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**Report of the Plenary of the Intergovernmental Science-Policy
Platform on Biodiversity and Ecosystem Services on the work of
its sixth session**

Addendum

At its sixth session, in its decision IPBES-6/1, section IV, paragraph 7, the Plenary of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) approved the summary for policymakers of the regional assessment of biodiversity and ecosystem services for Europe and Central Asia as set out in the annex to the present addendum.

Annex

Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Europe and Central Asia of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

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These maps have been prepared for the sole purpose of facilitating the assessment of the broad biogeographical areas represented therein.

¹ Authors are listed with, in parenthesis, their country of citizenship, or countries of citizenship separated by a comma when they have several; and, following a slash, their country of affiliation, if different from citizenship, or their organization if they belong to an international organization: name of expert (nationality 1, nationality 2/affiliation). The countries or organizations having nominated these experts are listed on the IPBES website.

I. Key messages

A. A precious asset: nature and its contributions to people's quality of life in Europe and Central Asia

Nature's contributions to people, which embody ecosystem services, are critically important for livelihoods, economies and a good quality of life, and are therefore vital to sustaining human life on earth. Nature has considerable economic and cultural values for societies. Nature also benefits, for example, human health through its role in medicines, the provision of food for varied diets and support to mental and physical health through green spaces. The knowledge and customary practices of indigenous peoples and local communities also enhance people's quality of life by fostering cultural heritage and identity. In Europe and Central Asia, which has an area of 31 million square kilometres, the regulation of freshwater quality has a median value of \$1,965 per hectare per year. Other important regulating services include habitat maintenance (\$765 per hectare per year); the regulation of climate (\$464 per hectare per year); and the regulation of air quality (\$289 per hectare per year).

Nature's contributions to people are under threat due to the continuing loss of biodiversity. Sustaining nature's contributions to people requires the maintenance of high levels of biodiversity. The continuing decline in biodiversity has had negative consequences for the delivery of many ecosystem services over the last decades. These include habitat maintenance, pollination, regulation of freshwater quantity and quality, soil formation and regulation of floods. These declines have occurred in part because of the intensive agriculture and forestry practices used to increase the provision of food and biomass-based fuels.

The region of Europe and Central Asia partially relies on net imports of renewable resources from outside the region. The population of Europe and Central Asia consumes more renewable natural resources than are produced within the region in spite of the increase since the 1960s in the production of food and biomass-based fuels. Central and Western Europe depends on food and feed imports equivalent to the annual harvest of 35 million hectares of cropland (2008 data), a land area the size of Germany.

Across Europe and Central Asia, nature's contributions are not evenly experienced by people and communities. In Europe and Central Asia, a combination of food provision and imports means that the region is currently food secure but, in some areas of Central Asia and Central and Eastern Europe, food security is threatened by exports arising from large-scale land acquisitions mainly by entities from both Western Europe and outside the region. Water security, which relies partially on nature's regulation of water quality and quantity, also varies across the region, with 15 per cent of people in Central Asia lacking access to safe drinking water. The decline of indigenous and local knowledge has negatively impacted on the heritage and identity of indigenous peoples and local communities.

B. The biodiversity of Europe and Central Asia is unique but threatened

The biodiversity of Europe and Central Asia is in continuous strong decline. The extent of natural ecosystems has declined, e.g., wetland extent has declined by 50 per cent since 1970 and natural and semi-natural grasslands, peatlands and coastal marine habitats have been degraded. Ecosystems have considerably declined in terms of species diversity. Of the assessed species living exclusively in Europe and Central Asia, 28 per cent are threatened. Among all the assessed groups of species living in the region, particularly threatened are mosses and liverworts (50 per cent), freshwater fish (37 per cent), freshwater snails (45 per cent), vascular plants (33 per cent) and amphibians (23 per cent). Landscapes and seascapes have become more uniform in their species composition and thus their diversity has declined.

