Key drivers and uncertainties

The key drivers of intensifying competition for resources are continuing economic growth and related growth in numbers of middle-income consumers. Depleting resources and changing geographical patterns of demand and supply influence access to key resources. Technological innovation will boost demand for certain minerals and metals not widely used before (such as lithium and rare earths metals). Efforts to expand the membership of trade agreements and other forms of economic integration may be important to alleviate competition over resources.

Major uncertainties include the continuation and global pattern of economic growth, the future direction and application of technological innovations such as the NBIC technology cluster and changing demand for certain resources. On the supply side, new reserves may be found. Some reserves may be too costly to exploit, however, because of environmental considerations (e.g. in the Arctic). Global progress in environmental agreements (e.g. on strict preservation of the Arctic environment) could exclude or reduce the availability of such resources. Geopolitical instability may hamper new trade agreements and other pacts that smooth international trade and reduce resource competition.

8 Decreasing stocks of natural resources

A larger and richer global population with expanding consumption needs will place growing demands on natural systems for food, water and energy. European resource stocks may likewise face increasing pressures.

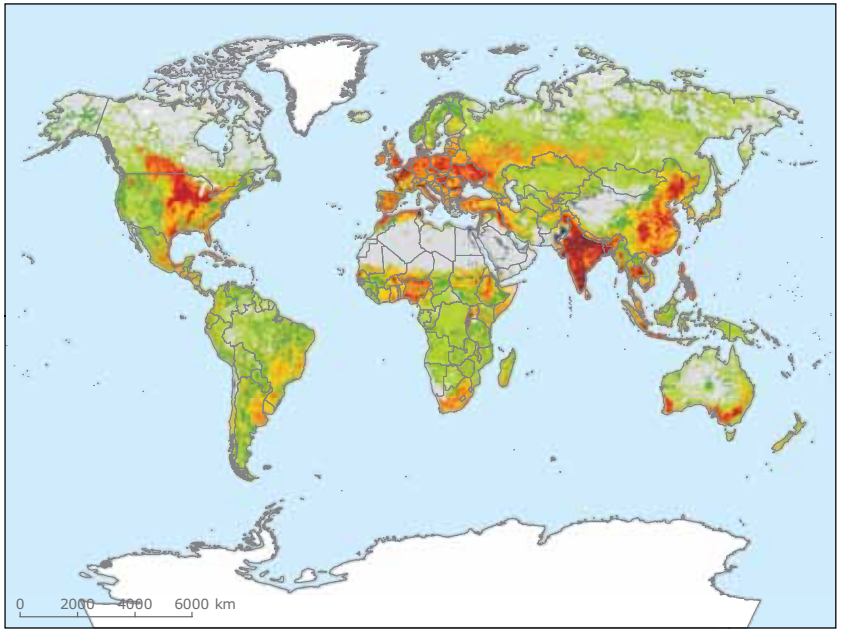
Growing human demand for natural resources, driven by continuous population growth and increasing individual consumption, has resulted in large-scale land conversion (deforestation, cultivation and urbanisation) and loss of biodiversity (MA, 2005). While biodiversity loss could be regarded as a megatrend in its own right, it is included here because land conversion and loss of natural ecosystems are central to changes in biodiversity. Humans have converted about a quarter of the Earth's potential net primary production ([5]), either through direct cropping (53 %), land-use-induced productivity changes (40 %) or human-induced fires (7 %). As shown in Map 8.l, the combined impact on natural ecosystems is biggest in North America, Europe and south-east Asia (Haberl et al., 2007).

Deforestation is occurring on an alarming scale, particularly in the tropics. The net area lost annually has decreased substantially, however, from approximately 83 000 km^2 per year in the 1990s to just over 50 000 km^2 per year from 2000–2010. The historical large-scale forest loss in temperate regions has come halted and forest cover there is slowly increasing again with a net gain of 30 000 km^2 in the period 1990–2005. Projections of forest cover by 2050 vary considerably depending on the underlying assumptions, but most studies indicate further overall decline (FAO, 2010; Leadley et al., 2010).

