources more efficiently.

Farming practices and technologies that are instrumental in greening agriculture include:

- Restoring and enhancing soil fertility through the increased use of naturally and sustainably produced nutrient inputs; diversified crop rotations; and livestock and crop integration;

- Reducing soil erosion and improving the efficiency of water use by applying minimum tillage and cover crop cultivation techniques;
- Reducing chemical pesticide and herbicide use by implementing integrated biological pest and weed management practices; and
- Reducing food spoilage and loss by expanding the use of post-harvest storage and processing facilities.

A diverse, locally adaptable set of agricultural techniques, practices and market branding certifications such as Good Agricultural Practices (GAP), Organic/Biodynamic Agriculture, Fair Trade, Ecological Agriculture, Conservation Agriculture and related techniques and food supply protocols exemplify the varying shades of “green” agriculture.

When it comes to forestry the major sources for discussing green growth that have been found are the European Commission (e.g. the forest strategy for EU), the UN (e.g. UNEP and FAO). In the UNEP (2008) report on Green jobs: towards decent work in a sustainable low carbon world, the greening of the forest sector is perceived as employment in the fields of “Reforestation and afforestation projects”, “Agroforestry”, “Sustainable forestry management and certification schemes”, and “Halting deforestation”. The EU forest plan for the years 2007-2011 focuses on the aspects of “Climate change mitigation”, “Biomass and energy”, “Protecting Biodiversity”, “Fire and pollution” and “Plant health”. The UNECE/FAO publication The forest sector in the green economy, focuses on the aspects of “biomass energy”, “green infrastructure and buildings”, “forest resources as carbon sinks” and the role of “environmental services from forests”.

Looking at the differences between agriculture and forestry for instance indicates that in the agricultural sector there seems to be more of a focus on the use of inputs, management practices and supply side measures – whereas the greening of forestry is framed more in the way wood products can be used as substitutes for non-renewable resources, and how forests can be utilised in climate change mitigation measures (sinks etc.). This can be explained by the fact that input use is a much more important part of agricultural production, something that is indicated already in the first chapter of the sector report. However, the certification of forests are one management factor which is important in green forestry.

What is the current state of greening?

Looking into the current state of the greening of the agricultural sector it is evident that there are both positive and negative signs. It is estimated that high nature value farmland covers more than 20% of the agricultural area in most member states (even more than 30% in some). The implementation of Natura 2000 represents a significant contribution to

the preservation of the biodiversity on farmland. The designated sites cover over 10% of the agricultural area of the EU-27. Also, 21% of the total forest area in the EU belongs to Natura 2000 sites. However, a decline in the population of farmland birds (one important indicator for biodiversity), largely attributed to intensive farming, can be observed in many Member States. This trend seem to have stabilised at EU level over the last decade but still biodiversity remains a problem for modern farming techniques.

The pressure from agriculture on water use is also critical in some regions as the share of irrigated area is higher than 20% of the agricultural area in several Member States. Irrigation is the source of a number of environmental concerns, such as the excessive depletion of water from subterranean aquifers, irrigation-driven erosion and increased soil salinity. In southern European countries such as Greece, Italy, Portugal, Cyprus, Spain and southern France, the arid or semi-arid conditions necessitate the use of irrigation. In these areas, nearly 80% of water used in agriculture currently goes to irrigation. However, irrigation does not have to be so water intensive. Water efficiency gains are already being obtained across Europe through both conveyance efficiency (the proportion of abstracted water that is delivered to the field) and field application efficiency (the water actually used by a crop in relation to the total amount of water that was delivered to that crop). In Greece, for example, improved conveyance and distribution efficiency networks have led to an estimated 95% water efficiency gain compared to previously-used irrigation methods. Forests can also contribute to the protection of water and at EU-27 level, 11% of the forests and other wooded land area is managed so as to protect water and soil.

Petrol and diesel are the main sources of on-farm energy consumption in most OECD countries, accounting for over 50% in both the EU15 and the United States. With the expansion in renewable energy production across an increasing number of countries, its share in on-farm energy consumption, though small, has risen, notably in Austria, Denmark and Finland. There has also been a trend in many countries toward an increasing share of electricity in on-farm energy consumption to power machinery, partly reflecting the substitution of labour for machinery. Much of the expansion in on-farm energy consumption in the EU has occurred in Poland, Spain and Turkey. The growth in energy consumption in these countries is largely explained by a combination of rising agricultural production since the 1990s, continued expansion of mechanisation and increasing machinery power, and the substitution of labour for machinery. Improvements in on-farm energy consumption efficiency (on-farm energy consumption growing at a lower rate than growth in farm production) are apparent for many countries. For example, on-farm energy consumption declined in Austria, Denmark and France, despite an increase in agricultural production.

Facts and figures from the EU show that an increasing part of agricultural area is now devoted to organic production, with an estimated 7.6 mio ha in 2008, i.e. 4.3% of EU-27 utilised agricultural area (UAA). In the period 2000-2008, the average annual rate of growth was 6.7% in the EU-15 and 20.0% in the EU-12. The area under organic agriculture is close to or higher than 9% of the total UAA in five Member States: the Czech Republic, Estonia, Latvia, Austria (15.5%) and Sweden. Still, consumer food demand grows at a fast pace in the largest EU markets, yet the organic sector does not represent more than 2% of total food expenses in the EU-15 in 2007. Also, the EU food manufacturing sector and households alone waste about 90 million tonnes of food annually or 180 kg per person, not taking into account losses in agriculture and fisheries. This has a huge impact on the amount of resources used in this sector; resources which

are in fact wasted (or to some extent transferred through the energy intensive food production and consumption process - to energy production; if waste is used for heat or fuel production). Furthermore, the intake of protein in the EU is well above the recommendations made by the world health organisation, in fact it is almost the double. Hence a cut-back on meat would be beneficial not only for the environment and resource base – but also for human wellbeing.

What are the most important drivers and enablers?

Drivers and enabling conditions can be many different things. In the GREECO project we have identified different types of conditions, structures, economic factors, political aspects and etc. which can be thought to impact on the evolution of green economy within all the sectors we do research on. The dimensions that we have emphasised, and that we think covers the spectrum of drivers and enablers for the agriculture and forestry sectors are policies, technology and innovation, human resources, economic dynamism and to some extent territorial dynamics. Obviously, all of these plays a part in the greening of the bioeconomy but it would seem from this investigation that the CAP is one of the most influential forces to move the agricultural sector towards a greening. The common agricultural policy is the most influential policy when it comes to agriculture (and to some extent forestry as well), and this driver or disabler of green growth within the is based on the huge amount of funding allocated from the EU budget towards agri-environmental measures, investments, and developments of firms and people within the sector. Obviously, the development of consumer awareness are another important driver which is not adequately addressed from an EU perspective. In fact, most of the drivers mentioned in the sector material investigated focuses on the supply side management and the development of new products within energy and materials.

