4 – Sustainable Europe

Policy relevant key findings:

- Achieving the Europe 2020 aspiration for economic recovery involves more than a return to where Europe was before the crises. There is a need for "a more resource efficient, greener and more competitive economy". The EU has 7.7% of the world's population, and accounts for 16% of the world's ecological footprint. In effect, the EU currently depends on the ecological reserves of other parts of the world.

- The effects of climate change for Europe's regions, their people and economies range from considerable challenges to new development potentials. In particular regions with a strong focus on agriculture, forestry and winter sports tourism are highly sensitive to changes in climate.

- Extreme weather events such as floods or storms can damage infrastructure and set back development in all kinds of regions. The location of 70% of Europe's largest cities in areas less than 10 meters above sea level underlines the importance of climate change adaptation and mitigation to Europe's economies.

- Many regions with the biggest potentials to tap energy from wind are located in Northern Europe and some of them are perceived as peripherally located regions. Transmission to the main energy consumption area is therefore one of the connections that needs to be made.

- Scenarios for a sustainable Europe suggest that most of the initial impact is led by the metropolitan regions, especially in Western Europe, where the main investments in new technologies are expected to be made, and thereafter disseminated to second and third tier cities. Furthermore, urban areas with strong urbanization trends and less developed public transport will be more challenged than others.

Sustainable growth is seen as a key part of the Europe 2020 vision. Economic recovery requires "a more resource efficient, greener and more competitive economy". European leadership in green technologies, backed by consumers who value resource efficiency can create new economic opportunities. By developing clean and efficient energy, Europe can reduce its imports of oil and gas and enhance its energy security. Green industries can create new jobs. Thus initiatives to tackle climate change or to make more efficient use of resources should no longer be seen only as the concern of environmentalists: rather economic recovery plans at all scales from the EU to the local need to include such measures.

The EU has set "20 / 20 / 20" targets for 2020. These are:

- A reduction in greenhouse gas emissions by at least 20% compared to 1990 levels.
- To develop renewable energy resources so that they account for 20% of our final energy consumption.
- A 20% increase in energy efficiency.

In addition, the goal of a true internal market in electricity and gas is now within reach. This will move Europe towards a low carbon economy. It will facilitate integration of renewable energy sources, and strengthen the European territorial dimension in the planning of networks.
Thus in recovering from the economic and financial crisis, Europe is also trying to shift towards a new type of economy. The idea of "Sustainable Europe" encapsulates this new direction. Territorial analysis undertaken through ESPON can assist this process of development and change. Traditionally regional policy sought to make regions richer but paid less attention to problems of congestion

and pollution that can be by-products of a rise in GDP. While GDP per capita will remain an important performance indicator nationally and regionally, measuring progress towards Sustainable Europe requires new thinking.

The well-known 'sustainability triangle' argues for a balance between the economic, the social and the environmental. Similarly, the idea of policy integration, which is so central to the territorial approach, implies the ambition to combine benefits in GDP growth with other claims on resources, such as those related to the environment or to social inclusion. Sustainable Europe means creating a synergy between these factors. As well as measuring the proportion of GDP invested in R&D, the five targets set in Europe 2020 call for measures of employment rates, greenhouse gas reductions, educational attainment and poverty reduction.

4.1 Europe's ecological footprint

As well as looking inwards to Europe, it is necessary to look outwards and understand Europe's position in the world. Some basic statistics show why economic recovery has to do more than return Europe to where it was before the crisis began. The EU has 7.7 % of the world's population, and contains 9.5 % of the world's biocapacity. Biocapacity is the capacity of ecosystems to produce useful biological materials and to absorb waste materials generated by humans, using current management schemes and extraction technologies. However, despite having above average biocapacity in relation to population, the EU still accounts for about 16 % of the world's ecological footprint. In other words, , the economic and social development in the EU countries depends on the ecological reserves of other parts of the globe. With the whole earth stretched ecologically and getting by through a strategy of eating into its resources, policy makers at all levels need to consider the ecological footprint of their territory.

The challenge is how to reduce the ecological footprint without losing the high level of economic and human development. The chapter addresses this question by looking at evidence and the scope for territorial policy to make a difference in four issues: climate change, urban sprawl, energy and conservation and clever use of landscape assets.

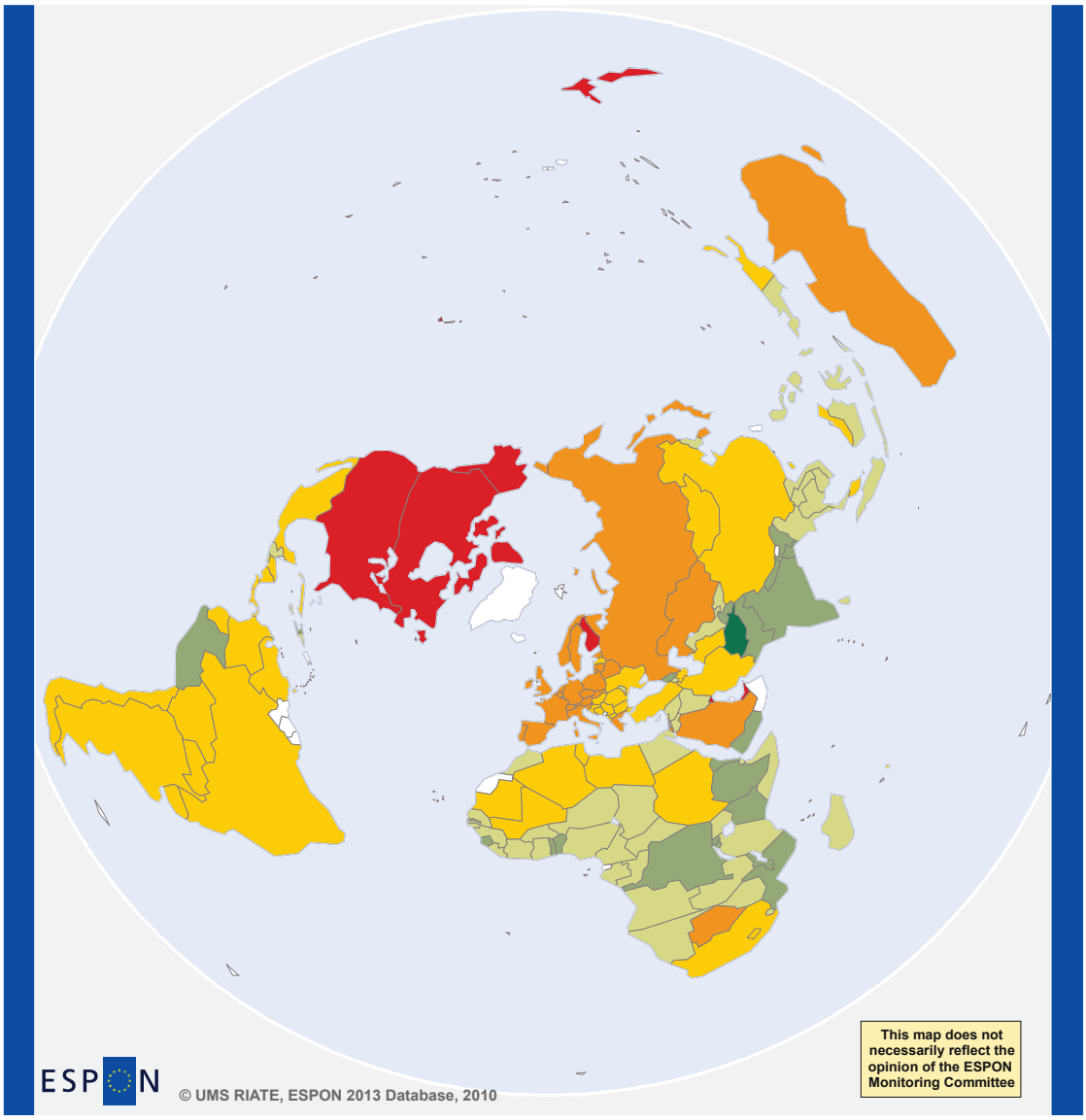
Box XII. Understanding the ecological footprint and human development index

The ecological footprint of a country is a resource accounting tool that shows a country's ecological balance sheet, and the pressure the country puts on the planet. The Global Footprint Network publishes these accounts annually for 201 nations of the world. The measure used is global hectares per person (gha); a gha is a hectare with global average ability to produce resources and absorb wastes. Europe's supply is about 2.2 gha per person, but its consumption is more than double that, and has more than doubled since the 1960s.