In recent years, national and international sustainability and conservation policies and actions have contributed to reversing some negative biodiversity trends. More sustainable management of fisheries and reduction of eutrophication has led to an increase in some fish stocks in areas such as the North Sea. Endangered habitats, such as Macaronesian woodlands, and species such as the Iberian lynx and European bison, have recovered substantially because of targeted conservation efforts.

Overall, progress towards healthy ecosystems is still insufficient. While some progress has been made in improving the status of biodiversity by safeguarding ecosystems, species and genetic diversity, biodiversity status and trends remain negative overall. Increasing conservation efforts and the sustainability of the use of biodiversity would enhance the chances of meeting national and international biodiversity targets.

C. Drivers of change in biodiversity and nature's contributions to people in Europe and Central Asia

Land-use change is the major direct driver of the loss of both biodiversity and ecosystem services in Europe and Central Asia. Production-based subsidies have led to intensification in agriculture and forestry, and, together with urban development, have led to biodiversity decline. Increasing intensity often impinges on traditional land use. Ceasing traditional land use has reduced semi-natural habitats of high conservation value and associated indigenous and local knowledge, practices and culture across the region. Although protected areas have expanded in the region, protected areas alone cannot prevent biodiversity loss. Only where protected areas are managed effectively can they contribute to the prevention of biodiversity loss.

The impact of climate change on biodiversity and nature's contributions to people is increasing rapidly and is likely to be one of the most important drivers in the future. Trends in natural resource extraction, pollution and invasive alien species have led to considerable declines in biodiversity and ecosystem services, and are likely to continue to pose considerable threats, particularly in combination with climate change. Natural resource extraction is still a major pressure on biodiversity. Furthermore, despite effective regulations, pollution continues to pose a major threat to biodiversity and human health. Invasive alien species have increased in number –for all taxonomic groups across all the subregions of Europe and Central Asia – and this has severe effects on biodiversity and ecosystem services. The individual and combined effects of all the direct drivers have chronic, prolonged and delayed consequences for biodiversity and the provision of nature's contributions to people owing to considerable time-lags in the response of ecological systems.

Economic growth is generally not decoupled from environmental degradation. This decoupling would require a transformation in policies and tax reforms across the region. Economic growth, as measured through traditional gross domestic product (GDP), across Europe and Central Asia has indirectly reinforced drivers of biodiversity loss, which in turn has reduced nature's contributions to people. Across the region, a range of policies, including environmental taxation, have been implemented to decouple economic growth from detrimental drivers. Furthermore, there still exist policy instruments, such as harmful agricultural and fishing subsidies, which continue to impede transitions towards a sustainable future. Decoupling would be assisted by new indicators that incorporate well-being, environmental quality, employment and equity, biodiversity conservation and nature's ability to contribute to people.

D. Futures for Europe and Central Asia

The continuation of past and present trends in drivers to, and beyond, 2030 (as represented in business-as-usual scenarios) will inhibit the widespread achievement of goals similar to and including the Sustainable Development Goals. Future scenarios that focus on achieving a balanced supply of nature's contributions to people and that incorporate a diversity of values are more likely to achieve the majority of such goals. Trade-offs are indicated between different ecosystem services under different future scenarios for Europe and Central Asia. Ways of resolving these trade-offs depend on political and societal value judgements. Scenarios that include proactive decision-making on environmental issues, environmental management approaches that support multifunctionality, and mainstreaming environmental issues across sectors, are generally more successful in mitigating trade-offs than isolated environmental policies. Scenarios that include cooperation between countries or regions are expected to be more effective in mitigating undesirable cross-scale impacts on biodiversity and ecosystem services.

Long-term societal transformation through continuous education, knowledge-sharing and participatory decision-making characterize the most effective pathways for moving towards sustainable futures. These pathways promote resource-sparing lifestyles and emphasize community actions and voluntary agreements supported by social and information-based instruments as well as rights-based approaches. They support regulating ecosystem services and highlight a diverse range of values in comprehensively considering biodiversity and nature's contributions to people across sectors, and across spatial and temporal scales. Other actions, such as technological innovation, ecosystem-based approaches, land sparing or land sharing, could support and pave the way for these more transformational solutions.