In fact, the most important factors for greening of the agricultural and forest sectors that are brought forward in annex 2 on this report are:

- i) Consumer awareness and demand changes. (Consumption of organic products and less consumption of meat and dairy products).
- ii) Labour and skills development and the availability of capacity in a region for the restructuring of the agricultural sector.
- iii) Local networks and local initiatives supporting a transition of both the supply and demand side of the agricultural economy.
- iv) The targeted use of CAP Policies at the national/regional level and the strategic content of such schemes.

Territorial dimensions

Finally, the tables in chapter 4.5. offer an insight into the possible territorial dynamics of greening of the bioeconomy and the possible territorial outcomes of such a greening. These tables, which are difficult to draw any simple conclusions from, offer a diverse picture of a sector which based on its place based character impact greatly on land, rural areas and resources. But at the same time we see a sector which is heavily influenced by

global trends, urban patterns of demand and supply side policies which have shaped the sector over the last decades. These tables are further synthesised within a report on the territorial dimensions of green economy for all sectors in the GREECO project.

References

COM (2004) 415 final COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT European Action Plan for Organic Food and Farming {SEC(2004)739}

COM (2011:112)A Roadmap for moving to a competitive low carbon economy in 2050

COM (2012) 60 final COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Innovating for Sustainable Growth: A Bioeconomy for Europe {SWD(2012) 11 final}

Copus, A. K (2010) A Review of Planned and Actual Rural Development Expenditure in the EU 2007-2013, RuDI (Assessing the impact of rural development policies (incl. LEADER) - EU Framework 7 Programme Project no. 213034. Deliverables D4.1, 4.2, 5.1 and 5.2 (<http://www.rudi-europe.net/reportspublications.html>)

DG Agri (2010). Rural development in the European Union: Statistical and Economic Information., Report 2010. Directorate-General for Agriculture and Rural Development

EC (2003) Sustainable Forestry and the European Union: Initiatives of the European Commission. European Communities, 2003

EC (2010b) An analysis of the EU organic sector. DIRECTORATE-GENERAL FOR AGRICULTURE AND RURAL DEVELOPMENT.

EC (2010a) SITUATION AND PROSPECTS FOR EU AGRICULTURE AND RURAL AREAS. DIRECTORATE-GENERAL FOR AGRICULTURE AND RURAL DEVELOPMENT

EC (2012). COMMISSION STAFF WORKING DOCUMENT Accompanying the document “Communication on Innovating for Sustainable Growth: A Bioeconomy for Europe”

EEA (2005). Agriculture and environment in EU-15 — the IRENA indicator report. Report No 6/2005

EEA (2013) “water for agriculture”, article on EEA webpage:
<http://www.eea.europa.eu/articles/water-for-agriculture>

EU SEC (2009) 1093 final. COMMISSION STAFF WORKING DOCUMENT. The role of

European agriculture in climate change mitigation

EU Forest action plan (2007-2011). European Commission. DG Agri.

European Parliament (2012). How to improve the sustainable competitiveness and innovation of the agricultural sector. DIRECTORATE GENERAL FOR INTERNAL POLICIES POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES, AGRICULTURE

OECD (2008), "European Union", in Environmental Performance of Agriculture at a Glance, OECD Publishing. <http://dx.doi.org/10.1787/9789264046788-34-en>

OECD (2011). Food and Agriculture, OECD Green Growth Studies, OECD Publishing

OECD (2011) A green growth strategy for food and agriculture. Preliminary report. OECD 2011

PBL (2011). The Protein Puzzle. The Netherlands Environmental Assessment Agency (2011)

SEBI (2010) Biodiversity Indicators.
http://ec.europa.eu/environment/nature/knowledge/eu2010_indicators/index_en.htm

THE EUROPEAN BIOECONOMY IN 2030 Delivering Sustainable Growth by addressing the Grand Societal Challenges. BECOTEPS - Bio-Economy Technology Platforms.

The Knowledge Based Bio-Economy (KBBE) in Europe: Achievements and Challenges. 2010.

UN (2010). The European Forest Sector Outlook Study II, 2010-2030. UN, UNECE and FAO.

UNEP (2008). Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World, UNEP/ILO/IOE/ITUC, September 2008

UNEP (2011a). Towards a green economy: Pathways to Sustainable Development and Poverty Eradication. (Chapter: Agriculture investing in natural capital)

UNEP (2011b). Forests in a green economy: a synthesis.

UNECE/FAO (2009) The forest sector in the green economy. Geneva Timber and Forest Discussion Paper 54.

Annex 1. Analysis of specific policies

The following policies have been assessed to have the greatest impact on the territorial dimension of green growth for agriculture.

Type of policy and hierarchy	Council Regulation	
Name	Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).	
Description	<p>The reforms of the Common Agricultural Policy (CAP) of June 2003 and April 2004 focus on rural development by introducing a financial instrument and a single program: the European Agricultural Fund for Rural Development (EAFRD). This instrument, which was established by Regulation (EC) 1290/2005, aims at strengthening the EU's rural development policy and simplifying its implementation. In particular, it improves the management and controls of the rural development policy for the period 2007-2013. The policy is divided into four axis.</p> <p>Axis 1: Improving the competitiveness of the agricultural and forestry sector</p> <p>Axis 2: improving the environment and the countryside</p> <p>Axis 3: quality of life in rural areas and diversification of the rural economy</p> <p>Axis 4: LEADER</p>	
Targets	The Fund contributes to improving the competitiveness of agriculture and forestry; the environment and the countryside; and the quality of life and the management of economic activity in rural areas. Actual targets for specific measures are national and very diverse.	
Territorial implication	Characterisation	<i>Strong</i>
	Description	<p>The Fund contributes to improving:</p> <ul style="list-style-type: none"> • the competitiveness of agriculture and forestry; • the environment and the countryside; • the quality of life and the management of economic activity in rural areas.
Indicators/Measures in the policy	<ul style="list-style-type: none"> • vocational training and information actions, • schemes promoting the establishment of young farmers (people under 40 years of age setting up for the first time as the head of a holding) and the structural adaptation of their holdings, • early retirement for farmers deciding to cease activities with the aim of transferring their holding to other farmers, and agricultural workers who decide to definitively cease all agricultural activities. In general, beneficiaries must be at least 55 years old, but below the regular age of 	