If all of the world lived like Europeans, it would need two planets to provide the necessary resources and to absorb the wastes (including CO2 emissions) and to leave some space for wild species. Ecologically Europe is running a deficit and is being bailed out by the poor countries of the Global south with ecological surpluses. The good news is that in Europe some decoupling of the footprint from GDP has taken place - but the bad news is that the index of the footprint is still rising more than the index for population numbers.

The human development index (HDI) offers an alternative to GDP as a combined indicator of human well-being and provides a useful entry point into information covering different aspects of human development. The human development index of the United Nations measures the average achievements in a country on three basic dimensions of human development (a) a long and healthy life (measured by life expectancy at birth), (b) knowledge (measured by the adult literacy rate and the combined gross enrolment ratio for primary, secondary and tertiary schools), (c) a decent standard of living (measured by the logarithm of GDP per capita in ppp). The index is constructed by the United Nations using indicators currently available worldwide, and it is widely accepted as a useful international measure of human well-being.

Map 21. Ecological footprint, 2006



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Source: http://geodata.grid.unep.ch, 2010
Origin of data: Ecological Footprint and biocapacity (2006 Edition)
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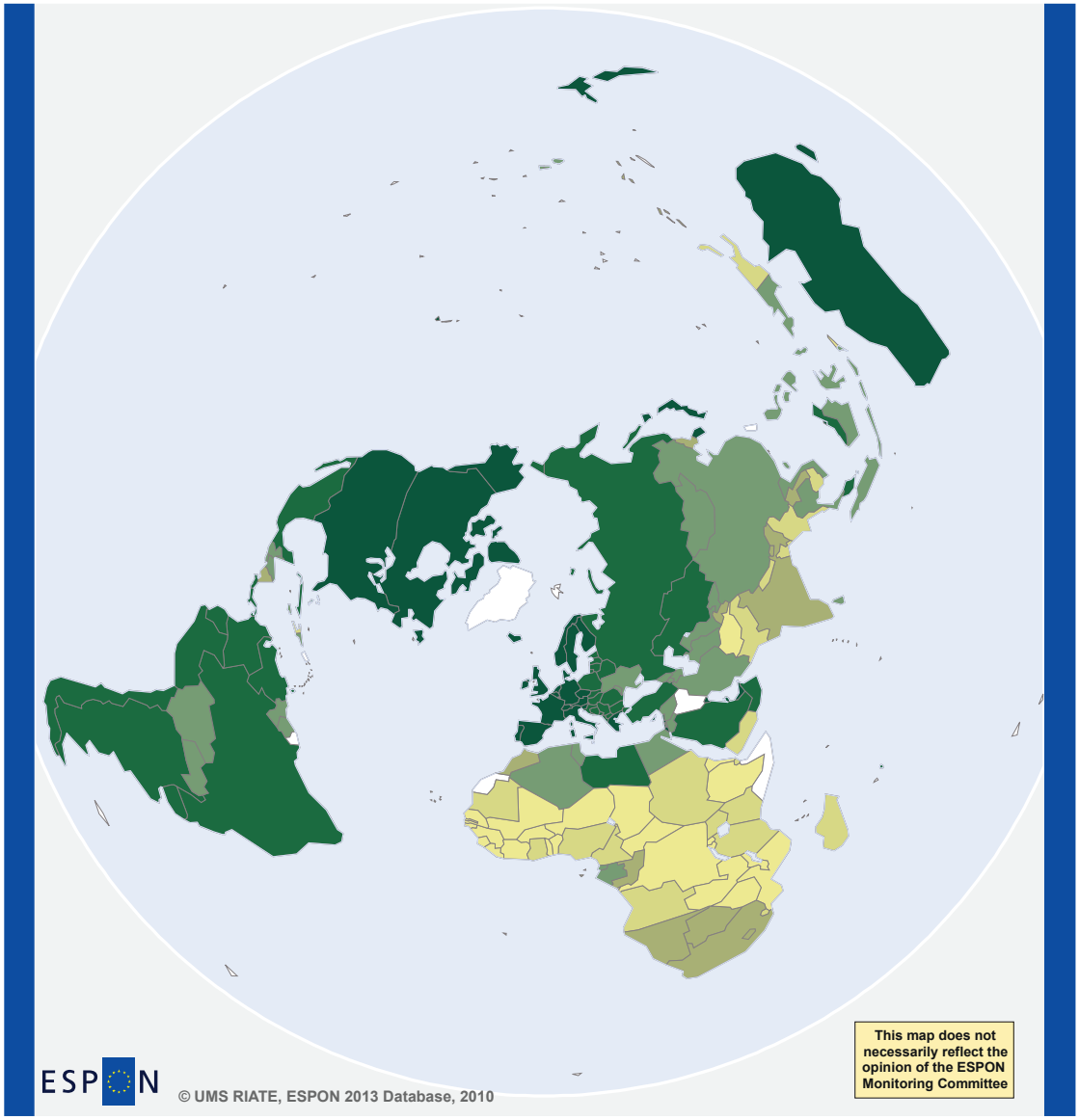
Ecological footprint, 2006
Global hectares per capita
devided by biocapacity (1.8 gha/hab)

5.7
4
2
1
> 1 planet

0.5
0.2
0
< 1 planet

No data

Map 22. Human Development Index, 2007



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Sources: http://geodata.grid.unep.ch/, 2010;
http://hdr.undp.org/en/statistics/, 2010
Origin of data: Human development report
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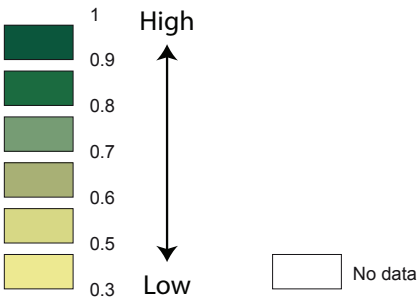
Human Development Index (HDI), 2007



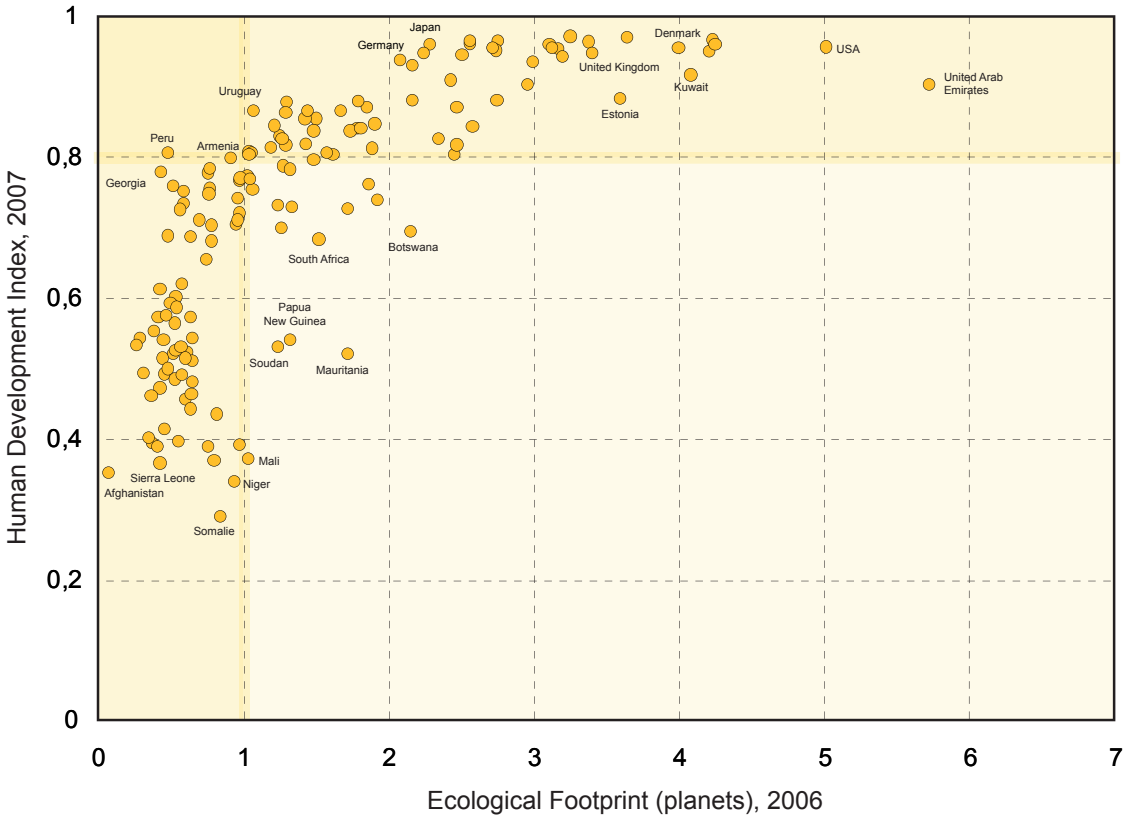
The scattergram and the maps show the global picture for countries in respect of the Human Development Index (HDI) and the country's ecological footprint.

