2.3. Land use footprints

1. Land, a limited resource, under pressure

European landscapes are – in all senses – a human environment. The land provides the spatial context for, and also bears the impacts of, human activities. Each of the factors discussed previously in Chapter 2.2 (such as population change, urbanisation, industrialisation, transport and tourism, changes in world commodity prices, agriculture and forestry) may impact upon land use. Land cover is usually modified as a consequence of changes in land use, which may result from socio-economic or natural drivers or as a consequence of national or EU policies (see Box 2.3.1).

Human activity is responsible for many valued features of the European landscape, but also for growing pressures on the land (Map 2.3.1).

At its most extreme, misuse of the land can lead to environmental catastrophe, with loss of human life and economic disruption (see for example the Campania landslide Case Study, Chapter 3.8). Irreversible land changes led to major flooding incidents throughout Central, West and South Europe in 1997 and 1998, exacerbated by developments such as soil sealing (see also Chapter 3.6) and the straightening of rivers to facilitate drainage and transport. Map 2.3.2 illustrates for the major watersheds in Europe the area covered by urban fabric, road infrastructure, industrial and commercial sites. The major watersheds in Europe with more than 5 % of the total surface covered by built-up area are mainly located in NW Europe (e.g. Rhine, Thames, Meuse, Scheldt, Weser, Elbe).

The intensifying pressures of urban development are illustrated by figure 2.3.1, which

Box 2.3.1 Definitions

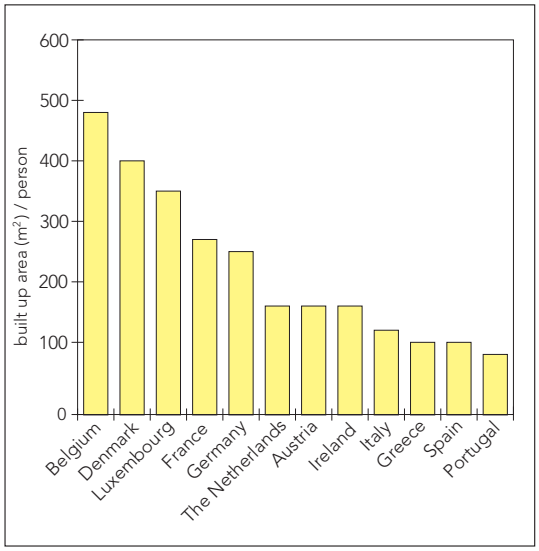
Land is defined as the surface of the solid Earth, together with superficial vegetation cover, built features and associated water surfaces, both freshwater and marine.

Land use describes the land surface from the social perspective; it is characterised by some identifiable purpose, or purposes, leading to tangible or intangible products or benefits.

Land cover is the description of the physical surface cover (e.g. grass, trees, rocks, buildings, water…).

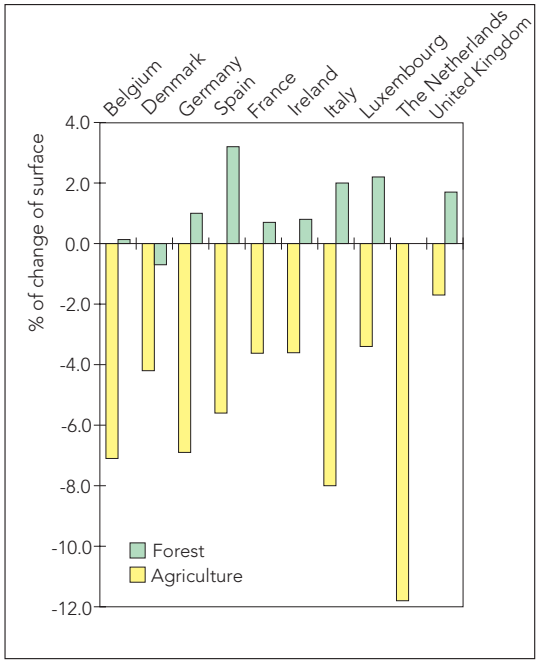
Land use and land cover are inter-dependent: changes in land use, which come about as a result of many of the socio-economic factors, impact directly on land cover.

