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Prospective Environmental Analysis of Land-Use Development in Europe: Understanding the problem and searching for robust long-term strategies

First Draft
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Introduction

In day-to-day environmental policy making, we are often confronted with long-term problems. They unfold over a longer time span of one generation or more and cannot be solved within one or two legislative periods. Prominent examples are climate change or biodiversity loss. At the same time, many of our decisions will have long-lasting effects and shape the future. Investments in energy or transport infrastructure, for example, can have a time span of 40 years and more. What will happen in the future is subject to great uncertainty. But if we want to maintain and improve the conditions for life on earth, we have to design policies that are robust over the long term, i.e. they have to function under a set of changing framework conditions.

This is a challenging task, both for research and policy-making. Normally, our perspective in day-to-day decision-making is confined by five-to-seven year legislative or budget cycles at best. But if we are to tackle the challenge of Europe's unsustainability, we need a long-term look beyond two legislative cycles and more.

More integrated approaches to policy-making have been proposed by governments and scholars alike. Over the last years considerable progress has been made in better understanding future trends and challenges and linking them to our decision-making procedures. However, an unemotional stock-taking reveals that we are still in the early stages of learning how to best explore long-term challenges and relate our findings back to the design of policies and institutions.

Most long-term evaluation studies are built around business-as-usual, or trend scenario, approaches. This is, as we argue in this paper, not always an appropriate procedure. If we want to gain better insights into long-term challenges and create effective, robust responses, we need to think in broader alternatives. A long view requires a broad mind. In this paper we propose an alternative scenarios approach that offers a more creative, yet structured and policy relevant way to scan the future. Scenarios have been widely used by international companies over the last three decades. They have also gained increasing importance in the realm of public policy, the most knowledgeable recent example being the Millennium Ecosystem Assessment that was conducted by the United Nations in 2005 (MEA 2005).

Our reflections on long-term scenarios are based on findings from a recently concluded project on land use scenarios. Land use is in many ways a prominent sustainability problem as land use changes cut across many policies and affect a wide range of societal interests. In the PRELUDE project (*PR*ospective *E*nvironmental analysis of *L*and *U*se *D*evelopment in *E*urope) a panel of 22 stakeholders from across Europe developed five land use scenarios for the EU-25 plus Norway and Switzerland for a time period of up to 2035. Qualitative information and model quantification using state-of-the-art simulation models were combined in an iterative way.

We distinguish two dimensions of scenario development:

- the *problem analysis*, i.e. developing different scenarios with a view to gaining better insights into main trends that shape Europe's landscape, identifying early warning indicators of change and

- the *strategy analysis*, i.e. analysing the scenarios with a view to gaining better insights which strategies are most robust to the long-term objectives of the European Union.

The PRELUDE project was focused on the first rather than on the second dimension. This paper reviews our findings from the problem analysis and discusses the implications for the strategy analysis that will be covered in future activities.

The reminder of this paper is organised as follows. In the next chapter we first discuss the need for the long-term view in greater detail. We proceed by sketching a framework for scenario development which is built around the "Story-and-Simulation"-approach. In chapter 3 we describe the process of scenario development in the PRELUDE project. Chapter 4 provides an overview of the PRELUDE scenarios. In chapter 5 we compare the findings of the scenarios and discuss their implications for robust long-term strategies. Chapter 6 transfers this discussion to the level of general strategy analysis and highlights the next steps of planned action.

2 Taking the long-term view: making the case for alternative scenarios

Throughout the years we have increased our knowledge about future challenges and trends and how they might affect sectoral policy-making. Quite a number of long-term evaluation or foresight studies have been performed at the European and member state level (see Georghiou and Keenan 2006 for an overview of foresight activities at the national level, see Glenn and Jordon 2005). We can make, for example, sound assumptions on the impacts of climate change. We have also advanced our knowledge about the possible economic and social consequences of demographic change.

But how often do we put all the facts together and try to make sense of the whole story? Many long-term studies focus only on one sector like energy, or one problem dimension, like climate change. Moreover, most often they are built around a Business-As-Usual scenario with smaller policy variations.

This is a reasonable approach if we want to study short-to-mid term future trends. But trends are not our destiny. Long-term problems like climate change or biodiversity loss manifest themselves over the time period of a generation and more. Discontinuity of trends becomes the norm, rather than the exception in this perspective, due to spill-over effects between problems, public action itself or unforeseen events. Disruptive events like September 11th or the fall of the Berlin Wall can have vast implications for the society and indirectly the environment. Looking back we see how often disruptive events have changed the course of action, sometimes dramatically.