The maps show that as the HDI increases above a certain level so does the ecological footprint. In 1995 Slovenia was the only European nation that had achieved an HDI score of over 0.8 and had an ecological footprint of less than the biocapacity available per person globally. However by 2003 its footprint had more than doubled to 3.42 gha, while its HDI had only increased from 0.86 to 0.9. Finland's footprint at 7.64 gha per person stands out on the map. However, along with Latvia and Sweden, it is one of only 3 EU countries to be an ecological creditor. This is because of its abundance of natural resources.

Germany has managed to stabilise its footprint despite increasing population. Germany has reduced the amount of coal it uses and is a world leader in renewable energy. Romania has the lowest ecological footprint of EU27. At 2.4 gha per person it is only just above the global average. The trend across Europe is that biocapacity is increasing as technology improves and creates efficiencies and as agriculture becomes more intensive. However the rate of increase is not keeping pace with the growth of consumption. Within consumption it is energy use - domestically, in transport and in businesses - that is the main driver of the rise.

It is also possible to do similar calculations for cities and regions. For example, in London the analysis was used to identify areas where high footprint reduction impacts could be made. An analysis has also been done for the ecological footprint of the Province of Milan. It found that the footprint score for the Province was 4.17 gha per inhabitant, a figure slightly above the national average for Italy which was 4.15 gha. By analysing footprints at these scales it is possible for local and regional governments to work together with local businesses to identify ways forward.

Human Welfare and Ecological Footprint compared



The scattergram has the 2007 HDI on the vertical axis, while the horizontal axis is the ecological footprint. Then countries are plotted by their scores on each of these two measures. The ideal is to be in the top left-hand corner, where the HDI is high, but the ecological footprint remains relatively low. The United Nations considers an HDI of over 0.8 to be "high human development." The global average Ecological Footprint would be 1.8 global hectares per person. Thus a country with an HDI of over 0.8 and a footprint score of less than 1.8 gha per person could be seen as achieving sustainable development. None manage this.

In terms of the HDI, in the 2009 rankings Norway leads the whole world, with Iceland in third place. Other highly-placed ESPON countries are Ireland (5), Netherlands (6), Sweden (7), France (8), Switzerland (9), Luxembourg (11), Finland (12), Austria (14), Spain (15), Denmark (16), Belgium (17), Italy (18), Liechtenstein (19), UK (21), Germany (22), and Greece (25). Five more ESPON countries are with these in the group of 38 countries ranked as having a very high HDI. The remaining countries in ESPON all feature in the next band with a high HDI, the lowest ranked being Romania at 63 globally. In other words together the 31 ESPON countries account for just about half of the top ranked-countries in the world.

4.2 Climate change and the regional economies

Europe 2020 calls for "a vision of structural and technological changes required to move to a low carbon, resource efficient and climate resilient economy by 2050". The transition will enable Europe to meet its emissions reductions targets. It will include new business development to sustain Europe's leading role in green technologies in the face of international competition, but also disaster prevention and response, and adaptation measures based on more efficient use of resources. Gathering of evidence about the potential territorial effects of climate change on regions and local economies can help to identify the threats and also the opportunities.

Box XIII. Towards a climate change scenario

Data from a model developed by the German Weather Service (the COSMO-CLM or CCLM model) was used to model the patterns of future climate change across the European territory. This was done for periods from 2011-2040, 2041-2070 and then 2071-2100. The Intergovernmental Panel on Climate Change scenario that was used was called A1B. The A1 scenario assumes Business as Usual, with very rapid economic growth, and a global population peaking at 9 billion in 2050, but then falling back gradually, a quick spread of new and efficient technologies, and convergence between regional incomes and lifestyles, as well as extensive social and cultural interaction worldwide. The A1B scenario then assumes a balance in the use of energy resources, rather than intensive reliance on either fossil fuels or non-fossil fuels.

At world scale, rapid economic and population growth over the next decades and a balance in the use of energy resources, rather than an intensive reliance on fossil fuels, can be taken as framework conditions for a scenario consistent with the thinking about smart, sustainable and inclusive growth in Europe 2020.

Following such a scenario on climate change, and comparing averages for the periods 1961-90 and 2071-2100, the UK, Ireland, Denmark, parts of The Netherlands and northern parts of Germany experience the lowest temperature changes, but these are still up to an additional 3 degrees Celsius. Western and northern parts of France, Belgium, most parts of Germany, Poland, Czech Republic, Slovakia, Estonia, Latvia, Lithuania as well as southern parts of Sweden and Norway will be subject to temperature increases between 3 and 3.5 degrees Celsius, again comparing the 1961-90 averages with the predicted 2071-2100 averages. Southern and south-eastern Europe (except for some parts of Greece, Bulgaria and Romania) as well as Northern Scandinavia and Finland are projected to experience absolute changes of more than 3.5 degrees Celsius. Spain, parts of Portugal and parts of the Alpine space face temperature changes of more than 4 degrees Celsius according to the projections.

This warming affects the annual number of frost days that can be anticipated. The main impacts are likely to be in the northerly and eastern parts of Europe, with regional peaks of 60 less frost days on average in the period 2071-2100 compared to 1961-90. The mean number of summer days predicted shows the inverse picture. Summer remains short in the north and east, but extends still further in the south and west. Equally important is the prediction that the north of Europe will get wetter, while the south faces a drier climate. In particular, the west coast regions of Norway, UK, Ireland and the north of France face more days with heavy rainfalls. Snow cover is expected to decrease most in the Baltic States, Finland, Scandinavia and the Alpine regions.

Sea levels

Sea level rise has become a familiar concept associated with predictions of climate change. Mean sea level has risen 10-20 centimetres in the 20th century, and the IPCC expects sea levels to rise 30-50 centimetres by 2100. However, it is important to realise that sea level rise will not necessarily flood areas, because protective infrastructure such as dikes is already in place, though such infrastructure could come under increasing stress. Nevertheless, sea level rise could involve more than just inundation of land less than a meter above sea level. Among the effects that scientists have anticipated are: various types of shoreline erosion, saltwater intrusion, more extreme storm surge flooding, rising water tables and impeded drainage, changes in wetlands, loss of some habitats, and barrier island migration. However, it remains difficult to know just what impacts sea level rise will have in specific locations and also when theose impacts will come. This makes it more difficult to value the benefits of adaptation measures than it is to quantify the likely costs. This uncertainty complicates any economic assessment of the three main adaptation strategies which are:

- Protect the land from sea so that existing land uses can continue, by constructing hard structures (e.g. seawalls) as well as using soft measures (e.g. beach nourishment).
- Accommodate by continuing to occupy the land but making some adjustments (e.g. elevating buildings on piles, growing flood- or salt-tolerant crops.
- Retreat: a strategy which involves no attempt to protect the land from the sea. In an extreme case, the coastal area is abandoned.