	<ul style="list-style-type: none"> retirement in the Member State concerned, the use of advisory services by farmers and forest holders and the establishment of advisory services, farm relief and farm management support services. The use of these services should help assess and improve the performance of their holdings; the modernisation of agricultural and forestry holdings and the improvement of their commercial performance by, for example, bringing in new technology, adding value to primary agricultural and forestry production. This means supporting investments aimed at enhancing the efficiency of the processing and marketing stages of primary production whilst simplifying the eligibility criteria for investment support compared to the criteria applicable at present, improving and developing infrastructure related to the development and adaptation of agriculture and forestry, restoring agricultural production potential damaged by natural disasters and introducing appropriate prevention schemes; assist farmers in adapting to the demanding rules laid down in EU legislation, partly offsetting the additional costs or loss of revenue resulting from these new responsibilities, encourage farmers to participate in schemes that promote quality food and that give consumers assurances of the quality of a product or production method, providing added value to primary products and boosting trade opportunities, support producer groups in their information and promotion activities for products covered by food quality schemes; aid for semi-subsistence holdings _ undergoing restructuring, aid for the establishment of producer groups, aid for agricultural holdings undergoing restructuring, including diversification into non-agricultural activities. 	
Distance to target (Graph or map should be provided in support of the distance to target analysis)	Targets are not really spelled out at the EU level. Each country has some targets for specific aspects of the policy; like amount of hectares covered by agri-environmental schemes – or the amount of businesses getting support for diversification. National, or regional, targets could potentially be assessed in the case studies.	
Policy effectiveness	Characterisation	<i>Different in different countries and different measures. Evaluations are conducted throughout the program periods for each measure specifically.</i>
	Description	National evaluations generally describe how the CAP payments sustain farming in rural areas and maintain open landscapes as well as social and cultural values.

		Policies for agri-environmental measures are instrumental since these are public goods that would not be provided by farms in not supported.
Transformative character of policy	Characterisation	<i>Strong</i>
	Description	Support for organic farming is thought to have a large transformative power on the sector. Also the conservation oriented support is believed to influence the way farmers perceive their role as stewards of the countryside and providers of public goods. The transformation into a diversified agriculture is also due to policy measures for investment and information campaigns.
Green economy implication	Characterisation	<i>Strong</i>
	Description	The CAP is the major policy affecting the environmental concerns in EU agriculture. Without this policy farmers would have no incentive to go beyond the measures that safeguard (short run) production and follow market signals. Externalities would not be internalised and the transformation to green agriculture would be only up to consumer demand, which is distorted by asymmetric information and bounded rationality.

Type of policy and hierarchy	Council Regulation
Name	Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91 and Communication from the Commission to the Council and the European Parliament of 10 June 2004 - "European Action Plan for Organic Food and Farming" [COM(2004) 415]
Description	This Regulation lays down a new legal framework for organic products. It sets out the objectives and principles applicable to

	<p>this type of production and illustrates the rules on production, labelling, controls and trade with third countries. This Regulation contains the basic objectives and general principles for organic farming. The objectives focus on sustainable agriculture and production quality, which must meet consumers' needs. The general principles concern, <i>inter alia</i>, specific production methods, the use of natural resources and stringent restrictions on synthetic chemical inputs. Furthermore, the Regulation lays down specific principles concerning farming, the processing of organic food and organic animal feed.</p> <p>This Regulation has been produced as part of a series of initiatives to foster organic farming. In the same framework, the Commission adopted an <u>Action Plan for Organic Food and Farming</u> in 2004. The first legal framework for organic farming was laid down in 1991 with <u>Regulation (EC) No 2092/91</u>. Since its adoption, several amendments have been introduced into this Regulation, because organic farming has become more and more important in all Member States (annual growth for this sector is estimated at almost 25 % between 1993 and 1998 and around 30 % since 1998).</p>	
Targets	Unknown	
Territorial implication	Characterisation	
	Description	
Indicators/Measures of the policy	<p>Allowing Member States to top-up with aids the EU support devoted to producer organisations in the fruit and vegetable sector involved in organic production. The Commission will develop a web-based menu listing all EU measures that can be used by the organic sector in relation to production, marketing and information. The Commission strongly recommends Member States to make full use within their rural development programmes of the instruments available to support organic farming, for example by developing national or regional Action Plans focussing on:</p> <ul style="list-style-type: none"> *stimulating the demand side by using the new quality schemes; *actions in order to preserve the benefits for the environment and nature protection on the long term; *developing incentives to organic farmers to convert the whole instead of part of the farm; *organic farmers having the same possibilities for receiving investment support as non-organic farmers; *developing incentives to producers to facilitate the distribution and marketing by integrating the production chain by 	

	(contractual) arrangements between the actors; *support to extension services; *training and education for all operators in organic farming, covering production, processing and marketing; *targeting organic farming as the preferred management option in environmentally sensitive areas (without restricting organic farming to these areas).	
Distance to target (Graph or map should be provided in support of the distance to target analysis)	The distance to target is uncertain since there does not seem to be a spoken target; but map 13 shows the current state of organic production across the EU.	
Policy effectiveness	Characterisation	<i>Unknown what the official targets are.</i>
	Description	
Transformative character of policy	Characterisation	<i>Strong?</i>
	Description	The Commission recognises the dual role played by organic farming in society. It represents a means of production for foodstuffs and has created a niche market for these kinds of food products. It is beneficial for the whole community and especially for the environment.
Green economy implication	Characterisation	<i>Strong?</i>
	Description	Organic farming is a valuable tool for promoting the environmentally friendly production of high-quality products. Stressing the advantages for the environment, rural development and animal welfare.

Type of policy and hierarchy	Council Regulation
Name	Council Regulation (EC) No 510/2006 of 20 March 2006 on the protection of geographical indications and designations of origin for agricultural products and foodstuffs.

Description	This Regulation sets out provisions on agricultural products and foodstuffs (excluding all wine-sector products, except wine vinegar) from a defined geographical area. If there is a link between the characteristics of certain products and their geographical origin, they may qualify for either a protected geographical indication (PGI) or a protected designation of origin (PDO). The use of corresponding EU symbols on the labels of such products provides consumers with clear and concise information on their origin. The introduction of these two terms also benefits the rural economy, since it boosts farmers' income and maintains the population in less favoured or remote areas.	
Targets	Unknown	
Territorial implication	Characterisation	<i>Medium?</i>
	Description	The introduction of this regulation is believed to benefits the rural economy, since it boosts farmers' income and maintains the population in less favoured or remote areas.
Indicators	Unknown if there are any indicators designated to this regulation at the EU level.	
Distance to target (Graph or map should be provided in support of the distance to target analysis)		
Policy effectiveness	Characterisation	
	Description	
Transformative character of policy	Characterisation	<i>Unknown</i>
	Description	There is potentially a strong transformative character of this type of regulations since they might help re-invent the connection between consumers and producers; and an understanding of what goes into production of food and beverages. There is have a possible informative power of such schemes. Also, this kind of regulations can allow farmers to charge more for commodities and hence produce in a more environmentally friendly way, taking into consideration if consumers would pay more for certain product characteristics. It also forces the farmer to consider the impact of production on

		the place/territory since destroying environmental or cultural features of the place would undermine future labelling and market values. The place enters into the production function so to say.
Green economy implication	Characterisation	<i>Medium?</i>
	Description	See the discussion above under “transformative character”.