E. Promising governance options for Europe and Central Asia

A mix of governance options, policies and management practices is available for public and private actors in Europe and Central Asia, but further commitment is needed to adopt and effectively implement them to address the drivers of change, to safeguard biodiversity and to ensure nature's contributions to people for a good quality of life. Well-designed, context-specific mixes of policy instruments building on, for example, ecosystem-based approaches, have been effective in the governance of biodiversity and nature's contributions to people. While legal and regulatory instruments are the backbone of policy mixes, economic, financial, social and information-based instruments provide additional incentives to trigger behaviour change. Developing rights-based instruments would fully integrate the fundamental principles of good governance, equalizing power relations and facilitating capacity-building for indigenous peoples and local communities. The mobilization of sufficient financial resources would strengthen institutional capacities to support research, training, capacity-building, education and monitoring activities. The removal of harmful subsidies in various sectoral policies, such as agriculture, fisheries and energy, in Europe and Central Asia, reduces negative impacts on biodiversity and allows for a more cost-effective use of public funds.

Mainstreaming the conservation and sustainable use of biodiversity and the sustained provision of nature's contributions to people into all sectoral policies, plans, programmes, strategies and practices could be achieved with more proactive, focused and goal-oriented approaches to environmental action. Partial progress has been made in tackling the underlying drivers of biodiversity loss, by mainstreaming across government and society. Mainstreaming could be harnessed in a three-step process by: first, raising awareness of the dependence of good quality of life on biodiversity, second, defining policy objectives concerning the ecological, economic and sociocultural needs for achieving sustainable development; and, third, designing instruments and policy mixes to support the implementation of effective, efficient and equitable policy and decision-making for nature and a good quality of life.

Better integration across sectors to coordinate biodiversity governance and the sustainable delivery of nature's contributions to people would avoid negative outcomes for nature and people. Improved coordination would enable better consideration of biodiversity and ecosystem services, taking trade-offs between different policy and economic sectors into account. There is, for example, ample room for further exploiting this potential for the agriculture, forestry and fisheries sectors and urban planning. Regarding an economy-wide perspective, this includes measuring national welfare beyond current economic indicators that take account of the diverse values of nature. Ecological fiscal reforms would provide integrated incentives and provide leverage to redirect activities that support sustainable development.

Increasing participation and stakeholder involvement will help to integrate various forms of knowledge in policymaking and decision-making while promoting shared responsibility. The importance of the effective involvement of different actors is recognized in Western and Central Europe and increasingly also in Eastern Europe and Central Asia. This involvement can be strengthened by careful monitoring and evaluation, taking various values into consideration, including those of indigenous peoples and local communities.

Box SPM.1

Region of Europe and Central Asia

The Europe and Central Asia region encompasses 54 countries (Table SPM.1) in four subregions (Figure SPM.1). These countries vary greatly in size, including the largest and smallest on Earth, and have diverse governance structures, cultures, economies, ecoregions and sectors. The seas of the region are heterogeneous in terms of temperatures, currents, nutrient availability, depths and mixing regimes. There are great differences in data monitoring and availability across the region.

Figure SPM.1

Region of Europe and Central Asia with the four IPBES subregions and regional oceans and seas



Table SPM.1

Subregions and countries of Europe and Central Asia according to decision IPBES-3/1, annex VII

Subregion	Countries
Western Europe	Andorra, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland
Central Europe	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia, the former Yugoslav Republic of Macedonia, Turkey
Eastern Europe	Armenia, Azerbaijan, Belarus, Georgia, Republic of Moldova, Russian Federation, Ukraine
Central Asia	Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan

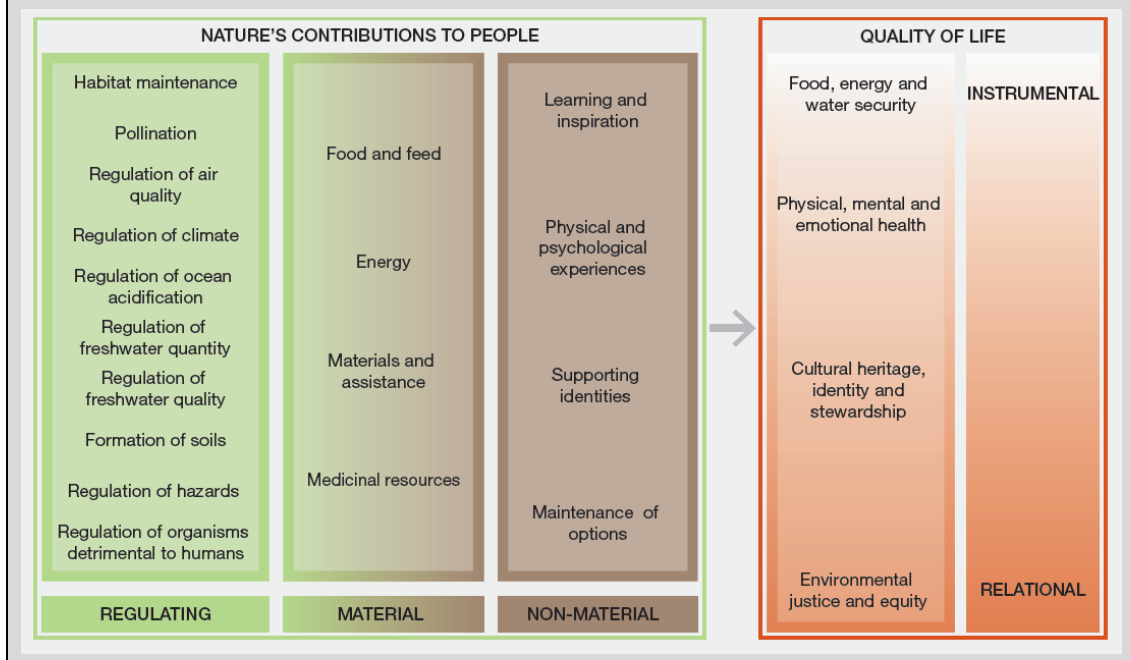
Box SPM.2

Nature's contributions to people

The regional assessment for Europe and Central Asia considers ecosystem services through the lens of nature's contributions to people (see appendix II), which embodies both the scientific concept of ecosystem goods and services, and the notion of nature's gifts from indigenous and local knowledge systems. Nature's contributions can be beneficial or detrimental to people, depending on the cultural context, and are assessed from two complementary perspectives: one generalizing in nature and the other context-specific. The generalizing perspective includes 18 categories organized into three partially overlapping groups: regulating, material and non-material contributions (Figure SPM.2) {2.1.1}. The context-specific perspective includes geographical and cultural aspects of indigenous and local knowledge systems. The grading of green and brown colours in Figure SPM.2 indicates whether nature's contributions to people are associated more with natural or with cultural systems. Instrumental values refer to the value attributed to something as a means to achieve a particular end. Relational values are positive values assigned to "desirable relationships", such as those among people and between people and nature.

Figure SPM.2

Nature's contributions to people and their relation to quality of life in terms of instrumental and relational values



II. Background

A. Nature and its contributions to people's quality of life in Europe and Central Asia

A1. Nature provides valuable material (e.g., food), regulating (e.g., climate regulation and pollination) and non-material contributions to people (e.g., learning and inspiration) (Figure SPM.2). These contributions are essential for people's quality of life as they have substantial economic, social and cultural values (*well established*)² {2.3.5}.

The highest valued regulating contributions to people in Europe and Central Asia include: the regulation of freshwater and coastal water quality (estimated to have a median value of \$1965³ per hectare per year) (*established but incomplete*); habitat maintenance (\$765 per hectare per year) (*unresolved*); the regulation of climate (\$464 per hectare per year); and the regulation of air quality (\$289 per hectare per year) (*established but incomplete*) {2.3.5.2}. Monetary values for regulating contributions to people, however, are site-specific and vary significantly across the Europe and Central Asia region depending on location, habitat, extent of contribution and valuation method used.