Average of total artificialised surface (buildings, industrial and commercial areas, transport infrastructure) per inhabitant. Figure 2.3.1

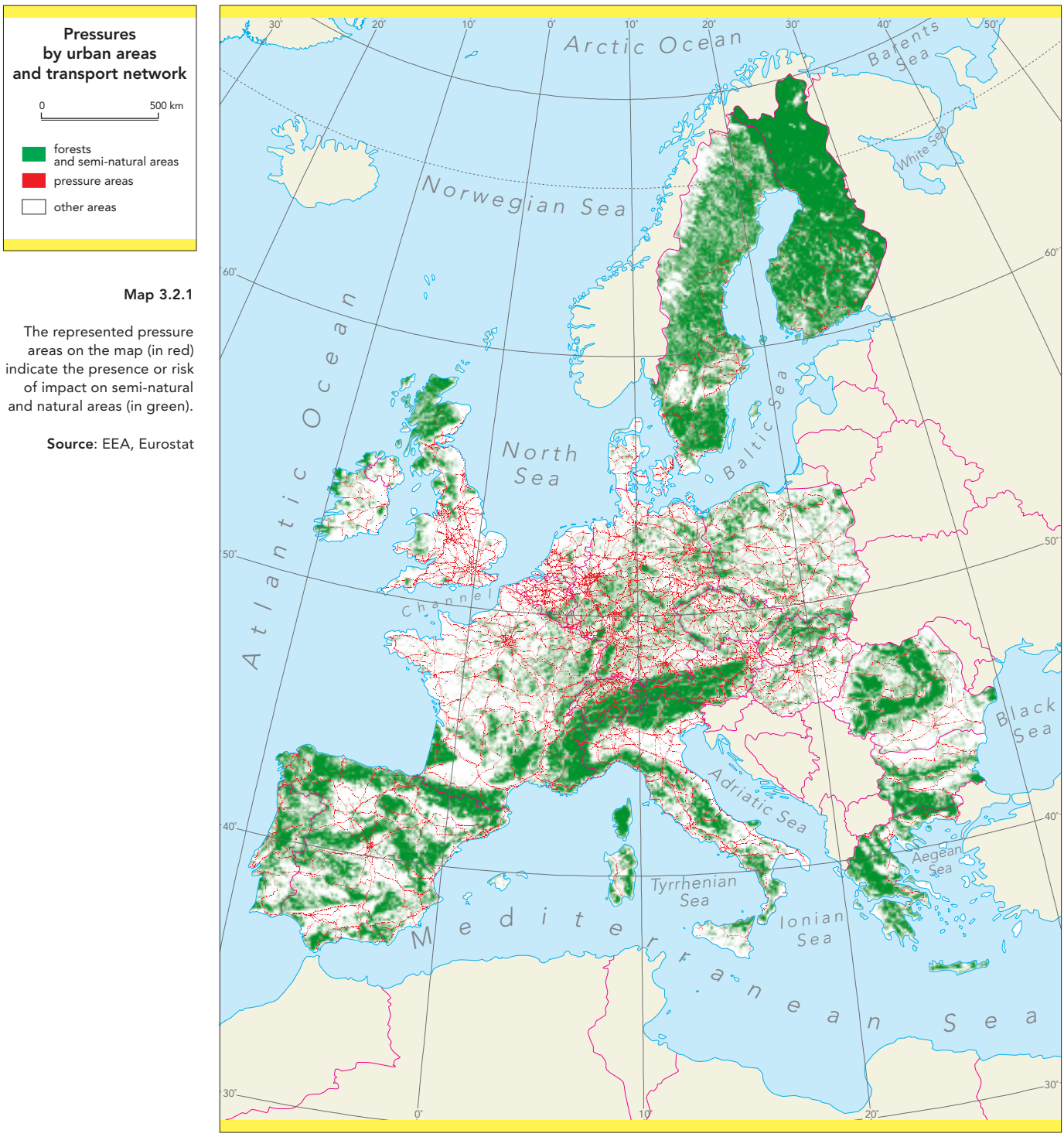


Source: EEA, Eurostat

Changes in agriculture and forest land, 1970-1990 Figure 2.3.2



Source: FAO



Map 3.2.1

The represented pressure areas on the map (in red) indicate the presence or risk of impact on semi-natural and natural areas (in green).

Source: EEA, Eurostat

shows that average built-up area per person tends to be higher in the more prosperous EU countries than in the peripheral regions.

2. Land and landscapes under significant changes

European landscapes have often been considered stable, timeless and changing so slowly that the effects are almost undetectable over long periods. In reality, the ability of modern society to change its surroundings has proven to be wide ranging, deep and the consequences can be rapid. Pressures arise from a combination of local pressures and driving forces that are external to the local landscape.