Any policy discussion on managing the transition towards sustainability should address these two issues: the complex mix of societal and environmental changes and responses as well as the possibility of sudden abrupt change. A Business-as-Usual approach is not always the appropriate approach in this regard, especially if we have to take a look beyond two legislative cycles and more (Ringland 2006). The development of long-term alternative scenarios appears to be more promising, as it allows us to scan the future in a more creative, yet coherent and policy-relevant way (Swart, Raskin, Robinson, 2004). Moreover, participatory scenario developments allow us to incorporate relevant knowledge from societal stakeholders like interest

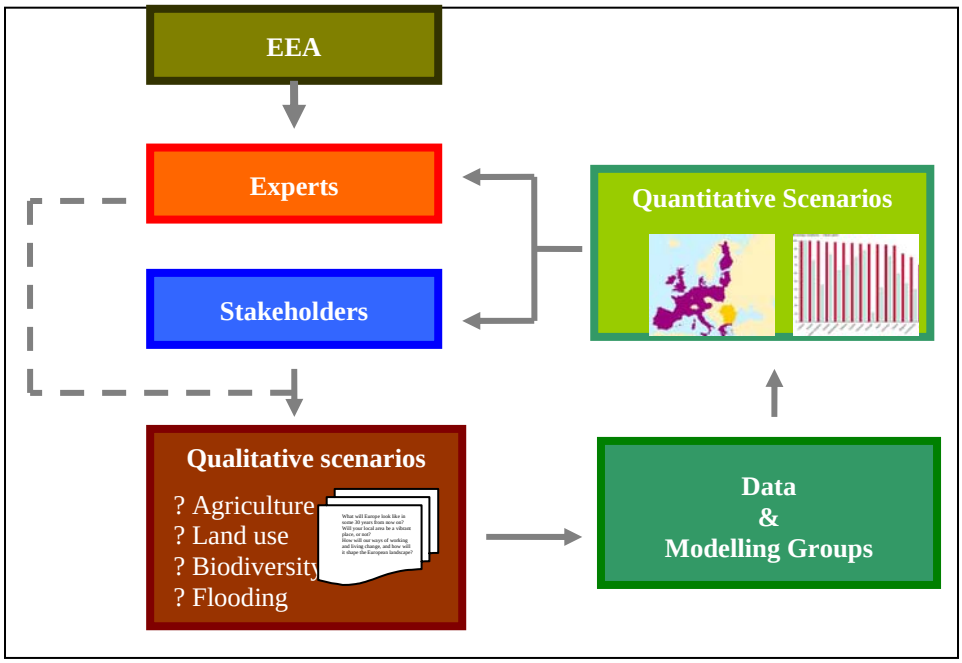
organisations or journals. It increases not only the information base and helps escaping the risk of being stuck with one particular scientific approach that might be too narrow in its perspective. It also allows increases ownership, legitimacy and dissemination of the scenarios and their recommendations.

Scenario development has become a prominent tool used by companies and governments worldwide (for example, Shell, 2005, OECD, 2005, NIC, 2004, Mintzer, Leonard, Schwartz, 2003, WBCSD 2006, DTI 2002). In spite of many different definitions there is a clear tendency to agree on the understanding that a scenario is neither a forecast nor a prediction but should be understood as "coherent, internally consistent and plausible description of a possible future state of the world" (Nakícenovíc et al., 1994).

Scenarios come, however, in many variants and the way in which they are conducted can vary greatly (Godet et al., 2004, van Notten et al., 2003, EEA, 2001). For example, the IPCC scenarios stem from a highly formalised process that involves only expert scientists from specific disciplines. Here, a clear distinction between scientists and political stakeholders is drawn (EEA, 2001a). On the other hand, exercises like the Millennium Ecosystem Assessment of the United Nations involve political and other societal stakeholders in the process of scenario development (MEA, 2005).

The 'story-and-simulation' (SAS) approach to scenario development of the EEA has been designed to combine the strengths of participatory qualitative scenario development with quantitative model analysis (EEA, 2001, see Figure 2.1).

Figure 2.1 The story-and-simulation approach (EEA 2001)



The main parts of the approach are (Figure 3.1):

- A group of stakeholders forms a stakeholder panel. They develop qualitative storylines, based on in-depth discussions about key uncertainties and

underlying driving forces of social, technological, economic, environmental and political development.

- Experts form data & modelling groups. They translate the qualitative information into quantitative model input and underpin qualitative analysis by quantitative modelling as feedback into the process.
- Stakeholders and experts engage in an iterative process of refining storylines and quantification until a set of compelling, plausible and relevant stories and simulations about the future is reached.
- The whole process is facilitated by external partners with no interest at stake.

Every approach has its drawbacks and this one is no exception: it can be a time-consuming and costly approach; it demands high level of engagement and availability from stakeholders and modellers; and it requires the use of transparent methodologies in the 'translation' of quantitative statements into quantitative modelling inputs.

However, following this approach can lead to interesting results when analysing long term developments: scenarios can be developed without the restrictions of existing *state of the art* models and data limitations in mind, include issues that science may not yet be able to model in quantitative terms, while, simultaneously benefiting from the rigour and consistency check that models can provide.

3. Scenario development in the PRELUDE project

PRELUDE stands for PRospective *E*valuation of *L*and *U*se *D*evelopment in *E*urope. Land use is a prominent sustainability problem (EEA 2005, see Busch 2005). Rich mosaic landscapes are an indispensable part of the European culture. Landscapes define regional identities, function as tourist attractions and are connected with many invaluable ecological services. But land is also limited as a resource. And it is under pressure. It must provide diverse, competing services like food, timber, fuel, housing, road and rail capacity, biodiversity, recreational landscapes etc.

Land use change can have major environmental impacts. Land use is also subject to a range of policy interventions over the next European budget cycle with large budget implications. The budgets for agriculture and structural and cohesion funds still form the biggest slice of the European budget cake.