Type of policy and hierarchy	Action plan
Name	Commission Communication of 27 March 2001 to the Council and the European Parliament: Biodiversity Action Plan for Agriculture (Volume III) [COM(2001) 162]
Description	<p>This communication is the third volume of the Commission Communication of 27 March 2001 on Biodiversity Action Plans in the areas of Conservation of Natural Resources, Agriculture, Fisheries, and Development and Economic Cooperation. This volume is specifically dedicated to agriculture.</p> <p>The Community Biodiversity Strategy and the Action Plans are covered by the European Union commitment to achieve sustainable development and integrate environmental concerns into other sectoral policies and other policy areas.</p> <p>Indicators will be used for the long-term monitoring and benchmarking of Action Plan implementation. These indicators, which still have to be specified by the Commission with the help of the Member States, scientists and organisations concerned, will be measured locally and results compared.</p> <p>The communication mentions several Community instruments that can be used to implement the biodiversity action plan, e.g. common rules for direct support schemes under the common agricultural policy; agri-environmental measures in the field of rural development: these are one of the key instruments of this action plan; other rural development measures; the environmental components of common market organisations;</p>
Targets	The volume on agriculture begins with an analysis of the reciprocal relationship between agriculture and biodiversity stressing mutual benefits but also the pressure on biodiversity from farming. That analysis produced the following priorities for the action plan:

	<ul style="list-style-type: none"> • keeping intensive farming at a level which is not harmful to biodiversity: by establishing good agricultural practice, reducing the use of fertilisers, supporting non-intensive modes de production and establishing sustainable resource management; • ensuring that farming activities are economically viable, socially acceptable and safeguard biodiversity; • implementing agri-environmental measures for the sustainable use of biodiversity; • ensuring that the necessary ecological infrastructure exists; • supporting measures related to maintaining local breeds and varieties and the diversity of varieties used in agriculture; • preventing the spreading of non-native species. 	
Territorial implication	Characterisation	
	Description	Mainly on biodiversity and quality of nature and landscapes. Hence both biological, social, cultural and economic implications.
Indicators		
Distance to target (Graph or map should be provided in support of the distance to target analysis)		
Policy effectiveness	Characterisation	
	Description	
Transformative character of policy	Characterisation	
	Description	
Green economy implication	Characterisation	<i>Strong</i>
	Description	Mainly on biodiversity and quality of nature and landscapes. Hence both biological, social, cultural and economic implications in relation to the green economy.

Type of policy and hierarchy	Directive
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Name	Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.	
Description	<p>Directive 91/676/EEC (henceforth referred to as the Nitrates Directive aims to protect waters in Europe by preventing nitrates from agricultural sources from polluting groundwater and surface waters by encouraging the use of good agricultural practices.</p> <p>The Nitrates Directive is an integral part of the <u>Water Framework Directive</u> and is one of the key instruments for protecting water against agricultural pressures.</p>	
Targets		
Territorial implication	Characterisation	
	Description	
Indicators		
Distance to target (Graph or map should be provided in support of the distance to target analysis)		
Policy effectiveness	Characterisation	
	Description	
Transformative character of policy	Characterisation	
	Description	
Green economy implication	Characterisation	
	Description	

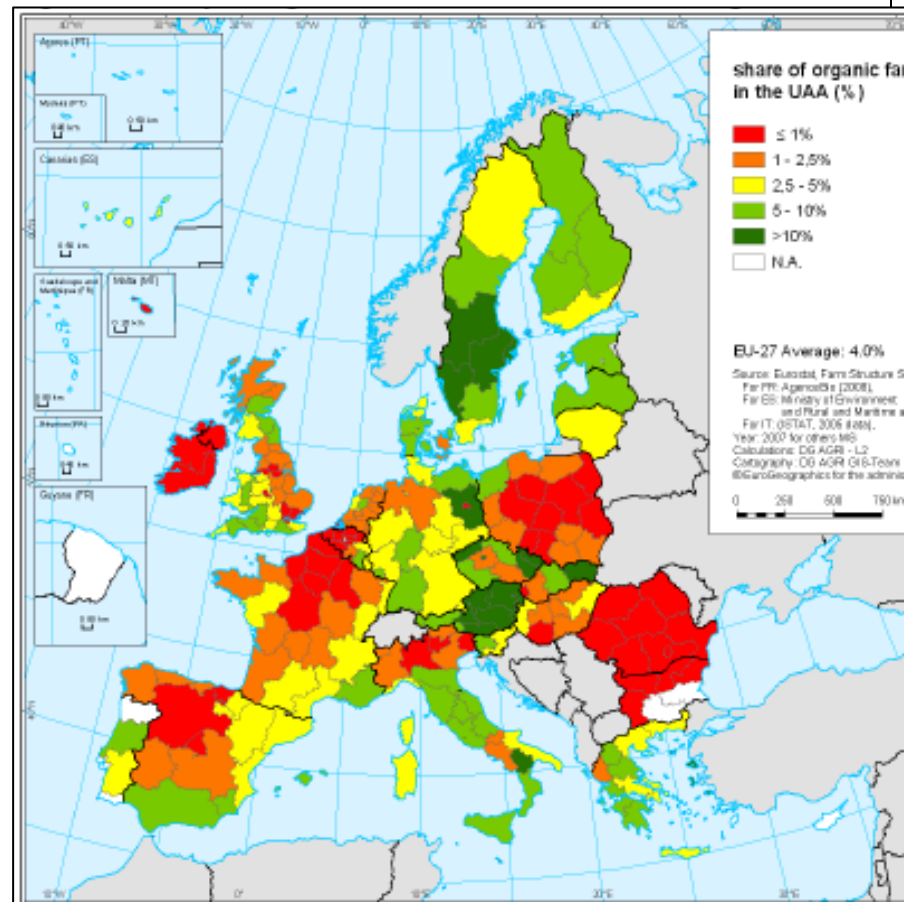
Annex 2. Analysis of factors of territorial potentials.

Territorial potential is described in the GREECO framework as territorial challenges, intrinsic features of territories and territorial capital that together produce an opportunity for expansion of the green economy. They can be thought of as a combination of factors that encourage or prevent regions and territories to transit to a greener economy. These can be thought of as both internal and external forces, and they can have an impact on both economic, environmental, social and territorial aspects of a region.

The following factors are thought about in relation to the analysis of territorial potential for greening of the agricultural sector at regional scale in Europe.