Nature's material contributions to people have important values that are partly reflected in conventional market prices. Agricultural production across the 28 member States of the European Union generates profits ranging from \$233 per hectare per year (cereals) to \$916 per hectare per year (mixed crops), while wood supply from forests generates profits of \$255 per hectare per year {2.3.5.1}.

Nature's non-material contributions to people, which include physical and psychological experiences linked to tourism and recreation, are estimated to have a median monetary value of \$1,117 per hectare per year (*unresolved*) {2.3.5.2}. Other non-material contributions, such as cultural heritage and identity, may be valued using non-monetary approaches (*established but incomplete*) {2.3.5.2, 2.3.5.3}. Such values are indicated through people's engagement with nature for leisure and tourism, spiritual and aesthetic experiences, learning, developing indigenous and local knowledge, and by their desire to conserve areas and iconic species (*well established*) {2.2.3}.

² For explanation of confidence terms, see appendix I.

³ These monetary values have been standardized to a common currency (the international dollar – \$) and base year (2017). The standardization procedure adjusts values elicited in a particular currency and year to a standard currency and year using appropriate gross domestic product deflators and purchasing power parity (PPP) exchange rates.

Nature and its contributions to people have value for human health (*well established*) {2.3.2}, including their role in contemporary and traditional medicine, dietary diversity (*well established*) {2.2.2.4, 2.3.2} and urban green spaces (*established but incomplete*) {2.3.2}. Unsustainable exploitation threatens the survival of, for instance some medicinal plants (*established but incomplete*) {2.2.2.4}.

Indigenous peoples and local communities hold distinct knowledge about nature and its contributions to people that have significant value for many local communities (*established but incomplete*) {2.3.3}. There has been, however, a loss of indigenous and local knowledge about ecosystems and species (*well established*) {2.2.3.1.2, 2.3.3} as well as declining trends of linguistic diversity (a proxy for indigenous and local knowledge) (*well established*) {2.2.3.1.2, 2.3.3}.

There is a range of monetary and non-monetary approaches to capture the multiple values of nature's contributions to people. Novel approaches enable these values to be integrated into decision-making to maximize economic, social and quality-of-life benefits.

A2. There are negative trends for the majority of nature's regulating, and some non-material, contributions to people in the Europe and Central Asia region between 1960 and 2016 (*well established*) {2.2.1, 2.2.3, 2.2.5}. This has resulted partly from intensive agriculture and forestry practices used to increase the production of food and biomass-based fuels, which have had a negative impact on many regulating services, such as soil formation, pollination and the regulation of freshwater quality (*well established*) {2.2.1, 2.2.2, 2.2.5}. This continuing decline in regulating contributions can have detrimental consequences for quality of life (*established but incomplete*) {2.3.1.1, 2.2.1.2, 2.2.1.5, 2.2.1.6, 2.2.1.7, 2.2.1.8, 2.2.2.1, 2.2.3.1}.

A total of 7 out of the 16 assessed nature's contributions to people are known to be declining in Europe and Central Asia, in particular regulating contributions and learning derived from indigenous and local knowledge (*well established*) {2.2.1, 2.2.3, 2.2.5}. These trends are consistent across the subregions of Europe and Central Asia (Figure SPM.3) (*well established*) {2.2.5}. Habitat maintenance, pollination (*established but incomplete*), regulation of freshwater quantity and quality, formation and protection of soils and regulation of floods are declining because of land-use intensification designed to increase the production of crops, livestock, aquaculture, forest biomass and cotton, as well as urban development (*well established*) {2.2.1, 2.2.2, 2.2.5}. Trade-offs between material and regulating contributions have compromised food and water security in some areas {2.2.1, 2.2.2, 2.2.5}.