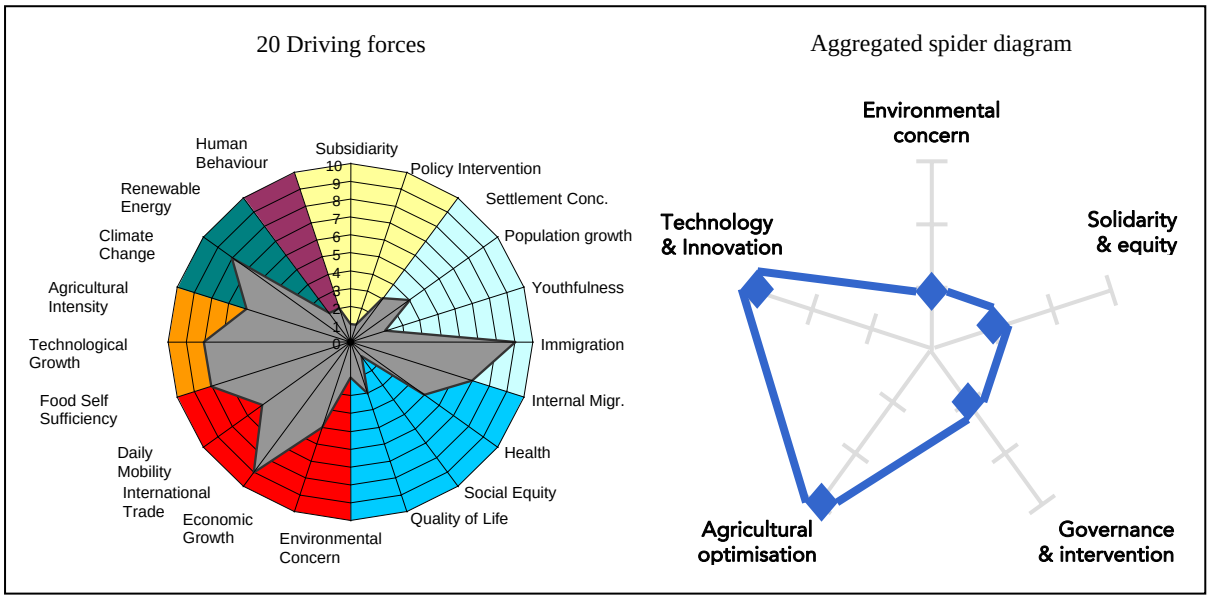
To support decision-making in policies with relevance to land use and landscape change, especially in agriculture, rural development and transport, the EEA set up a broad participatory process of scenario development that was structured alongside the SAS-approach. 22 stakeholders from across Europe with a broad diversity of backgrounds were brought together in a stakeholder panel. This included policy-makers (10), academic researchers (3), representatives of interest groups (6) and independent thinkers (3). Stakeholders met three times for three-day events within a year to build the narratives of the PRELUDE scenarios. The scenarios were underpinned with spatial explicit data from land-use simulation models. The storyline development was reviewed by the EEA and scenario analysis support and land use modellers and experts. The whole process was moderated by external partners (see Volkery, Hoogeveen, Ribeiro, 2006 for a detailed overview).

The PRELUDE scenarios combine the assessment of changes in the bio-physical environment with simultaneous changes in the socio-economic environment. Stakeholders categorised a broad variety of driving forces that influence different land use types and land use change in Europe. Consequently a common basis for comparison was needed. This was done in the following step wise approach:

- "Influence chains" were generated by the group and agreed upon.
- The influence chains and general driving force categories were used to derive a consistent set of 20 driving forces.
- The magnitude of change of the driving forces was qualitatively valued for each scenario on a scale from 0 (minimum value) to 10 (maximum value).
- This scale was adjusted to for the model inputs into acceptable values for each driving force, based on past data and existing authoritative scenarios for other issues (i.e. IPCC SRES scenarios).
- Finally, the 20 driving forces were clustered into five main categories. Scenario-specific "spider diagrams" were created, visualizing the different driver values in a comprehensive and easily comparable way.

Figure 3.1 gives an overview over the set of 20 driving forces. The values are for the base year 2005 (based on interpretation of trends from 2000-2004).

Figure 3.1 Driving forces in the PRELUDE project



The Louvain-la-Neuve land use/cover change model was used for assessing the changes in land use/cover at the European level (see for detailed model description: Ewert et al., 2005; Rounsevell et al., 2005; Kaukaanpää, Carter, 2004).

The modelling approaches embedded in the model have been developed with the specific aim of constructing spatially-explicit, land use change scenarios for Europe. The model uses interpreted satellite data from the PELCOM database as a starting point[1]. It simulates land use changes in two main steps:

[1] PELCOM is a 1 km^2 pan-European land cover database developed mainly from remotely sensed data for the year 2000. To adjust this database to 2005, statistical data as well as existing scenario work was used (see EEA, 2006).

- First, the demand for six different land use types (defined as an area) is derived at an aggregated spatial level, i.e. country or NUTS-2 (depending on the land-use type).
- These land use areas are disaggregated for EU-25 plus Norway and Switzerland using spatial allocation rules and GIS data layers that include spatial planning zones.

The following land use/cover classes are simulated: urban, cropland, grassland, biofuel crops, forests and abandoned land.