Factor	<i>Consumer awareness and demand changes. (Consumption of organic products and less consumption of meat and dairy products)</i>
Description	<p>More specifically “what” we consume and “how” it is produced. Also how much is wasted.</p> <p>Obviously, many of the benefits of organic farming relates to the aspects brought forward as the main components of greening the entire agricultural sector. Specifically, according to the Commission communication COM (2004:415) the main benefits of organic farming relate to:</p> <ul style="list-style-type: none"> •Pesticides •Plant nutrients •Soil protection •Biodiversity and nature protection •Animal welfare <p>Facts and figures from the EU show that an increasing part of agricultural area is now devoted to organic production, with an estimated 7.6 mio ha in 2008, i.e. 4.3% of EU-27 utilised agricultural area (UAA). In the period 2000-2008, the average annual rate of growth was 6.7% in the EU-15 and 20.0% in the EU-12. The area under organic agriculture is close to or higher than 9% of the total UAA in five Member States: the Czech Republic, Estonia, Latvia, Austria (15.5%) and Sweden. In 2008, it is estimated that there were about 197 000 holdings involved in organic agriculture in the EU-27, i.e. 1.4% of all EU-27 holdings. Consumer food demand grows at a fast pace in the largest EU markets, yet the organic sector does not</p>

represent more than 2% of total food expenses in the EU-15 in 2007.



Map: Share of organic area in total UAA in 2007. Source: Eurostat farm structure survey.

It is evident from looking at the relationship between GDP and protein consumption that we consume more protein the richer we get. Obviously there are some cultural and ethical differences to such patterns but the overall picture is such. As the prosperity of the EU has increased the trend is towards consuming more dairy, pig meat and poultry. The consumption of other protein products per capita is rather stable since the 1960s. Over all the intake of protein in the EU is well above the recommendations made by the world health organisation, in fact it is almost the double. Hence a cut-back on meat would be beneficial not only for the environment and resource base – but also for human wellbeing. The fact that over-consumption of meat and other protein product causes severe problems for the environment is due to multiple reasons. It involves both feed production (inputs such as land, water and other resources), manure nitrogen leakage, land use for grazing, greenhouse gas emissions from animals, etc. The most severe impact for GHG emissions are from beef and veal, dairy cows and pigs sectors. Poultry and egg

	<p>production have less of an impact. The picture is the same when it comes to feed use per sector. But here dairy cows are using more inputs compared to beef and pigs (looking at overall sectors and not per kg of produce). The picture for land consumption is the same. The land used for dairy production in EU is actually almost the same as that used for crops for human consumption.</p> <p>When it comes to waste the most important losses appear in the production of beef. From a 500 kg cow there is only 180 kg reaching the consumer. For a 2 kg chicken the loss is 1 kg. The problems of food waste in developed countries are primarily in private homes, retail stores, transport and food services. The EU food manufacturing sector and households alone waste about 90 million tonnes of food annually or 180 kg per person, not taking into account losses in agriculture and fisheries. This has a huge impact on the amount of resources used in this sector; resources which are in fact wasted (or to some extent transferred through the energy intensive food production and consumption process - to energy production; if waste is used for heat or fuel production).</p>
Specificity for the green economy	<p>Organic production is specific to the green “sub-set” of the sector. In many definitions this is in fact the most straight forward definition of how to classify labour in agriculture as being part of the green economy.</p> <p>Many believe that organic farming is one type of farm practice that can help in greening the agricultural sector. This is not a straight forward analysis though since some evidence question the possibility to produce enough food globally (using organic fertilisers and non-chemical ways to prevent pests) and the total effect on the environment given more use of machinery in relation to the size of the harvest. This depends heavily on the fuel for machinery and equipment as well as natural circumstances and crops grown. Anyway, organic farming (in Europe) relies on a number of objectives and principles, as well as common practices designed to minimise the human impact on the environment, while ensuring the agricultural system operates as naturally as possible.</p>
Provable impact on the green economy spheres	<p>Specifically, according to the Commission communication COM (2004:415) the main benefits of organic farming relate to:</p> <ul style="list-style-type: none"> •Pesticides: research indicates that organic farming has, on average, a greater effect on the improvement of the landscape, wildlife conservation and faunal and floral diversity than non-organic farming systems. Restricting the use of pesticides, as is the case in organic farming, also improves water quality and fewer pesticide residues are found in food products. •Plant nutrients: organic farming usually results in lower nitrate-leaching rates than those achieved on average in integrated or non-

	<p>organic agriculture, as shown by studies on autumn nitrogen residues in the soil of almost all relevant crops.</p> <ul style="list-style-type: none"> •Soil protection: management practices broadly used by organic farmers, such as growing catch crops to reduce nitrate leaching, wider and more varied crop rotations, and mixed grazing to reduce mono-specific overgrazing, all help to protect the soil. Although the organic matter content of soil is highly site-specific, it is usually higher on organic compared to non-organic farms. •Biodiversity and nature protection: organic farming contributes to the preservation of species and natural habitats by means of its reduced inputs, its high share of grassland within holdings and its greater use of indigenous breeds and plant varieties. •Animal welfare: organic farming may have a positive impact on animal welfare since the standards for organic farming include several requirements in this area that go further than the statutory provisions.
Trade-offs: mixed +/- impacts on green economic spheres?	
Externalities: impact on other sectors / case studies	Unknown
Interactions with other factors	<p>This factor interacts with many of the other factors brought forward for the agricultural sector. For instance “Policies and institutional capacity at the regional level” is important in shaping the awareness of consumers (as well as producers). Even the fact that there is government policy towards greening of agriculture (agri-environmental support schemes, schemes for organic production and marketing, etc.) can/might lead to a shift in the awareness and attitudes of consumers. Also the prevalence and activity of “local networks and local initiatives” supporting a transition of both the supply and demand side of the agricultural economy is important since it helps to bring these products to local markets (farmers market initiatives, transition days, etc.) and it adds to the awareness of all consumers. It can also impact on the availability of local meat products where animals are fed using grazing rather than imported feed products; this has for instance been a large product for the WWF internationally.</p> <p>“Urban and rural interactions” can obviously be an important interaction between these factors since the change in consumer behaviour will have to take place in urban areas – based on their understanding of something that is (most of the time) taking place in rural areas.</p>