The significant growth of the world's population in coming decades and the shift in diets from cereals to meat as wealth increases may cause demand for agricultural production to rise steeply. According

([5]) Primary production is the production of organic compounds from atmospheric or aquatic carbon dioxide, mainly through photosynthesis.

Map 8.1 Human use of terrestrial ecosystems



Note: (a) Primary production is the production of organic compounds from atmospheric or aquatic carbon dioxide, mainly through photosynthesis. This maps shows human appropriation of net primary production (HANPP) as a percentage of potential net primary production (NPP). HANNP can be calculated in different ways, depending on the reference value for primary production. For estimating the impact on natural ecosystems, this can be related to an estimated primary production of the potential natural vegetation. In this definition, HANPP also takes changes in primary production resulting from land conversion into account.

Source: Haberl et al., 2007.

to the United Nations Food and Agriculture Organization (FAO), demand for food, feed and fibres could grow by 70 % by 2050 (FAO, 2009).

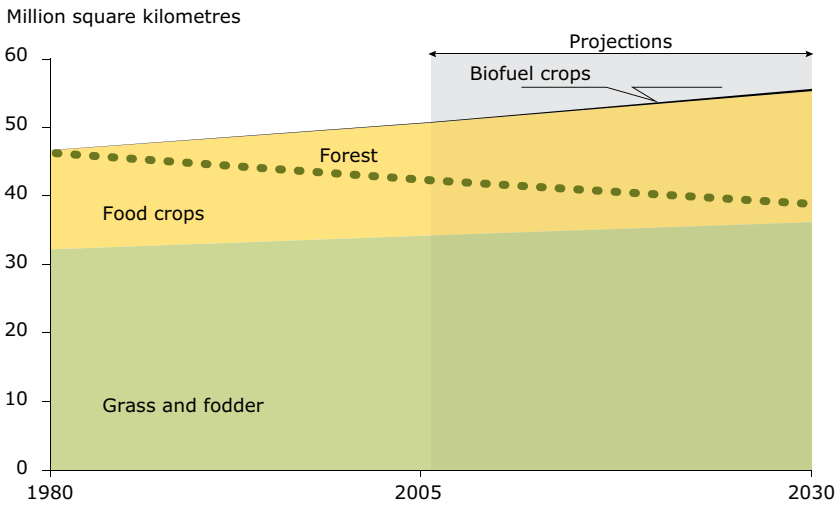
This growth in demand for agricultural output would have considerable implications for land use and natural ecosystems. A projected population increase of 27 % and a wealth increase of 83 % by 2030 would imply a demand for agricultural production that is 50 % higher than today's. Even if agricultural productivity increases at current rates, it would be necessary to expand the global agricultural area by roughly 10 % to meet demand (PBL, 2008; OECD, 2008, see also Figure 8.1).

Unsustainable management practices, however, may in the long run jeopardise productivity. Deforestation and improper agricultural management have already led to large-scale soil degradation. A common problem is soil erosion by surface water runoff, which ultimately reduces food production capacity (Map 8.2). Areas with high water erosion sensitivity are projected to increase by more than one third to some 27 million km^2 in 2030, nearly one fifth of the world's land area. The most impacted regions are in China, India, Africa, the USA and South America (OECD, 2008; PBL, 2008).

Overexploitation of natural resources and associated land use change ultimately leads to ecosystem degradation and loss of biodiversity. Habitat loss and species declines are projected to occur in most regions, most notably in the tropics (Figures 8.2 and 8.3).