Some parameters have been quantified on the basis of the IPCC SRES scenario parameters (IPCC, 2001) or on the ATEAM project scenarios which interpret the SRES scenarios for Europe (Rounsevell et al., 2005). For the other parameters, the descriptions of the stakeholders were not consistent with the IPCC SRES scenario parameters or parameters of other scenario studies. Some adjustments were needed, based on observed data of past and recent trends as well as on expert judgement about alternative plausible trends. A detailed description of the quantification of the PRELUDE scenarios can be found in EEA (2006).

The model produces maps and data tables for Europe (EU-25 plus Norway and Switzerland) with the percentage change of each land use/cover class as compared to the total area of the 10 minute (latitude and longitude) grid. New spatially-explicit land use/cover maps were developed for the five PRELUDE scenarios for two future time slices (2015 and 2035). The 2015 time slice was introduced to account for the breakpoint in the two scenarios “Lettuce Surprise U” and “Big Crisis”.

The PRELUDE scenario descriptions and analysis refer to six broad land cover classes which are 1) urban land, (2) cropland, (3) grassland, (4) forest, (5) other land, and (6) surplus land (see Volkery et al., 2006 for details). In order to make the link between land use/cover changes and environmental impacts, we used the concept of “dominant” landscape types and land use intensities. “Dominant” means that a landscape type comprises one or more land cover types which share more than the European average plus the standard deviation of this particular land cover type. Table 4.2 shows the European average and the standard deviation for the above five land cover classes. The last column of this table indicates the “dominance threshold”.[2]

Table 4.2 European average statistics for land cover classes in base-year (2005)

Land cover type	European average [%]	Standard deviation [%]	Dominance threshold [%]
Urban land	2	5	7
Cropland	33	32	65
Grassland	16	17	33
Forest	30	28	58
Other land	20	33	53

[2] This means that, e.g., the landscape type with a dominant agricultural character has to comprise more than 65% of cropland because the European average share of cropland is 33% and the European-based standard deviation of this is 32%, which together sum up to 65%. It should be noted that for urban land and grassland this dominance threshold is well below 50% so that in model cells that are dominated by either of theses two land cover types, the cells may well be dominated by more than one land cover class.

Starting with the five land cover classes (1) urban land, (2) cropland, (3) grassland, (4) forest, and (5) other land, dominant landscape types were assigned in each model cell for both the base year situation and for each of the five scenarios in 2035. Based on this analysis of the dominance that occurs in the model cells in all of Europe, nine landscape types are derived.

Table 4.3 gives an overview of the nine landscape types listed in order of 'land use intensity'.

Table 4.3 Classification of landscape types

Landscape type	Landscape characteristics (based on land cover classes in Table 3)
Urban Areas	Urban land use is dominant. All other land cover classes are not dominant
Urban Landscape	Urban land use is dominant but any other land use could be dominant as well
Rural Landscape (Cropland character)	Cropland is dominant, any other land use is dominant
Rural Landscape (Grassland character)	Grassland is dominant, any other land use is not dominant or Grassland in combination with other land and surplus land is dominant
Rural Mosaic Landscapes (Agricultural character)	With majority of agricultural land, i.e. cropland and grassland > 50% of model cell area
Rural Mosaic Landscapes (Abandoned character)	Other land category in combination with surplus land is dominant
Natural mosaic landscape	With majority of semi-natural land, i.e. other land, surplus land and forest > 50% of model cell area
Forest Landscapes	Forest is dominant
Non-forested mosaic landscape	Other land category is dominant