Causal level of operation (proximate/direct versus underlying/indirect factors)	This could perhaps be thought of as an indirect force (?) The feedback is through the choices of consumers – via markets – to the production choices of farmers.
Spatial level of operation (internal versus external factors)	This is a spatial factor since it is also much related to level of economic progress and the cultural and historical differences between places. The level of economic development is linked to some respect to awareness and the possibility to devote time and money to consuming eco-friendly products. But the consumption of meat is adversely related to the same – more income means more meat as shown at the national level.
Type of market force involved	The change in awareness is primarily a demand side factor that can be worked on in different regions to form a factor for change. The organic production is a supply side factor as well because it is as much about finding ways to keep up production while being less input intensive and new ways for fertilizing and pest control. These are really direct aspects of greening of agriculture and require supply side innovation both in technology and know-how.
Policy recommendations: making the link between policy and non-policy factors	<p>On the “consumption side” the EU is working with awareness programs, web-portals and certification schemes.</p> <p>There are many regulations/com on the supply and market sides:</p> <p>Regulation of the European Parliament and of the Council on organic production and labelling of organic products – Review of EU political and legal framework for organic production in particular Council Regulation (EC) N° 834/2007 and European Action Plan for organic farming of 2004</p> <p>Communication from the Commission to the Council and the European Parliament of 10 June 2004 - "European Action Plan for Organic Food and Farming" [COM(2004) 415]</p> <p>Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91</p>
Possible indicators	It is difficult to think of the indicators to measure the factors of potential. There are indicators for current performance. This could for instance be measured as the share of organic products in the consumption of food products. The composition of food consumption

	where the consumption of meat products on a to large scale will have a negative feed-back effect to producers and the greening of the sector. The waste could be measured as the proportion of food that is discarded at home, in the supply-demand chain, or in food away from home establishments.

Factor	<i>Labour and skills development and the availability of capacity in a region for the restructuring of the agricultural sector.</i>
Description	<p>Labour and skills development - and the availability of capacity in a region for the restructuring of the agricultural sector – are important factors for a transition to a green farming sector that builds on an understanding of how production impacts society and nature. Innovation does not have to be from within a region – but the application of innovation and the adaption of it to local circumstances have to be. Such factors are important for adopting new technology, new know-how and for producing within the boundaries in each territorial context. For instance, for the Mediterranean region it dictates the ability to develop (or adopt existing technologies) for water management and intelligent irrigation.</p> <p>In agriculture as in other sectors, active labour market policies including skills training are essential for helping workers make structural transitions. The adaptive capacity of labour markets in agriculture may be more limited than in other sectors owing to the narrower focus of farming and also location-specific factors. Safety nets for farmers and farm workers should be in place. Public initiatives to train rural workers in green skills such as retro-fitting farm buildings, landscape and habitat preservation, and renewable energy production are needed. Farmers will generally benefit from vocational training and gaining basic business skills in human resource management, networking and market development. Agriculture could also learn from looking at the fishery sector. In the fisheries sector, government efforts to facilitate adjustment have tended to focus on short-term efforts to finance alternative employment for redundant workers. These are generally introduced as an adjunct to capacity adjustment programmes given that vessel reduction is usually the main focus of policy reform. A longer-term issue is to ensure that governments develop broader and coherent set of policy signals for fishing communities so that adjustment occurs smoothly and largely autonomously in the future. Such policies are an essential complement to ensuring</p>

	that the adaptability and resilience of fishing communities are strengthened over time. The management arrangements for fisheries will also play a major role in ensuring the resilience of the fishing sector as it is essential that fisheries management policy and labour market policies are mutually supportive.
Specificity for the green economy	This factor is definitely not specific for the green subset of the sector. Development of the sector more broadly (efficiency, structural change, becoming more professional as managers, improving value added) requires the same set of regional factors.
Provable impact on the green economy spheres	No evidence has been found in the work on the sector report on how the factor has impacted the transition to green agriculture at the regional level thus far.
Trade-offs: mixed +/- impacts on green economic spheres?	
Externalities: impact on other sectors / case studies	There could be. The development of skills and enterprises in the farm sector will probably have an impact on at least the tourism sector and the energy sector. Farmers that have knowledge about the restructuring of the sector are (I should say perhaps because there is no reference to this in the sector report) perhaps more prone to pick up diversification activities to broaden their firm and develop such activities as agri-tourism and bioenergy production.
Interactions with other factors	<p>"Urban and rural interactions" are probably important in the development of the labour force and skills in agriculture. There is a need for a link between knowledge institutions and extension services and these are usually situated in more urban settings. But this is just a basic information interaction and perhaps not what is envisaged in the interaction of urban and rural areas from a geographical perspective.</p> <p>"Local networks and local initiatives" supporting a transition of both the supply and demand side of the agricultural economy can play a role in developing the labour market and skills. Local networks can be farmers themselves – but it can also be local action groups that want to have an impact on the sector.</p>
Causal level of operation (proximate/direct versus	This is probably best defined as a direct factor since it will have a direct impact on the decisions made on the farm.

underlying/indirect factors)	
Spatial level of operation (internal versus external factors)	Spatial level of operation (does the factor operate internally within territories (e.g. population growth in a given area), or is it rather a manifestation of an externally-driven force (e.g. climate change or globalization)?)
Type of market force involved	This is a supply side factor which impact the production side of the sector and how production is structured both in the short and long run. In the short run programs and interventions can impact on the management practices of the sector and the choices made by farmers in the day to day production of food and fibre. In the long run the impact can be on buildings, farm types, supply chains, and many other structural aspect of the sector.
Policy recommendations: making the link between policy and non-policy factors	<p>There are clear links to a policy factor here. In the CAP pillar II there are explicit schemes for developing the labour force and skills of farmers and farm workers. Measures aimed at promoting knowledge and improving human potential through:</p> <ul style="list-style-type: none"> •vocational training and information actions, •schemes promoting the establishment of young farmers (people under 40 years of age setting up for the first time as the head of a holding) and the structural adaptation of their holdings, •early retirement for farmers deciding to cease activities with the aim of transferring their holding to other farmers, and agricultural workers who decide to definitively cease all agricultural activities. In general, beneficiaries must be at least 55 years old, but below the regular age of retirement in the Member State concerned, •the use of advisory services by farmers and forest holders and the establishment of advisory services, farm relief and farm management support services. The use of these services should help assess and improve the performance of their holdings;
Possible indicators	<p>There are some indicators from Eurostat on the Agricultural training of farm managers, but it is only at the national level. Uptake/participation in the programs of the CAP should be possible to pick up at the national level as well – at least how much money are spent in each country (and perhaps region) on the development of the labour force.</p> <p>It could be interesting to use results/typology from the ESPON KIT project to say something about the backdrop of adaptive capacity when it comes to region. It could say something about the ability of the region to pick up technology, innovative practices, marketing</p>

	mechanisms, market structure, etc. (but I don't know if the "hard core" innovation definitions in such a project would apply nicely to agricultural practise?)