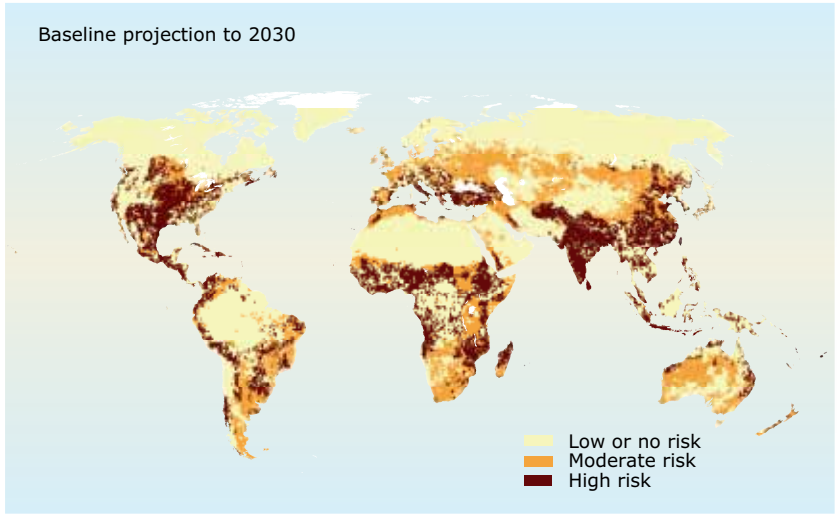
As for the marine environment, a recent study shows that 40 % of the world's oceans are severely affected by human activities (WWF, 2008). About 80 % of the world's marine fish stocks for which information is available are fully exploited or overexploited (CBD, 2010).

Figure 8.1 Changing area of farmland



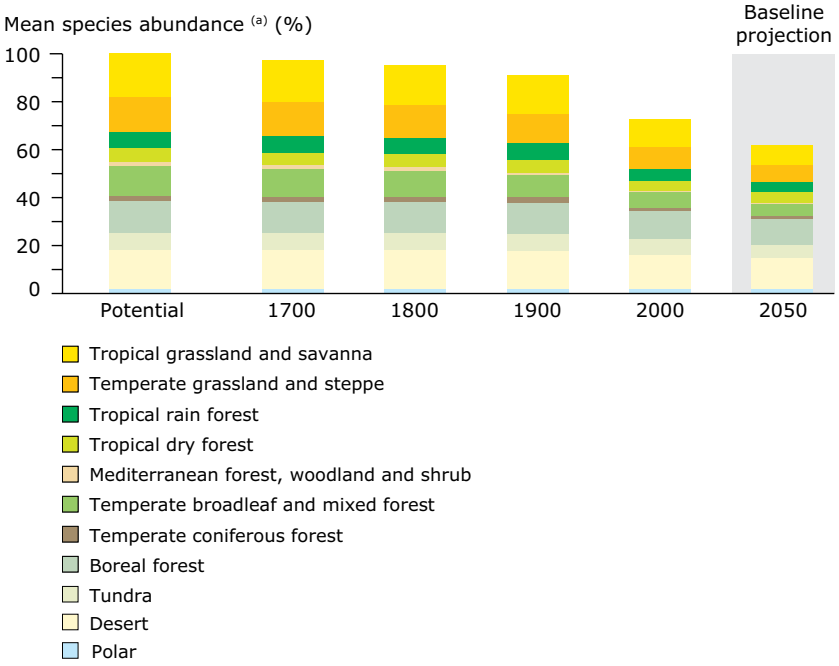
Source: OECD, 2008.

Map 8.2 Water erosion risk



Source: PBL, 2008.