The Europe and Central Asia region is currently food secure because of food production in the region and trade, despite the degradation of several of nature's regulating contributions and loss of food-related indigenous and local knowledge (*well established*) {2.3.1.1, 2.2.1.2, 2.2.1.5, 2.2.1.7, 2.2.1.8, 2.2.2.1, 2.2.3.1}. Soil erosion has affected 25 per cent of agricultural land in the European Union and 23 per cent in Central Asia. Combined with a decline in soil organic matter, this might compromise food production (*well established*) {2.2.1.8}. At the same time, between 2000 and 2010, erosion control increased by 20 per cent on arable land in Western and Central Europe {2.2.1.8}. Since 1961, Mediterranean and Central Asian countries have increased their dependence on pollination by producing more pollinator-dependent fruits (*established but incomplete*) {2.2.1.2}. At the same time, however, the diversity and abundance of wild insect pollinators have declined since the 1950s and severe losses of the western honeybee have occurred in Europe since 1961 (*established but incomplete*) {2.2.1.2}. Continuing rural depopulation across the region and the loss of indigenous and local knowledge about traditional land use affects food availability, especially in remote areas (*established but incomplete*) {2.2.3.1.2, 2.2.3.2.1, 2.3.1.1, 4.5.5}. Wild fish catches have decreased since the 1990s, with more sustainable management practices being introduced only recently. Fish production from aquaculture increased by 2.7 per cent since 2000 (*established but incomplete*) {2.2.2.1.2}.






Water security depends partially on the regulation of water quality and quantity by ecosystems, which is impaired by pollution, decreasing floodplain and wetland area, overexploitation of freshwater bodies, and climate change (*established but incomplete*) {2.2.1.6, 2.2.1.7}. Nevertheless, 95 per cent of the people in Europe and Central Asia have access to safe drinking water, despite a 15 per cent decrease in water availability per capita since 1990 (*well established*) {2.3.1.3}.




Figure SPM.3

Trends in nature's contributions to people (1960–2016) for Europe and Central Asia and the subregions

Trends are based on the evidence from publications and indicators reporting increasing, decreasing, constant or variable trends for each ecosystem service {2.2.5}. The higher level of confidence for the region of Europe and Central Asia compared with the subregions is the result of the extra publications that addressed the region as a whole.

		WE	CE	EE	CA	ECA
REGULATING NATURE'S CONTRIBUTIONS TO PEOPLE	Habitat maintenance	↘	↘	↘		↘
	Pollination	↘	↘	↘		↘
	Regulation of air quality	↕	↗	↗	↕	↗
	Regulation of climate	↗	↕	↗	↕	↕
	Regulation of ocean acidification					↕
	Regulation of freshwater quantity	↘	↕	↘	↘	↘
	Regulation of freshwater quality	↘	↘	↘		↘
	Formation and protection of soils	↘	↘	↘	↘	↘
	Regulation of coastal and fluvial floods	↕	↘	↘	↕	↘
	Regulation of organisms (removal of carcasses)	↗	↕	↗	↗	↗
MATERIAL NATURE'S CONTRIBUTIONS TO PEOPLE	Food	↗	↗	↗	↗	↗
	Biomass-based fuels	↗	→	→		↗
	Materials (wood and cotton)	→	→	→	→	→
NON-MATERIAL NATURE'S CONTRIBUTIONS TO PEOPLE	Learning derived from indigenous and local knowledge	↘	↘	↘	↘	↘
	Physical and psychological experiences	↕	↘	↘		↕
	Supporting identities					↕

 Increase
 Decrease
 Stable
 Variable
 Lack of evidence

Confidence level
 Well established
 Established but incomplete/unresolved
 Inconclusive

Abbreviations: WE - Western Europe, CE - Central Europe, EE - Eastern Europe, CA - Central Asia, ECA - Europe and Central Asia.

A3. Nature's contributions to people, and their influence on quality of life, are not always equally experienced across different locations and social groups in Europe and Central Asia (*established but incomplete*) {2.3.4}.