Factor	<i>Local networks and local initiatives supporting a transition of both the supply and demand side of the agricultural economy.</i>
Description	<p>This factor has not been brought forward so much in the sector report but it seems as an important factor at the regional level. It can be understood both as networks of farmers, networks between farmers and regional authorities, networks of other local action groups, or combinations of any of these. The merits of such networks in relation to the greening of agriculture can be either in supply side aspects (adoption of new practices or technique, participation in EU or national schemes, developing new products or markets, etc.) or it can be towards the demand side (to inform consumers, or if the network is consumers - they can put pressure on the supply side).</p> <p>From a policy perspective the power of setting up regional networks to deal with all of these issues have been manifested through for instance LEADER in the CAP pillar II. The aid allocated under the LEADER axis relates to:</p> <ul style="list-style-type: none"> • the implementation of local development strategies through public-private partnerships called "local action groups". The strategies applied to clearly designated rural territories must achieve the objectives of at least one of the three preceding axes; • the local action groups also have the option to implement inter-territorial or transnational cooperation projects. <p>The method was first introduced in 1991 as a tool to implement rural development in an alternative and more flexible way. The aim was to encourage innovative solutions to old and new rural problems. The method is based on stimulating solutions or projects that can then be transferred to other regions, the model value and the dissemination of information is thus paramount. In 1991 LEADER was not a part of the Common Agricultural Policy (CAP), but the method and the funding was integrated into the</p>

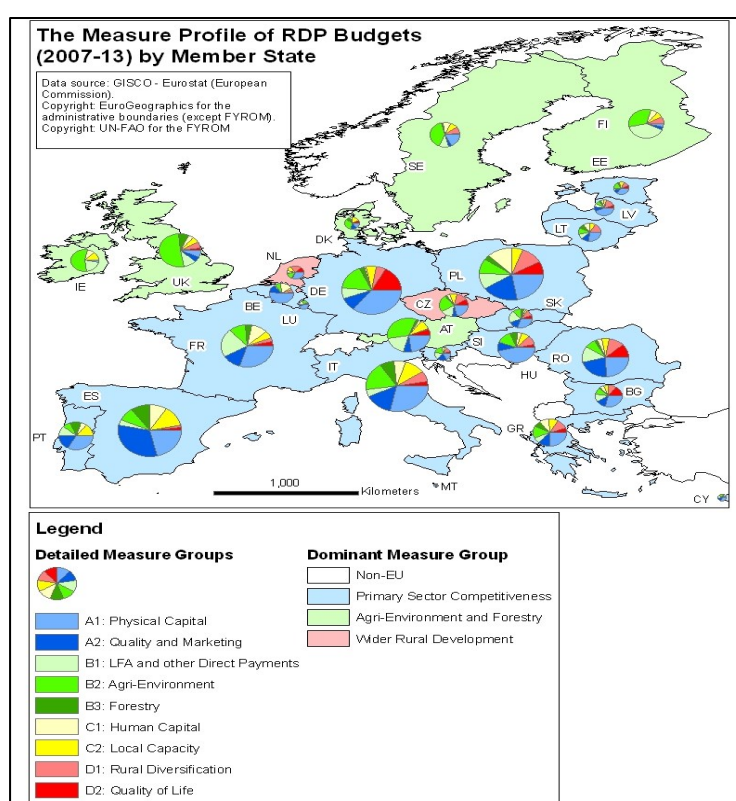
	<p>CAP's second pillar for the period 2007 -2013. Within the GREECO project we should consider some of the fundamentals of the LEADER approach as a possibility for understanding governance structures for pursuing a local (or place based) development of green growth. LEADER is widely considered a success in pursuing a place based rural development within the rural development programs.</p> <p>LEADER aims to promote the effective implementation of the Rural Development Programme by the added value of local support, influence and cooperation. Through a local mobilisation of endogenous (intrinsic / site specific / idiosyncratic) development potential the goal is to implement rural development policies based on a holistic view of the countryside. The aim of LEADER is thus to contribute to overall rural program goals and (sustainability). You could say that the "intervention logic" is "territorial" rather than to have a sector specific approach. There are specific geographic areas and LEADER is going across traditional administrative boundaries and is based on local resources, conditions, local "capital", available in each region. It is also important with a "model value" and "transferability" of practice and experience. I.e. transfer of operational projects (with an understanding of the conditions that led to the results) but also the transfer of work and training. This can be related to the green growth process as well where it is important with a transfer of ideas and solutions, as well as policy solutions. Intervention in LEADER works through both the projects that are actually carried out (actual expenditure) and through relationships, learning and community involvement. It has become widely acknowledged that results in terms of outcomes goes beyond the traditional indicators when it comes to this kind of interventions. Obviously there should be results and effects associated with the projects and programs quantitatively measurable objectives. But it is also acknowledged that it is difficult to measure the impact that activities and practices initiates learning and knowledge, interaction and relationships, local organisation and embedding of project activities in their local environment.</p> <p>If we consider the keywords within the LEADER implementation idea we see that they are also close at hand for a discussion about regional/territorial green growth processes: Local partnerships, bottom-up approach, multisectoral collaboration, decentralised decision making and financing, transnational cooperation, exchange of ideas and practices, Networking, Good Governance, Social Capital, Learning regions, Endogenous development potential.</p>
Specificity for the green economy	<p>This factor is definitely not specific for the green subset of the sector. The occurrence of regional networks are as important for developing</p>

	the farming more generally as well.
Provable impact on the green economy spheres	<p>Since the CAP is such an important policy, and the LEADER is one program within it, it would be wise to look at the impact of such schemes in this respect. All countries have to do such evaluations but looking at all of them is a to grand task (however the commission synthesises all evaluations and there will be results available for this program period after it ends in 2013). Nordregio have looked at the evaluation (half time) for the Nordic countries. According to all the Nordic evaluations important positive impacts have been achieved in terms of increased cooperation and networking, the encouragement of entrepreneurship and development of small firms. The supports to building competence and skills are generally seen as a success and tourism and the production of bio-energy have also been boosted by the programme in some regions (notably Finland). According to the Danish evaluation Leader has contributed to mobilizing human and financial resources that presumably otherwise wouldn't have been active, value added has increased in the agricultural sector and the productivity in agriculture and food has also increased. In Finland the significant role that the Leader method has had in activating local inhabitants and enterprises, and producing positive impacts on the demographics of the countryside, is emphasised. The Leader method is considered the most efficient tool in reinforcing the development potential of each rural area.</p>
Trade-offs: mixed +/- impacts on green economic spheres?	
Externalities: impact on other sectors / case studies	
Interactions with other factors	<p>This factor probably interacts in a positive way with “consumer awareness and demand changes”, “labour and skills development and the availability of capacity in a region for the restructuring of the agricultural sector” as well as improving the “institutional capacity at the regional level”.</p>
Causal level of operation (proximate/direct versus underlying/indirect factors)	<p>This probably best defined as an indirect factor since the impact will have to be later on in the actual decisions of farmers – or in the mind of consumers.</p>

Spatial level of operation (internal versus external factors)	Internal; this is really about the endogenous development potential of a region and the way such potential is defines, acted upon and integrated in different processes.
Type of market force involved	Can be both. Either on supply side aspects (adoption of new practices or technique, participation in EU or national schemes, developing new products or markets, etc.) or it can be towards the demand side (to inform consumers, or if the network is consumers - they can put pressure on the supply side).
Policy recommendations: making the link between policy and non-policy factors	
Possible indicators	The information from the countries on the implementation and effectiveness of LEADER can be one type of indicator here. Also, if there are other information about the occurrence of networks at national or regional level (but it is generally difficult to find out what such networks are working on explicitly in relation to greening of the sector and what kind of interaction they might have with farmers).