Agriculture is the main form of land use and has had a crucial role in the development of European landscapes (Figure 2.3.2). Changes in the commercial realities facing farmers can lead to damaging changes: for example, stone or earth terraces may fall into disrepair, leading to

Built-up land by major river catchment area

0 500 km

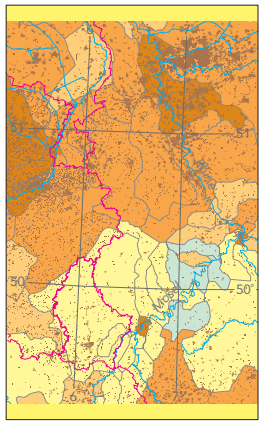
- more than 20%
- 10–20%
- 5–10%
- 2–5%
- less than 2%
- urban areas
- boundaries of catchment areas

Map 2.3.2

Source: EEA, Eurostat

Built-up land by sub-river catchment area

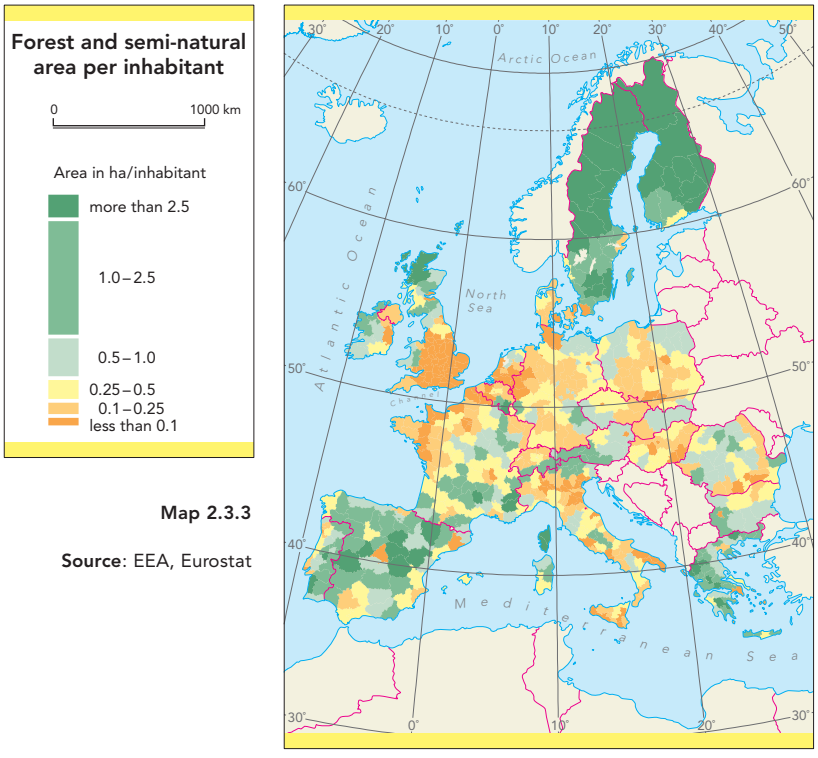
0 50 km



erosion and even to loss of farming potential, and threats can arise to the living landscape characterised by pollarded and coppiced trees, small and irregular fields, farm woodlands and hedgerows, a diverse mosaic of land uses, and traditional rotation patterns, including ley and fallow.

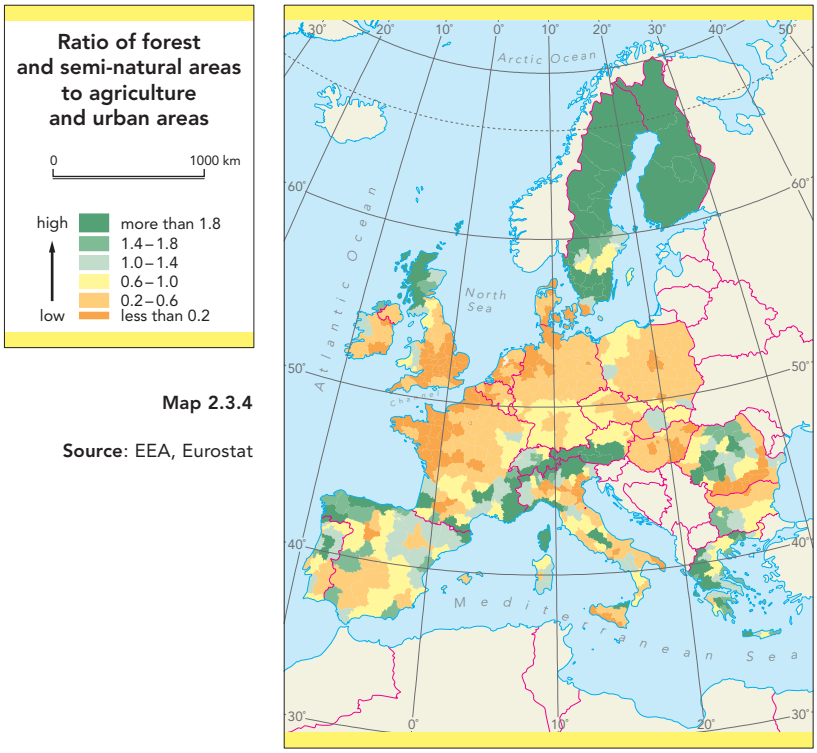
The past decades have also seen continuing trend towards urbanisation across Europe, together with increasing dispersal and sprawling of urban settlements with declining urban population densities, greater requirements for infrastructure. The consequence has been a significant growth in urban land and reduction of natural and semi-natural land. Map 2.3.3 shows the regional variation in the amount of natural and semi-natural area per inhabitant, juxtaposed to Map 2.3.4 illustrating the distribution of remaining natural and semi-natural areas in proportion to agricultural land and urban areas (see also Chapters 3.6 and 3.12).