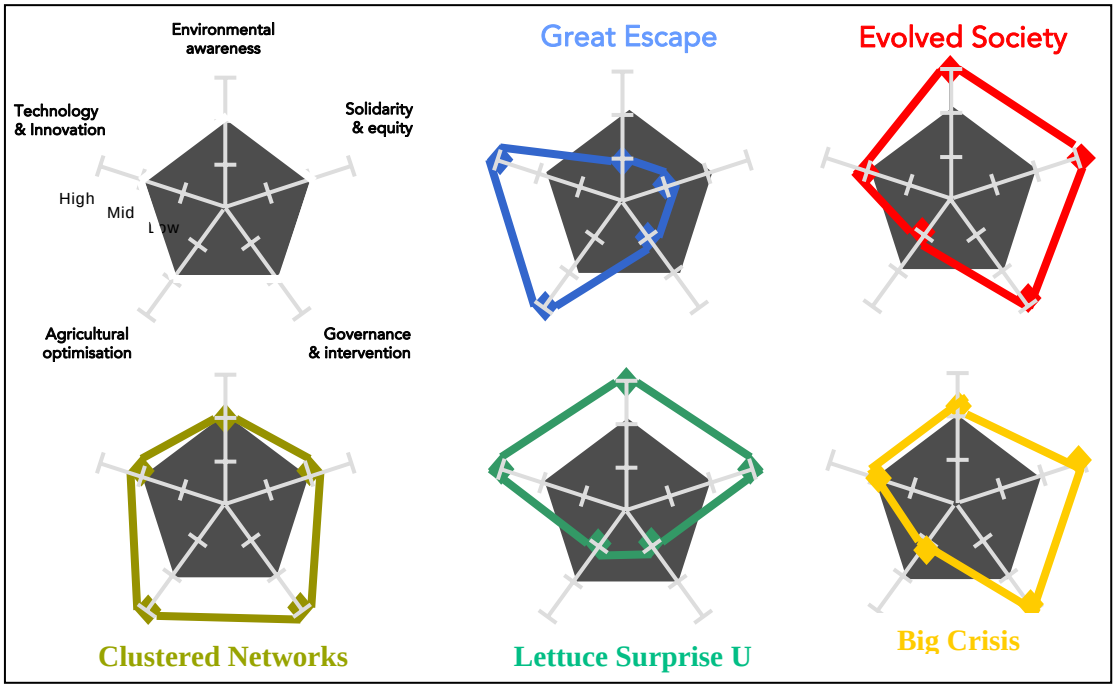
4 The PRELUDE scenarios

The five PRELUDE scenarios are

1. Great Escape - Europe of contrast
2. Evolved Society - Europe of harmony
3. Clustered Networks - Europe of structure
4. Lettuce Surprise U - Europe of innovation
5. Big Crisis - Europe of cohesion

Figure 4.1 shows the main influencing factors and their value for the different scenarios.

Figure 4.1 Key characteristics of the PRELUDE scenarios



Following we present a brief summary for each scenario, which can, of course, only give a first flavour[3].

The Great Escape – Europe of Contrast

Economic globalisation increases global competition pressure. Market concerns dominate the political agenda. Governments back off from market interventions. Technological innovation rates are high, but living conditions worsen for many. Social protection becomes individualised. Societal tension builds up as relatively poor immigrants move to urban city centres. Rich gated communities in the countryside stand in contrast to urban ghettos.

Agricultural markets are liberalised - agriculture is market-oriented and maximises profit. Climate change affects the growing conditions for agriculture. Mainly large-scale farms with intensive management are able to survive. Production intensifies but total agriculture diminishes. Many grasslands are abandoned or converted into arable. Agricultural intensification and urban sprawl affect the rural environment negatively. Many nature reserves and extensive farmland areas with high nature value are lost. However, in some areas of agriculture abandonment, soil and water quality improve and more diverse natural habitats may develop.

Evolved Society – Europe of Harmony
Heavy floods and exploding energy prices reinforce environmental awareness. Many people come to believe that lifestyles and economy should change. A revival of the countryside takes places as many people move away from densely populated and most vulnerable (lowland) areas and settle in more rural and safe areas, especially in

[3] For this purpose the reader is referred to the interactive PRELUDE tool which will be published online under www.eea.europa.eu/prelude soon.

Eastern Europe. Local community action is getting new impetus by concerns for social equity. Policies focus on rural development and eco-efficient technologies, at the expense of structural change.

Farming is high-tech and increasingly organic. The agricultural area remains approximately the same while farming intensity decreases. In areas that are prone to repeated flooding, cropland is reduced considerably. Overall land use changes are not dramatic, and extensive farmland with high nature value is relatively well conserved.

Clustered Networks – Europe of Structure

Globalisation propels economic growth, but environmental conditions and health, especially in the urban centres, gets worse. People in the countryside also struggle as many local shops and services close down. The needs of an ageing society lead to the development of coherent spatial planning policies. Migration away from polluted urban areas is encouraged. New so called thematic cities with a service economy are founded in peripheral regions where they serve as focal points for regional economic and social development.

Urbanisation is concentrated and rural development focuses on 'green belts' around urban centres. Agriculture marginalises. As a result of large-scale land abandonment, cropland and grassland strongly decrease. Climate change is a less prominent driver in this scenario. Biodiversity, water, soil and air quality benefits from receding agriculture and creation of green belts. Natural habitats develop in the wider countryside, but at the detriment of high nature value farmland.

Lettuce Surprise U – Europe of Innovation

A major food security crisis hits Europe. As crisis management fails, faith in governments and in the health and environmental safety of Europe's food supply decreases strongly. An alternative food production and control regime and regional self-sufficiency with regard to food and energy are strived for. Political decentralisation becomes the new paradigm. New communication technologies facilitate local participatory decision-making and open-source development of technologies. Migration is limited and urbanisation patterns do not really change.

Environmental awareness grows, leading to widely demands for environmental friendly produced food. Technological innovations offer new opportunities: New crop varieties enable higher yields with lower inputs. Agriculture in the core production areas is high-tech, clean and relatively small-scale. Cropland decreases strongly, grassland decreases at a slower rate. The reduction of agricultural area and input leads to an increase of biodiversity and improvements in soil, water and air quality. Land abandonment affects high nature value farmland moderately.

Big Crisis – Europe of Cohesion

A series of environmental disasters highlights Europe's vulnerability and lacking capacities to effectively adapt. There is a strong support for centralised government and new concerns for solidarity and equity arise. New policies for sustainable and