Factor	Heterogeneous application of CAP Policies at the national/regional level.
Description	By this factor it is meant the CAP agri-environmental policy and the way it is implemented and used at the regional scale. The fact that this factor is included here, although it is a policy, is the fact that it is used in such a different way in different countries and regions. The same policy package is available at the European scale for all countries, but they have a very high degree of autonomy in applying these schemes at the national level. In some countries the focus have been more on renewal in the agricultural “conventional production” and on developing enterprises from a competitiveness perspective. In other countries the focus has been on agri-environmental measures and providing funding for provision of environmental and cultural public goods. This will provide a large different for what prerequisites that have been

created in regions during the last 10-15 years for how to respond do the challenge or greening the agricultural sector. In countries that have invested in environmental payments there might be a scope for utilising such features now in the development of greener agriculture – for instance in Sweden the evaluators of the RDP have stressed this aspect of utilising such values and resources in the future sustainable development of farm enterprises. In countries that have focused on primary sector competitiveness there might be a larger scope for developing new products, marketing schemes, adopting new technologies, etc. Wider rural initiatives could give a local capacity to work together, and integrate strategies for local greening of many strands of society.



Map: The different profiles of countries when it comes to the application of CAP pillar II funding. Source: RuDi project.

Specificity for the green economy

This factor is extremely specific for the greening of the sector. Also the schemes that have to do with primary sector competitiveness have the overall ambition to improve the capabilities of the firms from a sustainable perspective. Obviously the agri-environmental schemes have this perspective more clearly. Rural development schemes capture in a more explicit way also the social aspects of greening of agriculture.

Provable impact on the green economy spheres	From the national evaluations of the programs there are clear evidence on the positive impact of schemes on the development of the sector. It is extremely difficult to gain a large overview on the European scale but in general it is perceived that the impact for positive environmental impacts, and for mitigating negative externalities, is important. In the context of developing businesses and competitiveness the investment support might crowd out ordinary channels for funding and create dead-weight. Project support for improving competitiveness through learning and networking (and building human capital) is more difficult to assess. The rural development support and mobilisation of actors and resources in rural areas is generally perceived as positive, especially through LEADER.
Trade-offs: mixed +/- impacts on green economic spheres?	
Externalities: impact on other sectors / case studies	The “direct” impact of CAP spending on other sectors is very limited. “Indirect” impacts are profound since agriculture has such a large impact on the landscape and on the supply –demand chain before and after the farm itself.
Interactions with other factors	Yes, it relates to “Consumer awareness”, “Labour and skills development and the availability of capacity in a region for the restructuring of the agricultural sector”, “Local networks and local initiatives” and, “Land and land-based resources”
Causal level of operation (proximate/direct versus underlying/indirect factors)	It could be defined as a direct factor in that it requires the farmer to do something very specific to receive the funding. If the farmer participates in a scheme to create a wetland, the wetland has to be created and it is not up to some indirect effect. But there are probably indirect effects as well, some studies have investigated the change in farmers perceptions from participating over a longer period of time in stewardship schemes. Hence, the long run green economy impact might be an indirect one.
Spatial level of operation (internal versus external factors)	This is an internal factor which is specific for countries or even regions.
Type of market	- a policy factor

force involved	
Policy recommendations: making the link between policy and non-policy factors	
Possible indicators	It is possible as the RuDi project demonstrated to look at the country profiles for how the support from Pillar II has been implemented.

Annex 3. Measures available in CAP Pillar II (RDPs)

Axis 1	111	Vocational training, information actions, including diffusion of scientific knowledge and innovative practices for persons engaged in the agricultural, food and forestry sectors
	112	Setting up young farmers
	113	Early retirement of farmers and farm workers
	114	Use by farmers and forest holders of advisory services
	115	Setting up farm management, farm relief and farm advisory services, as well as forestry advisory services
	121	Farm modernisation
	122	Improving the economic value of the forest
	123	Adding value to agricultural and forestry products
	124	Cooperation for development of new products, processes and technologies in the agricultural and food sector
	125	Improving and developing infrastructure related to the development and adaptation of agriculture and forestry
	126	Restoring agr. production potential damaged by natural disasters and introducing appropriate prevention actions
	131	Helping farmers to adapt to demanding standards based on Community legislation
	132	Supporting farmers who participate in food quality schemes
	133	Supporting producer groups for information and promotion activities for products under food quality schemes
	141	Supporting semi-subsistence farms undergoing restructuring
	142	Setting up of producer groups
	143	Provision of farm advisory and extension services in Bulgaria and Romania
	144	Holdings undergoing restructuring due to a reform of a common market organisation
Axis 2	211	Natural handicap payments to farmers in mountain areas
	212	Payments to farmers in areas with handicaps, other than mountain areas
	213	Natura 2000 payments and payments linked to Directive 2000/60/EC
	214	Agri-environmental payments
	215	Animal welfare payments
	216	Support for non-productive investments
	221	First afforestation of agricultural land
	222	First establishment of agroforestry systems on agricultural land
	223	First afforestation of non-agricultural land
	224	Natura 2000 payments
	225	Forest environment payments
	226	Restoring forestry potential and introducing prevention actions
	227	Support for non-productive investments
Axis 3	311	Diversification into non-agricultural activities
	312	Support for the creation and development of micro-enterprises
	313	Encouragement of tourism activities
	321	Basic services for the economy and rural population
	322	Village renewal and development
	323	Conservation and upgrading of the rural heritage
	331	Training and information for economic actors operating in the field covered by Axis 3
	341	Skills acquisition and animation with a view to preparing and implementing a local development strategy
Axis 4	411	Local development strategies. Competitiveness.
	412	Local development strategies. Environment/land management.
	413	Local development strategies. Quality of life/diversification.
	421	Transnational and inter-regional cooperation
	431	Running the local action group, skills acquisition, animation
	511	Technical assistance
	611	Complements to direct payments for Bulgaria and Romania

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