The picture that emerges from land-cover change analysis is one of an extremely



Map 2.3.3

Source: EEA, Eurostat



Map 2.3.4

Source: EEA, Eurostat

dynamic landscape, primarily shaped by man. Interestingly, the average annual rate of land-cover changes tends to be quite small but the cumulation results in dramatic changes at local or regional scale. Map 2.3.5 shows the importance of changes in coastal areas during the past 50 years for the area of Zeebrugge at the Belgian coast. This area has experienced a yearly average change of less then 1% since 1930, resulting in a total area land change of over 50% by 1995. (For more information on changes in coastal areas, see also Chapter 3.14). Current statistical tools at European level do not yet allow us to pick up such changes in a systematic way.

Increased economic wealth and social expectations will continue to be powerful forces for change throughout Europe. Today, most of the EU countries have at least 80% of their territory given over to 'productive' uses like agriculture, forestry, urban centres, transport and industry, leaving a limited margin for further uses. Planned extensions to the motorway network will increase the total length by more than 12 000 km within the next 10 years. And a 5% increase in urban population will, according to present trends, require an equal increase in the take of urban land. Figure 2.3.3 shows projected changes in the 'productivity' of land in the EU countries between 1990 and 2010.

These challenges are being exacerbated because people are leaving new 'footprints' on the environment and the economic pressure on land is likely to be further increased by the eastward expansion of the EU. Of course, the pressure on land resources do not fall uniformly: 74% of the population of Europe is concentrated in only 15% of its land surface and zones in closest proximity to existing conurbations are, in general, those under greatest pressure from intensification of land use. However, there has been a remarkable tendency since the 1950s for a dispersal and sprawling of urban settlements, causing new hot spots to emerge (see Box 2.3.3).

3. The influence of EU Policies

Policies explicitly relating to land-use issues, and especially physical planning, measures, have generally been the responsibility of the authorities in member states, rather than the EU which does not have an explicit competence in that area. Nevertheless, EU policies

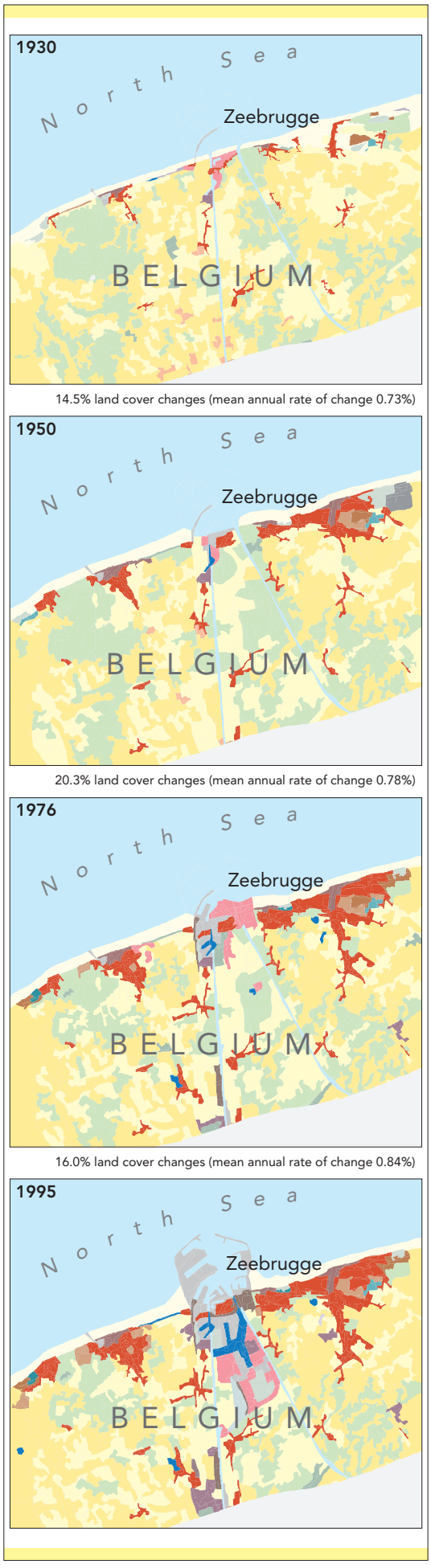
and legislation generate powerful forces for change in land use and land cover. Their potential to influence land use across Europe is extensive. There is a very real danger that inadvertent and unforeseen damage can arise from EU initiatives in areas such as regional development, transport, environmental protection, agriculture and forestry.