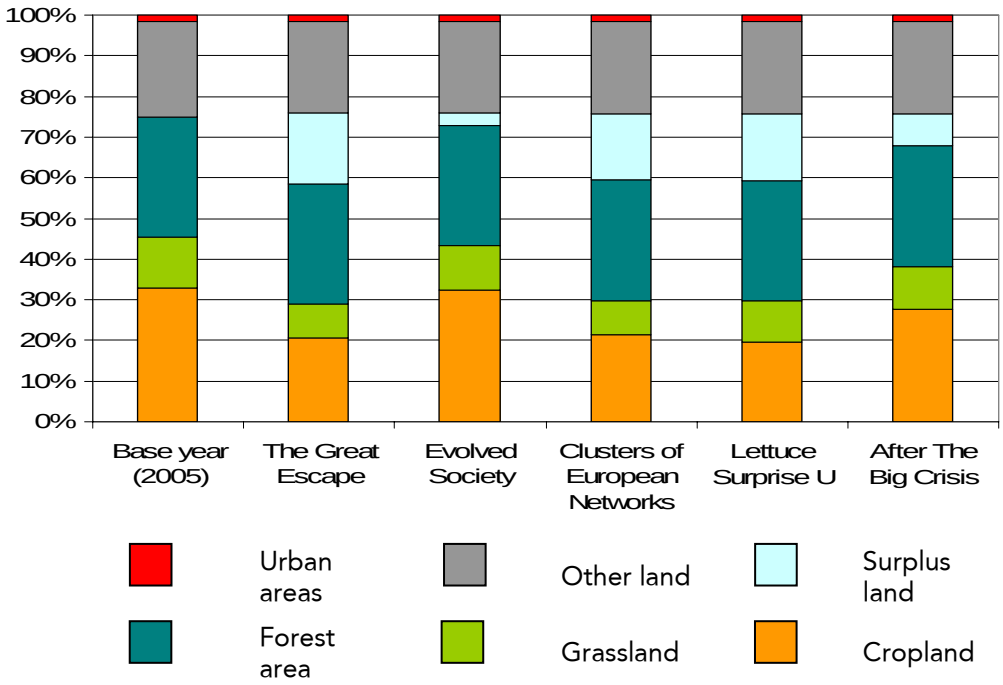
regionally balanced development are consolidated at the European level. Public transport is strongly promoted as environmental awareness grows.

Agricultural intensification is largely reversed after 2015: Agricultural oversupply is being diminished; the main focus of agriculture is on landscape stewardship. Land use changes are limited. The population in current urban core areas decreases slightly. Cropland and grassland decrease moderately. The initial environmental pressures are relieved. Soil, water and air quality benefit from agricultural extensification and limited land abandonment. The loss of high nature value farm-land remains relatively small.

5 Scenario analysis

We compare the magnitude of changes in the four main classes of urban area, cropland, grassland, and forest area per scenario. Based on this comparison, we use the concept of landscape types to compare the land use intensities in the scenarios.

Figure 5.1 Major land cover types in 2035 for EU-25 plus Norway and Switzerland compared to the base year 2005



The highest urban changes are observed for the “Clustered Networks”- and the “Evolved Society”-scenarios; however, note that they are rather small in total since they occur on a rather low general level. In both scenarios high rates of internal migration between different European regions occur. “Big Crisis” is also characterized by long distance population migration, but since this process is only assumed to kick in after 2015, the cumulative increases in urban land use by 2035 will be smaller than in the above two scenarios. For the other two scenarios, total urban land cover changes are lower because there is much less migration.

The spatial patterns of urban change are different for all scenarios, but for the majority of them, rural areas or small cities are more attractive than large cities. Only in the “Great Escape” scenario, the new urban settlements are located in large cities due to new arrivals from international immigration and the migration of poor people from rural areas. All scenarios exhibit some diffuse urban growth patterns. With the exception of “Great Escape” scenario, no new urban settlements are permitted within designated areas and so the landscape is preserved in these areas.

The highest agricultural changes are observed in the “Great Escape” scenario with high profits and the “Clustered Networks” scenario with its large imports. These are global market-oriented scenarios, and drastic agricultural changes are brought by the pure profit orientation in optimal locations in the first scenario and the large imports of agricultural products in the second scenario. The decrease in cropland is also very high for the “Lettuce Surprise U” scenario mainly due to a strong importance of high-yield and self-fertilizing plants and partly due to a transfer of cropland to grassland. Fewer changes are observed for the more environmentally-oriented scenarios because of the extensification of agricultural land and landscape preservation, i.e. the “Evolved Society” scenario and the “Big Crisis” scenario after 2015.

The surplus areas stemming from abandoned land for agricultural production are very high for the three scenarios “Great Escape”, “Clustered Networks”, and “Lettuce Surprise U”. Some of this land is used to grow biofuels either in form of crops or forest plantations; however, this constitutes a rather small fraction of the surplus land.