While some adaptation measures will be taken by governments, it is likely that the majority will be actions taken by individuals and businesses. Of course exposure to the threat posed by sea level rise varies across Europe. In the Netherlands, for example, 60-70% of the country's population and economy is concentrated in areas at risk from flooding from the sea or from the rivers. In addition rising global temperatures and resulting sea level rise will affect freshwater availability and agriculture there.

Coastal acquifers
Low-lying coastal areas are a common feature of Europe's geography. For example, such coastal areas can be found in Finland (Baltic Sea), the Netherlands (North Sea), England (Atlantic Ocean), Spain (Mediterranean) and Romania (Black Sea). Many of these coastal areas are densely populated and economically highly developed. Both private and corporate water consumption depend to a large degree on coastal aquifers. The acquifers are important fopr drinking water and irrigation water for coastal populations and economies respectively. The most important climate change variables in relation to coastal acquifers are changes of sea water levels, precipitation, temperature and evaporation. A specific risk and threat for seashore acquifers is contamination due to salt water intrusion.

Climatic change and Europe's cities
While agriculture and tourism easily catch the eye in respect of climate change, it is the urban agglomerations that are really crucial. As seen in previous chapters, cities are the key engines of the global economy, they are where business and people are concentrated and so not surprisingly they contribute most to energy use and greenhouse gas emissions. The urban areas are therefore vital because of their economic vulnerability and because successful mitigation will require substantial changes in the way cities currently function.

A huge amount of Europe's fixed capital is invested in urban agglomerations. Such settlements are mainly on a coast or on the banks of great rivers that carry runoff from across a wide, often transnational water system. In Europe 70% of the largest cities have areas less than 10 meters above sea level. The urban areas in the north and west that are vulnerable to increased heavy precipitation face flood risks that could be extremely damaging in economic, social and environmental terms. Economically this could translate into serious disruption and loss of output, with additional consequences for the insurance industry at a time when financial services generally have been in crisis. The Association of British Insurers has estimated that claims for storm and flood damages in the UK doubled to over 6 billion pounds over the period 1998-2003, with the prospect of a further tripling by 2050.

Socially the cities are where most of the poor live, and the poor are least likely to be insured against or able to absorb the consequences of such climate shocks. Environmental impacts of floods include the washing of urban pollutants into water systems, reduced water quality in reservoirs, and health risks from failures of sewer networks and plants. Add in the extra vulnerability of urban areas to problems during spells of intense heat, and it is clear that there is a strong urban dimension to climate vulnerability, and a significant climate change dimension to Europe's future economic competitiveness.

One factor in urban growth is likely to be migration from rural regions, often outside Europe. According to the International Federation of the Red Cross, natural disasters are a bigger cause of population displacement than war and persecution. Rapid and unmanaged growth in urban populations can strain the availability of housing. There are important policy questions then at the urban and regional scale about how to plan for provision of affordable housing in locations where it will be in high demand.

Implications for regional economies

How might exposure to these types and scales of climate change affect regional economies? Much depends on the sensitivity of the region and its ability to adapt to change. Some sectors are very directly affected by the climate. Examples would be agriculture and forestry, but also some tourism sectors such as winter sports: the skiing season is likely to shorten in Central Europe. Thus regions where these economic activities are particularly important will have high sensitivity to exposure to the climatic changes outlined above.

In contrast, manufacturing activities and most services are not so directly affected by the climate. However, extreme weather events such as floods can badly disrupt business and cause expensive damage. Infrastructure is likely to be able to withstand small variations from normal regional weather conditions: the problems will come with intense, though possibly sporadic, deviations from such conditions. Adaptation and mitigation measures in anticipation of such emergencies can therefore enhance the sustainability of regional economies, by preventing or reducing future damage and disruption. Importantly, adaptation also involves taking advantage of new economic opportunities that climatic change might present, such as scope for change of crops or farm practices.

Climate change and related habitat changes (and potential negative ecological consequences) are also important for areas with a high ecological value (based on their rare and/or untouched vegetation and fauna). Any climate changes that may result in a decreasing size or reduction of biodiversity in these areas would be of special concern.

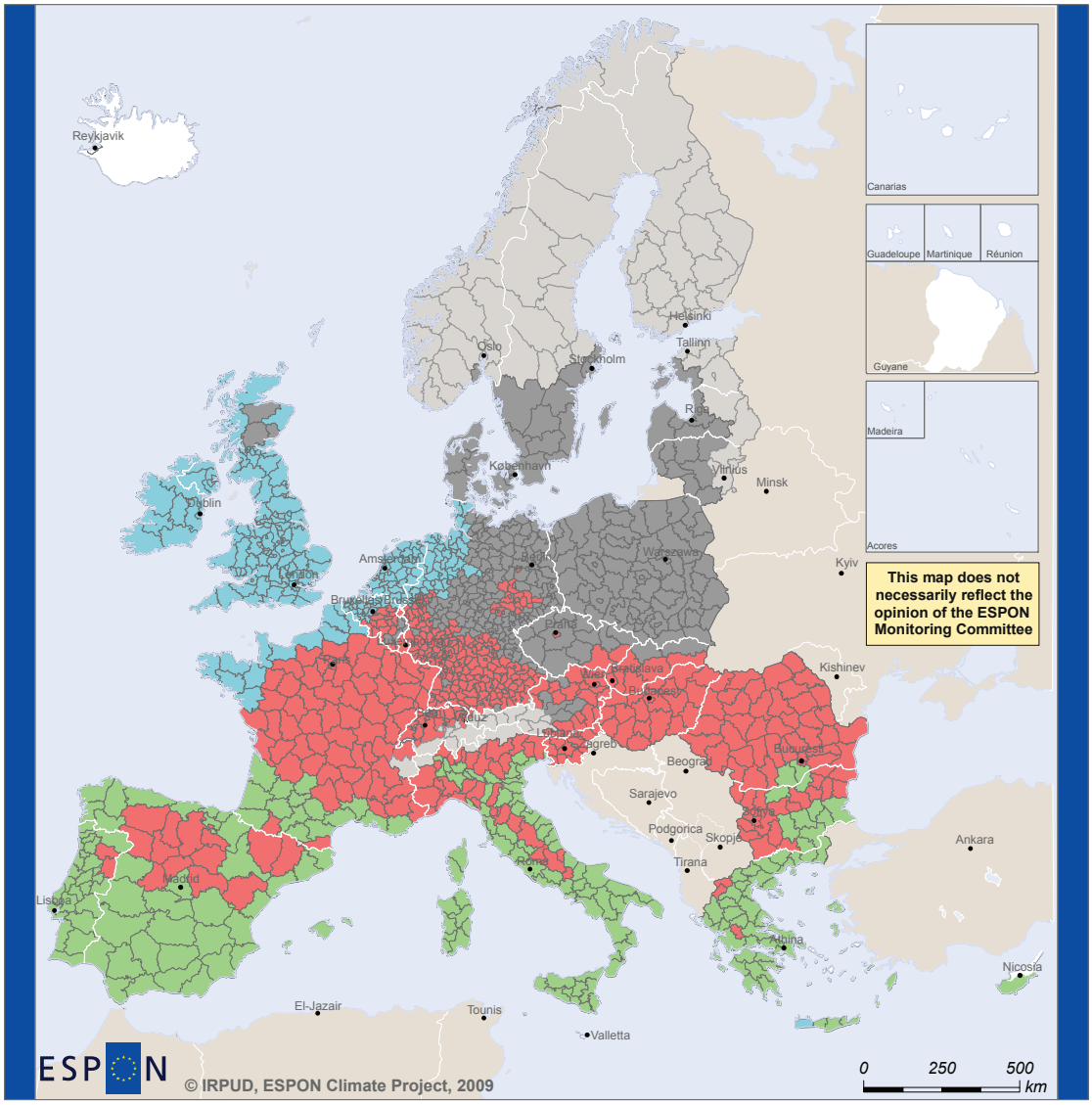
In summary, for long term sustainability of Europe's economic strength, policy makers could usefully consider:

- How agriculture might adapt to temperature changes that would create longer growing seasons in the north of Europe, but possibly pressures on water for irrigation in the south, where agriculture is still an important part of regional economies.
- How warmer seas will affect fish and consequently EU fisheries policy and related on-shore economic activities.
- The resilience of energy networks to respond to new regional peaks in demand linked to more extreme temperature ranges, through connectivity and better sharing of energy supplies.
- The ways in which the tourism industry could develop – e.g. through developing spring and autumn tourism in the hotter Mediterranean while grasping new opportunities in the warmer northern summers.