EU regional and rural development policies are now increasingly directed towards creating alternative opportunities that incorporate integrated environmental safeguards (see Chapter 3.13).

EU environmental protection legislation can also exert a major influence on land use. Here, the principal impacts come from Directives in the areas of Environmental Impact Assessment, water management (the new Water Framework Directive, see Chapter 3.5) and nature protection policies. Nature protection influences land use mainly through measures designed to conserve species and habitats by the designation of 'Special Protection Areas' (Birds Directive) or 'Special Areas of Conservation' (Habitats Directive). Given that nature protection networks such as Natura 2000, designated by the member states, may eventually cover as much as 10% of the land area of the EU, these legislative schemes are likely to prove an important tool for the management of European land and landscape resources (see Chapter 3.11).

4. Implications of EU enlargement

Proposals for the future enlargement of the EU, as set out in the communication 'Agenda 2000 for a stronger and wider Europe', are likely to lead to significant and often unpredictable changes in land-use patterns across the whole of the EU. Across the EU, increased East-West trade will demand expanded transport infrastructures. Trends are likely to result in loss of natural land and the degradation of land in the proximity of centres of development. Agricultural systems in the Accession Countries will be exposed to competition from more intensive practices in the West. Agriculture is the dominant form of land use, over 55% of total land area on average in the Accession countries, and an important factor in shaping the countryside. Over the period 1989-1997, the total arable land has remained relatively stable or declined slightly during transition in most Central and Eastern European Countries. Overall, this is likely to



Map 2.3.5

Source: CEO/JRC

Box 2.3.2 The European Spatial Development Perspective (ESDP) initiative

The origins of the ESDP
The European Commission has been charting the spatial development of the Community territory since 1989, with the launch of the Europe 2000 programme of studies. The ministers responsible for spatial planning decided at their informal meeting in Liège (1993) to lay the groundwork for the European Spatial Development Perspective (ESDP). Further meetings led to the adoption of the first official draft in 1997 in Noordwijk, to be finalised in May 1999. In December 1997, the ministers launched a public debate based on this document and decided to prepare a further chapter on the territorial impact of the next enlargement of the Union, as well as confirming their intention to create a European Spatial Planning Observatory Network.

ESDP and the role of Environmental and other Community policies
Four main policy areas affect the development of Community territory: the Common Agricultural Policy, regional and cohesion policy, policies linked to trans-European networks in transport and telecommunications, and environment policy. The ESDP examines both the achievements and inadequacies of these policies and draws attention to risks relating to economic and social cohesion and environmental protection. Initial conclusions highlight three main points to be addressed by an integrated vision of the whole of the European territory:

- more balance geographical distribution of production activities to correct present trends towards concentration in the most competitive areas;
- more sustainable land use to ensure appropriate choices in terms of basic infrastructure in the longer-term interest of the entire territory;
- greater sensitivity to specific territorial needs.

Some examples of some environmental objectives considered within the ESDP:

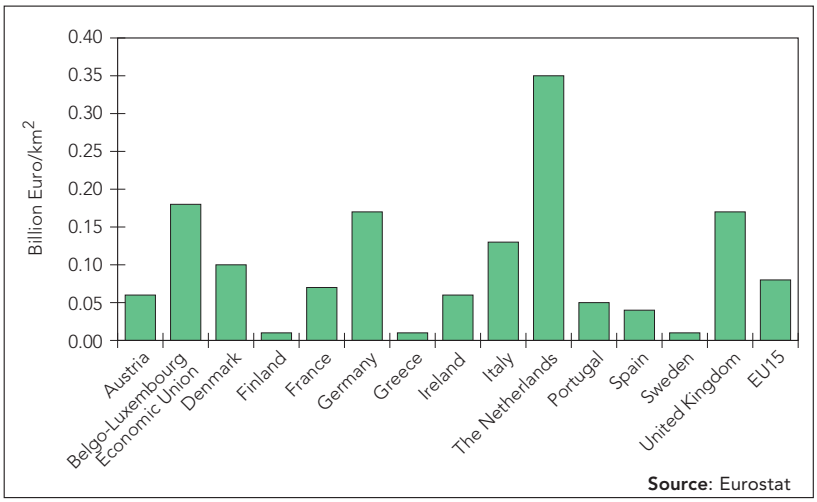
- **Better environmental protection.** The ESDP insists on the necessity of speeding up the creation of the European ecology network Natura 2000, drawing together protected sites. It proposes to ensure appropriate management of ecologically vulnerable areas or sites of exceptional biodiversity, as well as promoting policies that reconcile the maintenance of the natural heritage with the economic development of rural areas.

- **Careful management of water resources.** The ESDP recommends shared management of the major water tables and of coastal waters to preserve them from pollution, to develop mutual strategies against risk of flooding (particularly in the transnational river basins), the balancing of supply and demand for water in areas prone to drought, and the protection of wetland areas threatened with over-exploitation of water resources.

- **Better exploitation of rural landscapes.** The safeguarding of rural landscapes for their beauty, as well as cultural and historical importance, is not incompatible with economic development. The natural heritage requires careful management in line with local conditions. This is often closely linked to the maintenance of agriculture, as farmers play a central role in landscape management. Co-operation in this area will encourage the preservation and good management of rural landscapes, appropriate land-use policies and the rehabilitation of landscapes which have been degraded as a result of human activity.

  There is a risk of conflicting impacts resulting from divergent policy-making in different areas of European competence. Debate on European spatial development should be focused on the potential of the ESDP to contribute greater coherence to separate Community policies.

Figure 2.3.3 **Changing intensity of land use in the EU between 1990 and 2010 illustrated by the increase of GNP per unit area of land surface (euro/km²)**



Source: Eurostat

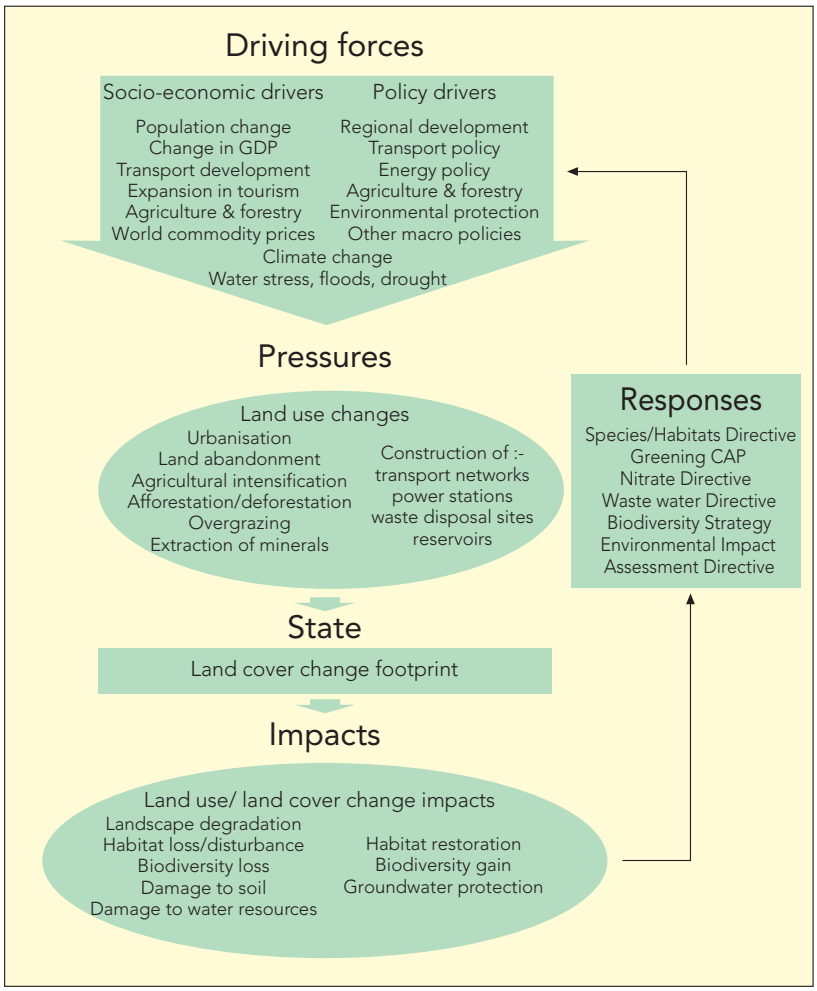
exacerbate existing trends towards intensification in the more productive areas and decline in marginal regions.