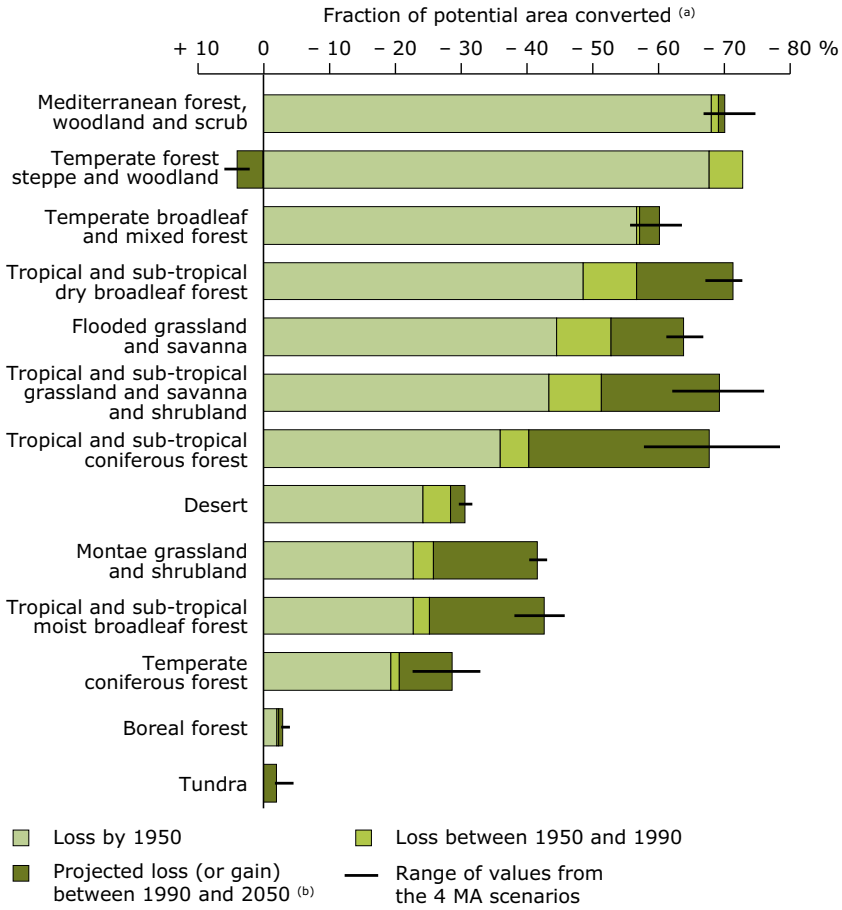
Figure 8.2 Loss of species diversity in the world biomes



Note: (a) Mean species abundance (MSA) is an indicator of biodiversity. Combining the extent of ecosystems and abundance of selected species, it reflects the state of impacted ecosystems, compared with their pristine, unimpacted state. As such it indicates how natural an ecosystem is.

Source: PBL, 2008.

Figure 8.3 Conversion of regional ecosystems (biomes)



Note: (a) The extent of different regional ecosystems (or biomes), prior to significant human impact, cannot be estimated, but the potential area of biomes can be determined on the basis of soil and climatic conditions.
(b) According to the Millennium Ecosystem Assessment (MA) scenarios. For the 2050 projections the average value of the projections under the four scenarios was plotted; the error bars (black lines) represent the range of values from the various scenarios.

Source: MA, 2005.

Box 8.1 Why is depletion of natural resources important for Europe?

In general, the loss of natural ecosystems and soil degradation damage a wide range of ecosystem services, including cycling carbon and water, and providing food and fibres. Food and water security is clearly a key concern here. The fragility of global food systems has already become apparent over recent years. Driven by recurring food and economic crises throughout 2006–2009, the number of undernourished people rose to more than one billion in 2009. The proportion of undernourished in developing countries, which was previously declining, has also risen in the past few years (FAO, 2009). Ultimately these trends may lead to regional conflicts and social instability.

Potential impacts on Europe include changes in the abundance of species, climate change, increased demand for and depletion of domestic resources (such as food and timber), and environment-induced immigration from developing countries.

Key drivers and uncertainties

More people, with greater affluence and more meat in their diets, will increase demand for agricultural production. Expansion of agricultural land is therefore likely but its extent is uncertain as it depends on population and economic growth, diet changes and technological advancement. The responses of species and ecosystems to further land conversion and intensified land use are still unknown but soil degradation and ecosystem collapses can significantly and irreversibly reduce natural production capacity.