4.3 Urban sprawl and high energy-use commuting

Urban transport is an important parameter in attempts to create sustainable growth in Europe. The economic importance of urban centres and metropolitan regions has been highlighted already. If Europe and its regions are to reduce their ecological footprint while continuing to enjoy a high standard of living fed by competitive businesses, ways have to be found to get people into and around urban areas in ways that are less ecologically damaging than those of today.

Map 23. Climate change in Europe, 1961-2100



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Regional level: NUTS 3
Source: ESPON 2013 Database, 2010
Origin of data: Calculations based on Lautenschlager et al., 2009
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- Southern-central Europe
- Northern Europe
- Northern-central Europe
- Mediterranean region
- Northern-western Europe
- No data

Explanation: The analysis of European patterns of climate change has led to a typology of climate change regions derived from a cluster analysis. Based on a set of exposure indicators different types of regions according to their climate change profile have been identified.

Across South-Central Europe (red on the map) the scenario anticipates that the main changes will be: strong increases in average mean temperatures and in annual mean number of summer days; strong decrease in the annual mean number of frost days; and strong decrease in mean summer precipitation.

For regions in Northern Europe (grey on the map) the picture is: a strong increase in average mean temperature, but also in annual mean winter precipitation; overall more days with heavy rainfall, more evaporation, but a strong decrease in frost and snow cover days.

North-central Europe (black) can expect: an increase, but a moderate one, in average mean temperatures, annual mean number of summer days, annual mean precipitation in winter months and annual mean evaporation. There will be a strong decrease in frost days, less days with snow cover and a reduced amount of summer precipitation.

For the Mediterranean region (green) a strong increase in mean temperatures and the annual number of summer days is expected along with a strong decrease in precipitation in the summer months and similarly a strong decrease in frost days.

In northwestern Europe (blue) it is more days of heavy rain, more winter rain but less summer rain, higher mean annual temperatures and more summer days, but fewer frost days.

In regional terms, some examples of the implications of these changes are:

Bergen is the economic driver of a region of 360,000 people, and Norway's second city. Its climate is already cool and wet, yet precipitation levels will increase, especially in autumn and winter. The number of days with heavy rainfall could double, increasing the risk of river flooding and landslides. Sea levels on this coast could rise over 2 metres during storm surges. This poses a threat to essential infrastructure, such as transport and sewage systems, as well as to buildings, businesses and households. However, the city has already undertaken extensive adaptation and mitigation measures and plans more.

The European Alps are shared by eight countries. The Alps are characterized by mostly rural areas, but many of the 13 million inhabitants live in the densely populated river valleys. Climate change has already led to a significant retreat of glaciers and decline of snow cover. Further increases of temperatures and higher variability of precipitation will result in changes of glaciers and permafrost zones, water scarcity in summers and reduced snow reliability in winter. Occurrence of alpine hazards (e.g. avalanches, land slides) is also forecast to increase significantly. A transnational strategy is necessary to foster climate change mitigation and adaptation.

The Tisza River Basin, the largest sub-basin of the Danube, is home to approximately 14 million people. It consists of a mountainous, mainly rural upper part (the first 200 km of the river) and the lowlands (last 760 km) where there are some large cities. Droughts are a major challenge in the lowlands. According to the scenarios, precipitation will decrease and annual mean temperatures increase, exacerbating the drought problem. Dry periods will be followed by sudden, heavy rainfalls and an increase in severe river floods is expected. Such changes will have serious consequences for the urban centres and agriculture, which is still a significant sector of the regional economy.

Low density spread from the edge of the city is intimately intertwined with car-dependent patterns of commuting that in turn create greenhouse gas emissions and also high energy dependency. If energy prices escalate then cities with more compact forms that can be served by public transport are likely to be more resilient than areas of low density urban sprawl.

Cities experiencing very rapid and diffuse growth had significantly lower use of public transport than cities growing more slowly. It was also notable that cities from Eastern Europe had levels of public transport use roughly 20% higher than cities spreading at similar rates elsewhere in Europe during the period 1990-2000.

Reuse of land within the urban areas is preferable to development at low density on greenfield sites in and beyond the urban fringe. This was an important theme in the Leipzig Charter which was agreed by EU member states in 2007. For the period 2000-2006 reuse of urban land had increased in and around the core cities. However, countries which experienced early de-industrialisation, like Belgium, tend now to have a low supply of vacant urban land. On the other hand, both the supply and the challenge of re-use are greater in the eastern countries.

Greenfield sites are often more attractive to developers and carry less commercial risk. There is thus a danger that economic growth will favour loose knitted, decentralised patterns of development that will work against the EU's 20-20-20 targets and increase rather than contain the ecological footprint of territories.

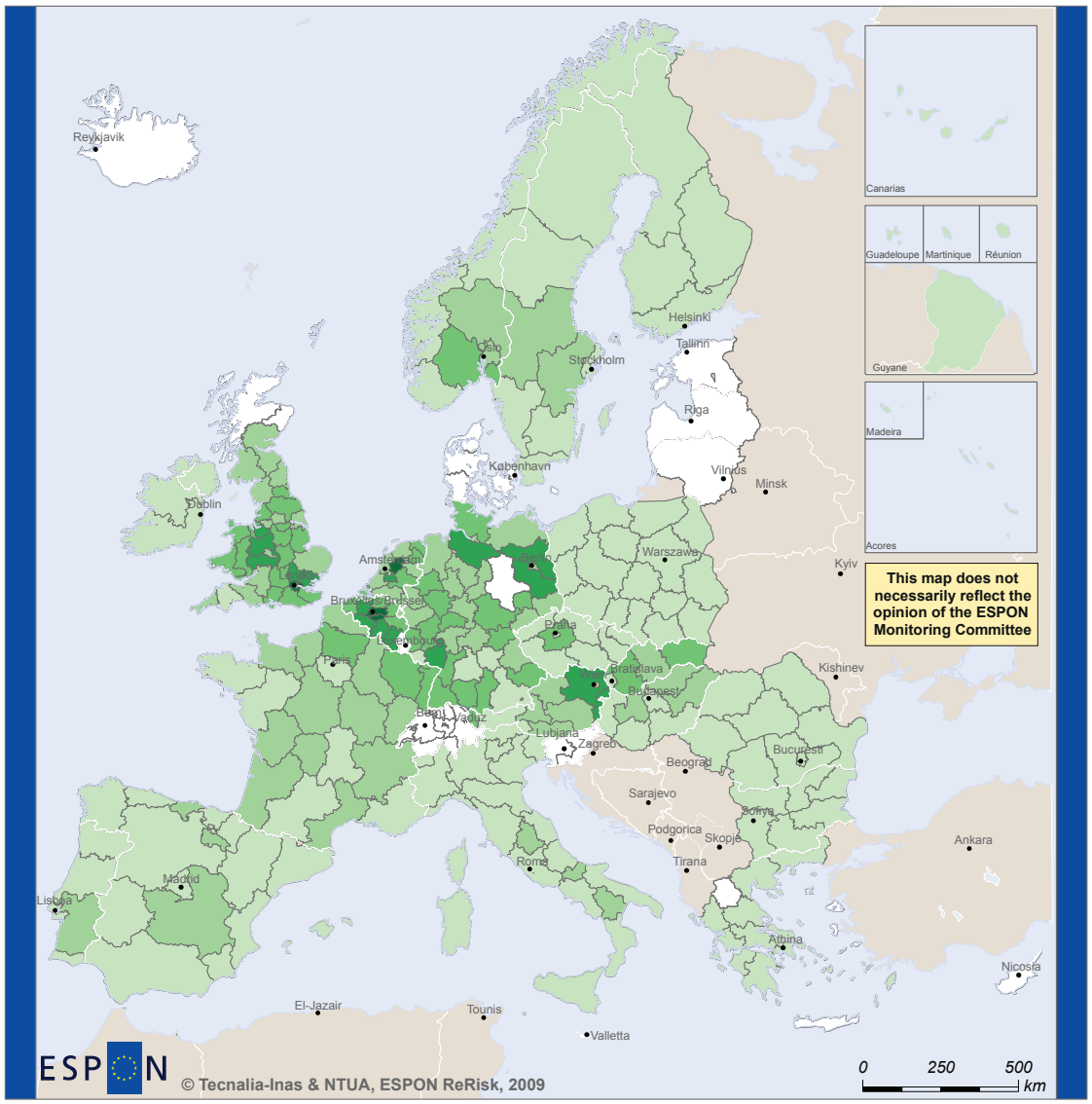
Implementation of Europe 2020 therefore should be backed by territorial strategies at national and regional levels using incentives and controls to steer development to brownfield sites. At local level a co-ordinated practice of spatial planning and economic development will need to engage with the design and development of such sites. The impact of such policies could be to divert into the urban cores some of the growth that has gone into rural regions that are accessible to such urban centres.