5. A need for territorial policies

Land management and land planning are issues to be dealt with through coordination between all levels: EU, national, the regions, and locally. Managing European land resources needs therefore a share of long-term perspectives, but final success depends on regionally and locally experienced situations and actions. There is still much that remains unknown, partly because there is not yet a coordinated vision at the EU level for the future of land planning and spatial planning activities. An integrated planning approach is re-

flected in the European Spatial Development Perspective, now under consideration by the Member States and the EU (Box 2.3.3). The success of such initiatives will, in part, be determined by improved access to information on land resources, especially in spatially-referenced forms. Such information will be of crucial importance as a means to guide the formulation and performance analysis of spatial development policies which lies in many different, complex and interacting factors influencing processes of change (see Figure 2.3.4).

DPSIR for changes in land use and land cover Figure 2.3.4



Box 2.3.3 Environmental hot spots in Europe

About the experiment to map hotspots in Europe
A geographical analysis of the coincidence of environmental problems in Europe is dependent on the availability of suitable, accessible and scientifically robust pan-European data. Environmental problems manifest themselves at various geographical scales; the currently available geographical datasets mainly describe problems that are on a continental or even global scale. Problems that are diffuse (e.g. agricultural pollution) or that occur at a local scale (e.g. disposal of toxic waste) may be reported only at the Member State, or even local government level, or not at all. For these localised problems little harmonised European data is available. Consequently, the results shown on [Fig. HOTACC] largely reflect those environmental issues that have received greatest political attention (see also Walker & Young, 1997, and Working Group on the SEA of the TEN, 1998, for discussions on the limitations of available data). These results also reflect the challenge of complexity for policy-makers.

Defining the coincidence of environmental problems
The pressure, state or impact data mapped here address only seven **EU policy areas of concern** for which data were available: acidification and eutrophication; coastal issues; habitat loss; tropospheric ozone increases; soil degradation; ultraviolet radiation caused by stratospheric ozone depletion; and effects on freshwater resources. Additional data might reflect wider pressures and impacts. Only geo-referenced data describing environmental impacts, pressures or states that covered all of the Member States, at the sub-national scale, were used. Data that did not reflect the trans-boundary nature of environmental problems were not used. The EMEP150 grid (Hettelingh *et* al., 1991) was chosen as a base map since many of the available datasets were reported at this scale.

First, thresholds were applied to each data layer to identify environmental problems. The thresholds were defined based on one of two criteria: policy or legislative guidelines (for example, WHO air quality guidelines (WHO, 1987, as quoted in Bosch *et al.*, 1997)), or through the use of expert knowledge when such policy thresholds were not available. This resulted in policy or expert-based 'problem' maps. Based on these results, each data layer was transferred onto the EMEP150 grid by calculating the area within each cell occupied by the problem.

For each policy area the available grid layers were combined to create a map showing where one or more problems were occurring. The coincidence of

.../...

environmental problems was then defined by overlaying these different policy area layers. The result of this analysis is shown in Map 2.3.6.