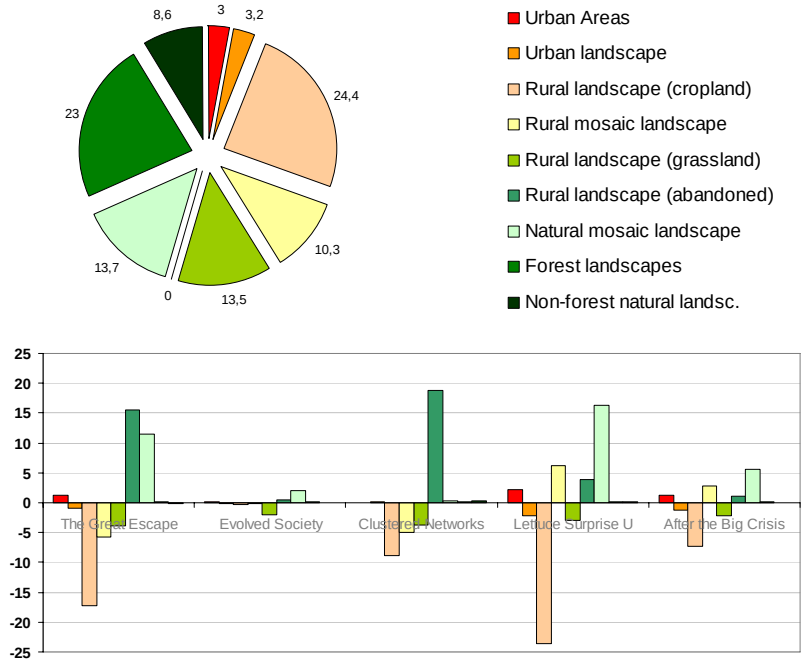
Forest land increases only slightly for all scenarios, based mainly on current trends of afforestation, which are low and which are assumed to continue in all five scenarios. Secondly succession time in forests is rather long so that the surplus land that is just left to turn to scrubland (and later forest land) will not have produced much new forest after the 30-year scenario period.

As regards for landscape type changes, urban land use increases in all scenarios. The main difference between the scenarios is the shift between urban areas and urban landscapes. As an example, we look at the “Lettuce Surprise U” scenario where a considerable shift towards urban landscape takes place. This increase is, however, not due to an increase in urban area itself, but due to the fact that landscapes with urban character which, in 2005, were dominated by both urban areas and cropland, are only dominated by urban land in 2035.

Agricultural land use is decreasing in all scenarios. Only in “Evolved Society” the changes are rather small. Whereas in 2005, rural landscapes (particularly those that are cropland-dominated) present a majority of landscapes in Europe, in 2035 this is only true for the “Evolved Society” scenario. Due to substantial abandonment of both cropland and grassland, there is a shift in dominance in “Great Escape”, “Lettuce Surprise U”, and “Big Crisis” towards at least one of the three other rural landscape types.

Shifts in land use patterns do not occur homogeneously throughout Europe. Whereas Scandinavia remains almost unchanged in all five scenarios, changes are particularly large for Eastern Europe, the Iberian Peninsula, and some Central European countries. Landscape patterns can change considerably, depending on the particular scenario.

Figure 5.2 Landscape type changes 2005-2035 in the scenarios



Great Escape - landscapes with agricultural character are maintained only in economically optimal cropland areas. Therefore, we see a large shift from cropland-dominated rural landscapes towards rural mosaic landscapes in central and Eastern Europe whereas in southern Europe these turn into rural landscapes with large fractions of abandoned land.

Evolved Society - the landscape patterns of the base year situation are largely maintained. However, despite strong and successful policies are assumed grassland is still diminishing.

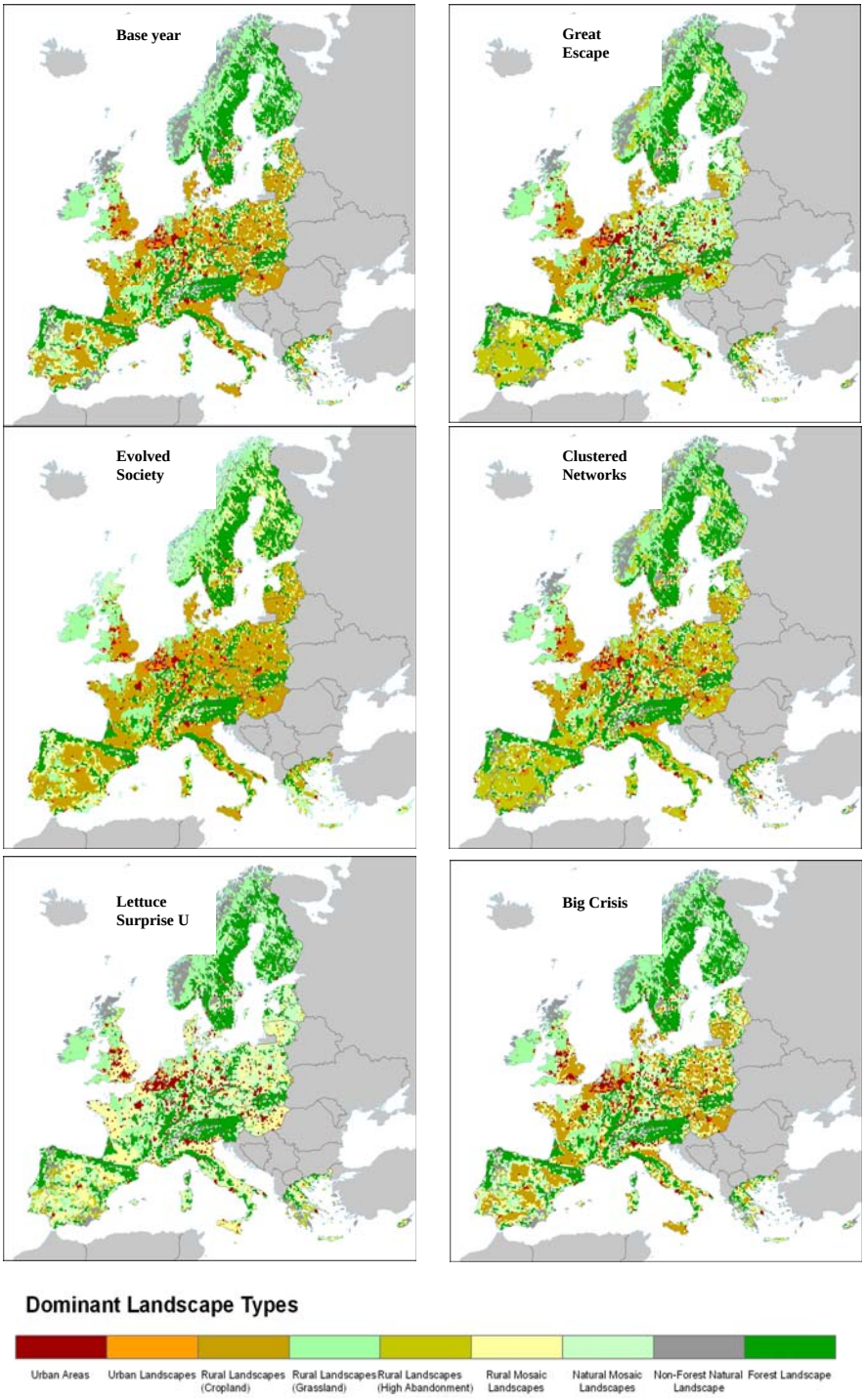
Clustered Networks - cropland-dominated rural landscapes are well preserved in economically optimal cropland areas as well as around cities due to the establishment of buffer zones. On the other hand, especially in the southern and eastern parts of Europe, there is a considerable shift of cropland-dominated rural landscapes towards rural landscapes with large fractions of abandoned land.