Commuting patterns (together with other factors such as energy intensity of industrial processes and building energy efficiency) contribute to regions' vulnerability to energy poverty. Commuting is highest in the core and around the major metropolitan regions, though commuting levels are notably less in the Eastern states. In the eastern European cities the challenge must be to at least sustain the quality and reach of the public transport systems they have. This will be difficult to achieve if patterns of growth around cities like Prague or Sofia continue in low density, loose knit forms.

Commuting is evidently one of the drivers of demographic and employment change in accessible rural regions, however it increases the risk of energy vulnerability. Industrial and commercial uses have become the main components of urban expansion. This suburban spread of trip-generating functions may mean that the distribution of land uses will make it harder to contain car-based trips in the future. Companies can contribute to reducing regional energy consumption through the better energy efficiency in their business premises, and through new arrangements of space and working times, which would also reduce the need for commuting.

Coherent, up to date territorial development strategies at regional scale need to be backed by transparent and consistent application of policies that address concerns about commuting and transport dependency. National and regional governments should be asking whether their policy and planning systems are fit for the purpose of delivering smart, sustainable and inclusive growth in the light of the ESPON findings. Deficit reduction strategies in many European countries could imply that savings are sought by cutting back on urban public transport and pushing up the prices of travel by bus, tram or train.

Map 24. Workers commuting to another NUTS 2 region, 2005



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Regional level: NUTS 2
Source: ESPON 2013 Database, 2010
Origin of data: Eurostat, 2010
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Share of workers commuting in 2005 (%)

0 5.09 12.03 25.21 50.67 98.22

No data

Due to the reliability and quality of the datasets behind this map, the Lead Partner of the ReRisk Project decided not to include data collected from other sources than Eurostat

Commuting is a measure of transport dependency. The map looks at the number of workers commuting from one region to another and compares that figure with the population working in the same region. This is then expressed as a percentage. The original data was provided by Eurostat, and unfortunately does not cover all the ESPON space. However, the analysis does reveal that there are high levels of commuting in Central Europe, but levels are notably lower on the periphery. The patterns of commuting around some of the major cities stand out. London, Birmingham, Brussels, Amsterdam, Oslo, Berlin, Hamburg and Vienna are examples.

However some caution must be exercised in any comparison because much depends on the scale of the spatial statistical unit used, and in particular how tightly the boundary is drawn around the core city. Despite this limitation the map provides a basis for beginning to think about how and where a reduction in transport dependency might contribute to a Sustainable Europe, in which all regions were less vulnerable to potential impacts of rising travel costs. Modernisation of transport and energy networks is one of the actions that Europe 2020 aims to reinforce. The Association of European Border Regions has argued that this should take account of the territorial dimension. ESPON's findings confirm that this is a central issue for reducing the vulnerability of regions with a high level of commuting.

4.4 Landscapes, culture and biodiversity as economic assets

There is a rising market demand for leisure and tourism products that offer consumers an experience of "authentic" landscapes, cultures and habitats. Such assets are very much based on place, and therefore will be an important part of the territorial development strategies in some regions or cities. Sensitive exploitation and conservation of these assets can contribute to the Europe 2020 aim of sustainable growth.

A rich legacy of cultural landscapes and heritage buildings can be found across Europe: indeed this is a field where the idea of strength in diversity is perhaps most clearly demonstrated. However, it is also an area where the public and private sector need to work closely together to ensure that assets are not devalued by overuse of insensitive development, and that regional marketing and branding makes best use of the full range of qualities that a region has to offer.

Each landscape, artefact or habitat is unique, and recognition of that is fundamental to effective promotion and management. However, some generalised territorial issues can have been identified by ESPON. In particular, care has to be taken in rural areas that are accessible to urban centres. In these regions the supply of these environmental and cultural assets is under constant pressure from the kind of counter-urbanisation pressures and urban sprawl noted earlier in this chapter. There is also the threat form the "standardisation" associated with globalisation, which can erode the distinctiveness and variety of places. "Modernisation" of agriculture and other traditional industries can also be problematic in this respect. However, the concerns are not confined to accessible regions: the "wrong kind of tourism" can have a toxic effect on the very assets that attracted the tourists in the first place.

Skye and Locahlsh in the west of Scotland is remote from any significant city, and Skye itself is an island. The area has suffered massive and long term population decline. However, since the 1960s it has managed to reverse that trend. There is still and outflow of young people, but that is now exceeded by the in-migration new residents in the 45-64 age group. The region is renowned for its cultural identity, associated mainly with the 'crofting' smallholdings, the collective ownership of land, and the use (and revitalisation) of the Gaelic language. This, together with the landscape beauty produces the 'magic of Skye' which has helped attract tourists and in-comers to the region,. Crucially, new employment opportunities have been developed around cultural heritage tourism, IT, horticulture, and alternative energy. The region's renaissance is often lauded as a success story of rural development. Confidence has been rebuilt and the cultural and natural heritage remain assets for this and future generations.

To sustain environmental and cultural assets while growing the businesses to sustain the local economy too, experts recommend "soft" and "integrated" forms of tourism development. Often in rural regions this takes the form of household pluriactivity: this means that memberfs of a household between them are engaged in a range of different jobs or community activities. In this way living incomes can be earned and essential services sustained. However, the success of such endeavours can be helped by skills training and by strategies that build accessibility to major markets, whether by conventional transport links or through information and communications technology. Business networks able to combine strong local linkages with global reach are especially valuable behicles for effective regional development.

4.5 Recovery supported by renewable energy

It is expected that, by 2030, per capita energy consumption will increase by 9%. Recognition of the limits to fossil fuel production, the contribution of depletion and CO2 emissions to Europe's ecological footprint, combined with greater awareness of energy security issues, has given impetus to policies supporting the development of renewable energies in Europe. More specifically this means developing new industries around 'green' energy sources such as wind power, tidal power, solar power and biomass.

Realising the potential of renewable energy should be a fundamental part of the idea of "Resource efficient Europe", one of Europe 2020's Flagship initiatives. Many of the areas with most potential to contribute to a "Resource efficient Europe" in terms of tapping energy from the wind are in the periphery. Examples are the north of Sweden and Finland, as well as Ireland and the Highlands and Islands of Scotland and also the Baltic States. Similarly there is considerable scope for solar energy development in southern and eastern Europe in particular.

However, having the potential to contribute energy from wind power is not the same as actually doing so. One significant problem is the variability of wind which means that wind-generated energy is best seen as part of an overall energy portfolio where connected networks can shift between sources in response to supply and demand.