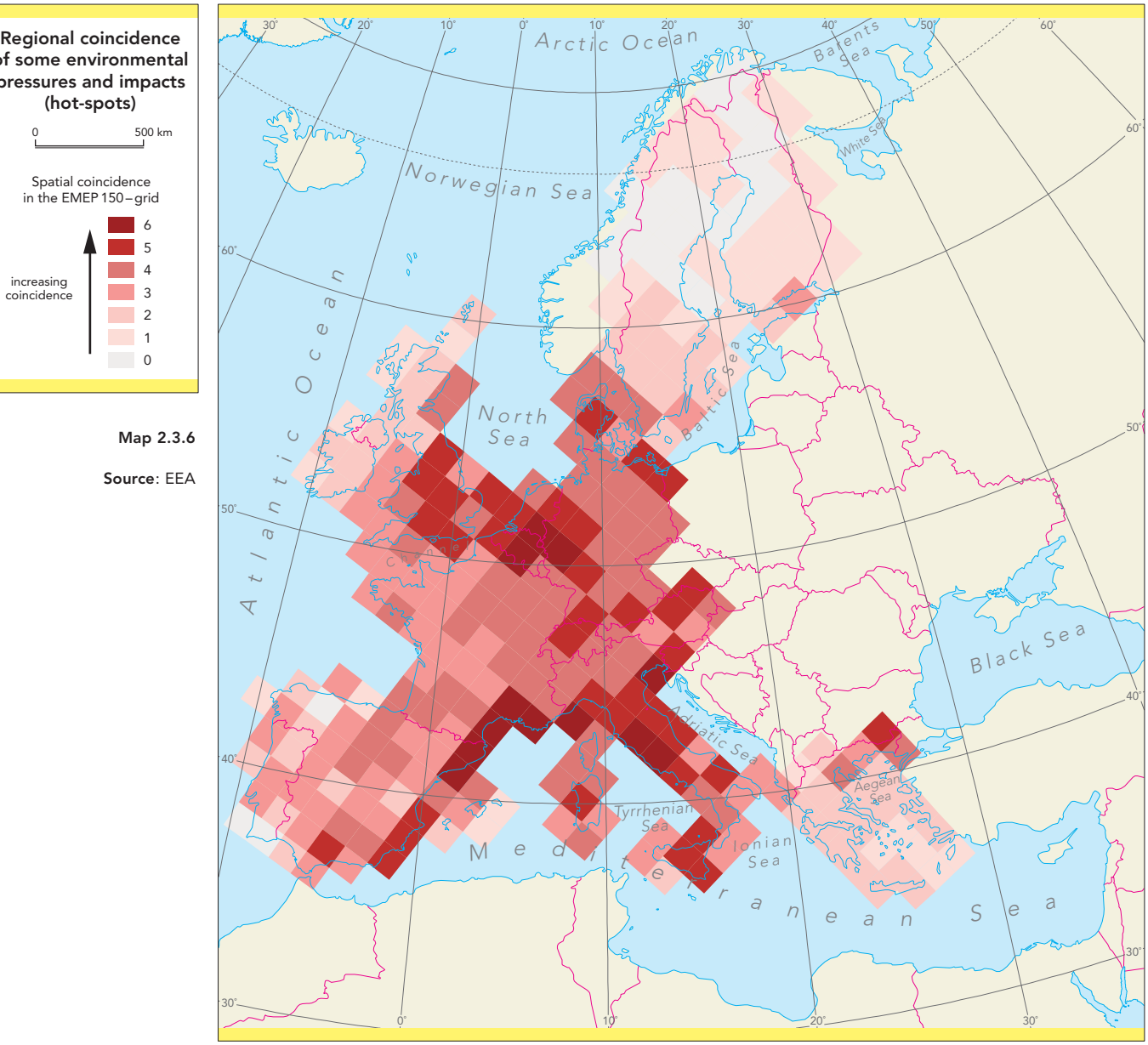
Interpretation: what the map tells us
This map shows us the extent of the urban 'footprint' across the face of Europe. If we look for the underlying driving forces and pressures (see Figure 2.3.4) we see associated problems which could not appear on the map because of data restrictions. For example, there is no 'water quality' data layer. The map also shows us where to look for areas where environmental damage may be preventable, repairable, or possibly beyond repair.

As urban population densities decrease, the actual numbers of people in spreading urban areas increases; this means that more land is taken up to supply the demand for energy, water, food production, leisure, and the transport networks which make all these things possible. So although 'traditional' hot spots (areas of high metal, PAH and sulphur deposition, for example) may be less intense and less frequent, 'new' hot spots of habitat loss and long-term soil and water deterioration appear.

The map shows us that the accumulation of problems coincides with the density of transport routes and industry in the UK, the Rhine-Ruhr corridor and in France, Germany, and Northern Italy. We see that industrial use of water, and continuing air pollution, in Germany and the Netherlands will contribute to the continuation of acidification and the loss of freshwater resources. If industrial technologies don't change then the Rhine-Ruhr corridor in particular will continue to suffer from hazardous-substance emissions and deposition: cadmium, dioxins, benz(a)pyrenes and polychlorinated biphenyls, although these substances are not mappable at this scale, at this time.

In the Mediterranean countries, where agriculture is the highest consumer of water, and in the livestock areas of France, Germany, and Benelux, we see widespread eutrophication. The Mediterranean coast, including the Athenian basin, and the Alps reflect their popularity as tourist destinations: seasonal fluctuations in demand for water and sewage treatment, and the need for permanent roads for access, are reflected in the data of habitat loss, soil degradation, and coastal problems (on the seaboard).

Regional coincidence of some environmental pressures and impacts (hot-spots)



Map 2.3.6

Source: EEA

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