Lettuce Surprise U - virtually no cropland-dominated rural landscapes are left. They have all shifted to rural mosaic landscapes, or other landscape types. Grassland-dominated rural landscapes however are largely maintained due to a shift from crop-based pig production to grassland-based livestock production.

Big Crisis - cropland-dominated rural landscapes are surrounded by rural mosaic landscapes, similar to the situation in 2005. Also in the case of the other landscape types, this scenario shows similar pattern to the base year situation in 2005. Only in large parts of Germany, cropland-dominated rural landscape areas shift to other rural landscape types.

The landscape patterns corresponding to the scenarios are shown in Figure 6.3.

Figure 5.3 Landscape type comparison between 2005 and the five scenarios 2035



6 Implications for policy and strategy analysis

The PRELUDE results lead us to expect a further decrease of agriculture area in Europe that can have serious consequences for the socio-economic stability of some regions. Even in the most optimistic scenarios, the agricultural area decreases and traditional landscapes disappear. There is already a large share of elderly in the rural population. Current demographic data suggests a general decline of population in the long-term. This might aggravate the situation further.

Data for 2005 show that rural landscapes - and in particularly those that are cropland-dominated - present a majority of landscapes in Europe. Having played through five largely different scenarios, we see that in 2035 a similar pattern can only be found for the “Evolved Society” scenario, which is based on strong assumptions on value shifts and successful policy intervention. Europe’s landscape is likely to change and is likely to change profoundly. It will make itself felt especially in Eastern and Southern European countries.

Abandonment of agriculture land will most likely endanger many of our traditional landscapes. There are already a large number of measures set up to maintain traditional landscapes. However, rural development and environmental policies slow down the trend, but do not stop it entirely in our scenarios. Even if we largely increase our efforts compared with today’s values, the conservation of all areas of interests seems to be unlikely, given the magnitude of change.

To use our resources most effectively, it may be necessary to set stricter intervention priorities. This is especially true for the conservation of high nature value farmland, which is particularly affected. Here, a more concentrated effort in core areas is required, which implies higher budgets for this area. However, many habitats and species that depend on extensive agriculture are likely to decline considerably.

It also means to prepare for change and develop strategies accordingly. In some situations, all efforts might be needed to conserve a valuable landscape. In other situation it could be the right decision to let change happen as it cannot be prevented in the long-term. And in other situation there are promising opportunities for successfully steering change. Declining impacts of agriculture offer new chances for large scale nature development. If land use issues are solved in an integrated way there appear considerable opportunities for slowing down the loss of biodiversity. In order to cope with these challenges it may be necessary, however, to improve capacities for central planning at the European level.

Of course, the resolution of our scenario assessments is rather coarse. Also the assessment of policy options is rather broad, like regulation or deregulation of markets, central or decentralised spatial planning, supranational or regional institutions. Long-term assessments like PRELUDE are not supposed to provide blueprints for the transition towards sustainability. They rather fulfil the function of an eye-opener: What is needed to reach long-term (environmental) objectives if we see a Europe of Contrasts evolving? Or an Europe of Innovation?

The future will not resemble any of the PRELUDE scenarios. Rather it will contain bits and pieces of every scenario. The PRELUDE scenarios are first and foremost designed as a discussion tool. They are not supposed to answer all the questions that might arise with regard to the complex analysis of future patterns in land use and their driving forces. They are supposed to help thinking through alternatives when setting the course for strategic policy decisions. The PRELUDE scenarios offer context and a backdrop against which the debate about the future of land use, agriculture, rural communities and the natural environment can take place. They provide a sound problem analysis of future land use change across Europe and its environmental implications. Next steps of work will comprise discussions with EU member states and interested organisations on the implications for strategic decision-making.

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