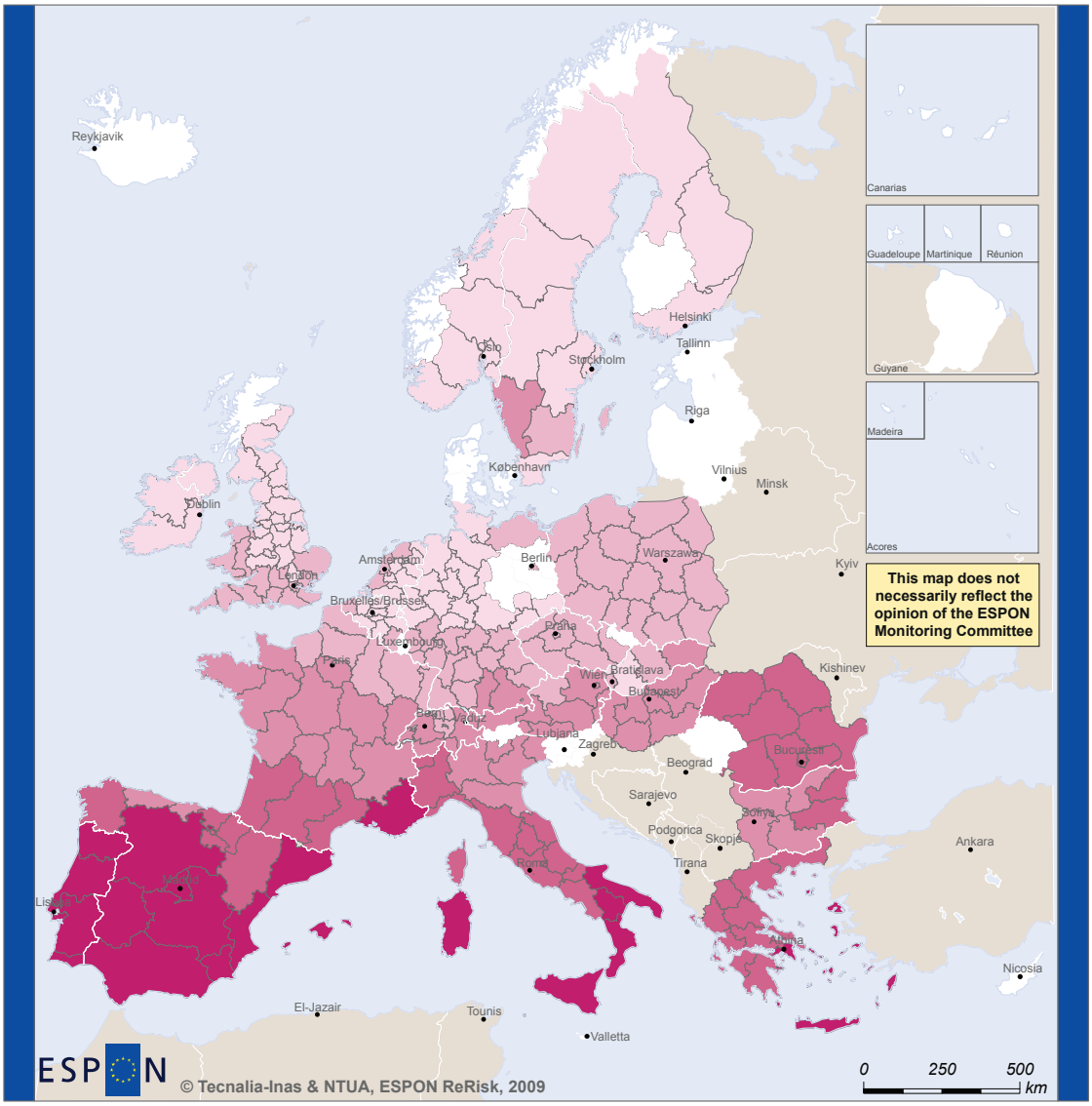
Such approaches require effective long-term strategies including regional maps of untapped energy reserves. Energy planning requires a time horizon of 30 to 60 years. The energy sector is presently undergoing a far-reaching transition process, and the political and investment decisions that are now being made will be an important element in regional competitiveness for time to come.

There are some concerns about development of biomass. Biocrops compete with other uses for scarce resources, such as land and water, in agriculture, forestry or natural sites. Specializing in certain types of plants with high energy yield could jeopardize other objectives of agricultural policy, such as that of promoting a higher level of regional sufficiency with regard to food production (by growing subsistence crops). Large-scale biomass plants could accelerate deforestation or endanger local biodiversity. These observations are not an argument against development of biomass as a new renewable energy industry. Rather they are intended to emphasise once again the need for an integrated approach to territorial development.

The map of solar energy potential shows the regional potential for electricity production from solar panels. This has been calculated and supplied by the Joint Research Centre's Sunbird data base. The data refers to the yearly total yield of estimated solar electricity generation (for horizontal, vertical, optimally-inclined planes) [kWh]

It is similar but different to the wind map. The difference is that the regions with greatest potential are now in the south and east of Europe. The similarity is that the core is again weak, while the main potential lies on the periphery.

Map 25. Solar Energy Output



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Regional level: NUTS 2
Source: ESPON 2013 Database, 2010
Origin of data: JRC, Sunbird Database
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Solar energy output

- 1506,2
- 1291,4
- 1113,2
- 951,1
- 845,1
- 676,1
- No data

Due to the reliability and quality of the datasets behind this map, the Lead Partner of the ReRisk Project decided not to include data collected from other sources than JRC

Scenarios – "A green high-tech Europe"?
Assumptions about the use of renewable energy sources have been built into ESPON scenarios with the underlying hypothesis that energy prices will remain at a high level and the assumption of different political responses.

A "Green High-Tech" scenario foresees an extensive growth of energy production from renewable sources which leads to a new balance between centralized and decentralized solutions.

A second scenario "Energy-efficient Europe" assumes a general decrease of total energy demand as energy efficiency is the main mitigation measure. A greater use of natural gas is inferred. Renewable have mainly served to compensate for the closure of nuclear plants.

Nuclear energy is the main priority for a centralized energy development in a third scenario ("Nuclear Energy for Big Brothers"). In this scenario large-scale renewable energy witnessed a significant expansion until the early 2020's, but then encountered a phase of stagnation.

In the "Business as usual" scenario only a moderate transition to renewable energy sources has taken place. It is characterised by a high demand of coal and natural gas and reduction for demand of nuclear energy.

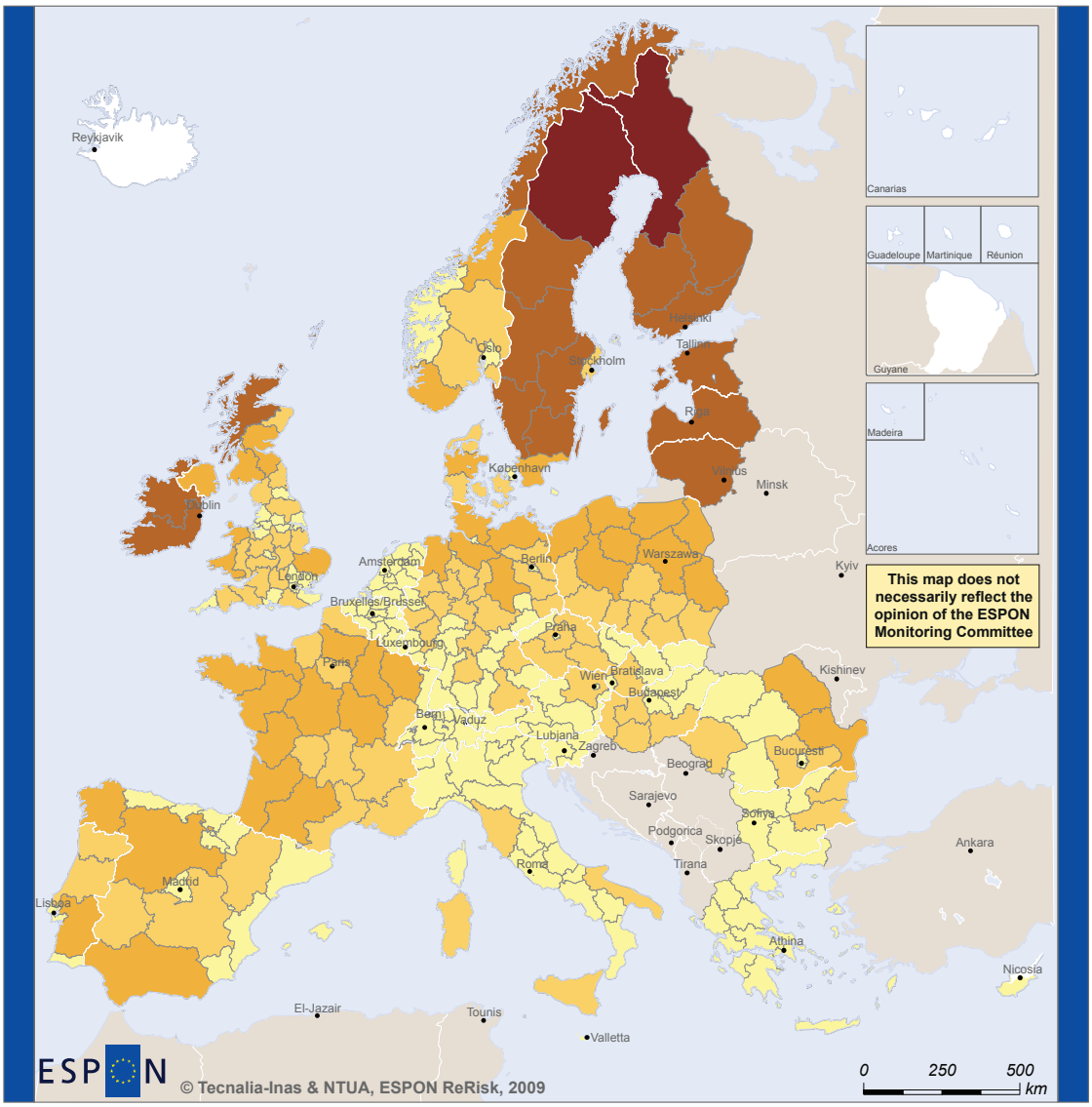
Expert assessment of the regional implications of these scenarios suggested that:

- In the first scenario new opportunities for renewable production would arise for rural regions, while urban areas would still experience social and economic growth.
- A development like in the second scenario would lead to a more polycentric growth pattern. Peri-urban areas with accessibility to natural resources would benefit particularly, while socio-economic growth would continue in urban areas.
- The agricultural areas with good access to large cities were expected to benefit under the third scenario, while remote areas were anticipated to face depopulation processes.
- In the "Business as usual" scenario urban areas would remain the only growth-poles because a rural exodus was expected to become a more general phenomenon with most negative impacts on tourist-dependent regions

The original data on wind intensity in the regions was prepared in GIS format by the European Topic Centre on Air and Climate Change (ETC/ACC), led by PBL the Netherlands, on request of the EEA (EEA, 2009). It has been converted to NUTS 2 level by ESPON. It measures the production potential of wind power stations, taking into account environmental and other restraints. The areas with the highest potential are shown in the darkest shades. These are in Sweden, Finland, Ireland, Estonia, Latvia and Lithuania as well as the north of Norway and Scotland. However, most of these areas are very distant from major urban markets where the demand for electricity is concentrated. To fully realize the potential of the peripheral regions among others transmission costs would have to be overcome.

There could also be conflict with nature protection designations. For example, national planning guidance requires Scottish planning authorities to make positive provision for renewable energy developments. They also have to work within the Habitats Directive. The Western Isles, swept by Atlantic and Arctic gusts, are also areas with extensive designations for Special Protection Areas. Thus when a 243 turbine, 702 MW wind farm was proposed on Lewis in 2004, it encompassed three Special Protection Areas and encroached on an important area for birds' habitats. Reduced CO2 emissions, local jobs and benefits to the Scottish economy were on offer, but peatlands, birds and fisheries were under threat. As well as the various quangos and pressure groups opposing the scheme, there were almost 11,000 objections from the public. The planning application was refused by the Scottish Government in 2008 on the grounds that the development would adversely affect the integrity of a protected European site. This example shows the need to look at the territorial impact of EU Directives, and this is the focus of an ESPON project which started in 2010.

Map 26. Wind Power Potential, 2005



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Regional level: NUTS 2
Source: ESPON 2013 Database, 2010
Origin of data: EEA, 2009
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Wind power potential in 2005

- 1795408
- 1051077
- 487853
- 204547
- 79181
- 0
- No data

Due to the reliability and quality of the datasets behind this map, the Lead Partner of the ReRisk Project decided not to include data collected from other sources than EEA

4.6 Scenarios - Imagining a sustainable Europe

The time dimension is fundamental to developing and implementing strategies for a more sustainable Europe. The ten-year timescale of Europe 2020 needs to be in the foreground, but it is also important to look further into the future. This is necessary as environmental impacts are long lasting, climate change is a long-term process and the patterns of urban areas and energy and transport networks take time to adapt while also being created by investments that require more than a decade to realise a return.

Thus while the horizon of Europe 2020 is long-term from the perspective of economic development, it is short-term from the viewpoint of sustainable development.. To help policy makers better appreciate and understand how current options and actions have long-term impacts, ESPON has developed a number of scenarios that explore how a Europe concerned with a sustainable environmental future might look. In particular there are scenarios that focus on how we respond to climate change.

One such scenario is based on the assumption that the decisions adopted at international level that aim to curb the speed of climate change are efficiently grasped as an opportunity to generate significant economic growth throughout Europe. In this scenario the increasing tertiarisation of the economy takes a distinctive path through rapid development of the "green economy". This creates jobs both in R&D and in green manufacturing activities. The scenario looks to services moving towards higher added value segments. A more regional globalization is envisaged, and this results in higher financial services being re-centered in Europe. Through higher competitiveness and stronger public support, European enterprises are less in danger of being taken over by non-European groups or external sovereign funds.

"The Green Economy is seen as a cross-sectoral set of activities encompassing energy and transport systems, architecture and building techniques, urban planning and the greening of cities, the general use of renewable energy sources, changes in agricultural and forestry practices. It comprises activities stretching from basic research down to the implementation at large scale throughout Europe of numerous concrete applications concerning virtually all citizens. It will be accompanied by significant changes in mobility and consuming patterns, ways of life, leisure and tourist activities etc."

The territorial impacts of the scenario change somewhat over time. The initial impact is led by the metropolitan regions, especially in Western Europe, where the main investments in new technologies are expected to be made. However in the later phase of the scenario there is diffusion of these ideas and a more polycentric pattern of growth. Indeed, some medium-sized and small cities in rural regions are seen to benefit from the creation of new sources of income through renewable energy development and "soft" tourism. There is also cooperation at the scale of macro-regions to develop renewable energy and combat the impacts of climate change. At the city scale one finds more compact urban forms and expanding public transport networks, together with the greening of cities.

It is important to recognise that such a scenario poses more challenges for some regions than for others. South and east European cities might be more challenged by sustainability issues, as they often have strong suburbanization trends; less developed modern public transport systems; more polluting cars, buses and trucks; a lower amount of green areas; less public resources for improving the environment etc. The scenario assumes that EU policies target these cities in the south and east.

Looking at the national Rural Development Programmes for 2007-2013, it seems that:

- Policies of the Mediterranean countries appear to be detailed and concrete enough to promise possible beneficial outcomes, but there is less institutional and professional ambition to tackle the issue than exists in some other parts of Europe.
- The UK, France and Netherlands have produced precise schedules and detailed programmes. Their early initiative in commencing with the integration of climate change into their programmes would ease the adaptation process.
- Northern European countries, the pioneers of using innovative technologies to tackle climate change, benefit from public concern and local authorities' provisions on the climate issue.
- The Eastern European states face a more challenged situation than others: there is less public concern and weaker institutional frameworks to carry through development.

In summary, the linking of the aim for an environmentally sustainable Europe into the economic recovery strategy is consistent with the direction that research has followed in ESPON 2013. However, to achieve the general European aims there has to be action not just at the EU level, but also across macro-regions, and at national, regional and local level too. Furthermore, the nature of the challenges posed by Europe's Green Agenda differs from one region to another, and so the solutions also have to work with regional realities and the unique opportunities that each region can offer.

Further reading:

Further information on the issues addressed ins this chapter can be mainly found in the reports of the ESPON projects on territorial impact assessment (TITAP), energy risks (RE-RISK), urban areas (FOCI), climate change (CLIMATE), and rural development (EDORA).