Intra-regional equity in access to food and a balanced diet is largely achieved (*well established*) {2.3.1.1} as indicated by, for example, the average dietary energy supply, which ranges from 137 per cent in Western Europe to 121 per cent in Central Asia of the average dietary energy requirement for the population of the region {2.3.1.1}. However, large-scale land acquisitions in Central and Eastern Europe and Central Asia by entities from outside and within the region, mainly from Western Europe, may compromise the opportunities for certain groups of people to influence their own food systems (*established but incomplete*) {2.3.1.1}. Nature's contributions to people are factors in influencing the situation in which some 15 per cent of people in Central Asia, but only 1 per cent in Western Europe, lack access to safe drinking water (*well established*) {2.3.1.3, 2.3.4.2}. Within cities, inhabitants have unequal access to green spaces with consequences for public health and well-being (*established but incomplete*) {2.2.3.2, 2.3.4.2}. For example, residents in cities in the south of the European Union have less access to green space than residents of northern, western and central cities. Public access to forests for recreation is uneven across countries, with a high level of access (98–100 per cent) in Nordic and some Baltic countries and lower levels (under 50 per cent) in some

other Western European countries (*well established*) {2.3.4.2}. There is also temporal inequity as today's generations are benefiting from nature's contributions to people at the expense of future provision (*established but incomplete*) {2.2.3.4}.

A4. The population of Europe and Central Asia uses more renewable natural resources than are produced within the region (Figure SPM.4) (*well established*) {2.2.4}. The region depends on net imports of both renewable natural resources and material contributions of nature to people (*well established*) {2.2.4}. Some of these imports to Europe and Central Asia negatively affect biodiversity, nature's contributions to people and food security in other parts of the world (*established but incomplete*) {2.2.4, 2.3.4}.

Measures of ecological footprint⁴ and "biocapacity"⁵ show that Central and Western Europe import more of nature's contributions to people than Eastern Europe and Central Asia (*well established*) {2.2.4} (Figure SPM.4). While most of Western and Central Europe and Central Asia have a "biocapacity" deficit, in Eastern Europe and northern parts of Western and Central Europe high footprints are offset by even higher biocapacities (*well established*) {2.2.4}. This negatively affects biodiversity, nature's contributions to people and food security both within Europe and Central Asia and other parts of the world (*established but incomplete*) {2.2.4, 2.3.4}. For instance, according to the technical report 2013-063 funded by the European Commission, 10 per cent of the world's annual deforestation was the result of consumption by the then 27 member States of the European Union (*established but incomplete*) {2.2.4.1}.

Western Europe's ecological footprint is 5.1 global hectares⁶ per person and its "biocapacity" 2.2 hectares per person; Central Europe's footprint is 3.6 hectares per person and its "biocapacity" 2.1 hectares per person; Eastern Europe's footprint is 4.8 hectares per person and its "biocapacity" 5.3 hectares per person; and Central Asia's footprint is 3.4 hectares per person and its "biocapacity" 1.7 hectares per person (*well established*) {2.2.4} (Figure SPM.4).

Food availability in Central and Western Europe relies significantly on imports from countries, both outside and within the region, of the product of 35 million hectares of cropland harvested per year (2008 data), particularly from Argentina, Brazil, China and the United States (*well established*) {2.2.4}. Western Europe became less self-sufficient in crop production between 1987 and 2008, while the rest of Europe and Central Asia became more self-sufficient (*well established*) {2.2.4}. Seafood exports from Europe and Central Asia increased over the period 1976–2009, with Norway, Spain and the Russian Federation being the main exporters (*well established*) {2.2.4}. Over the period 1997–2012, there was a stable pattern of imports to Western Europe of roundwood and wood products from Central and Eastern Europe (*well established*) {2.2.4}.

⁴ Ecological footprint has a variety of definitions, but is defined by the Global Footprint Network as "a measure of how much area of biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices." The ecological footprint indicator used in this report is based on the Global Footprint Network unless otherwise specified.

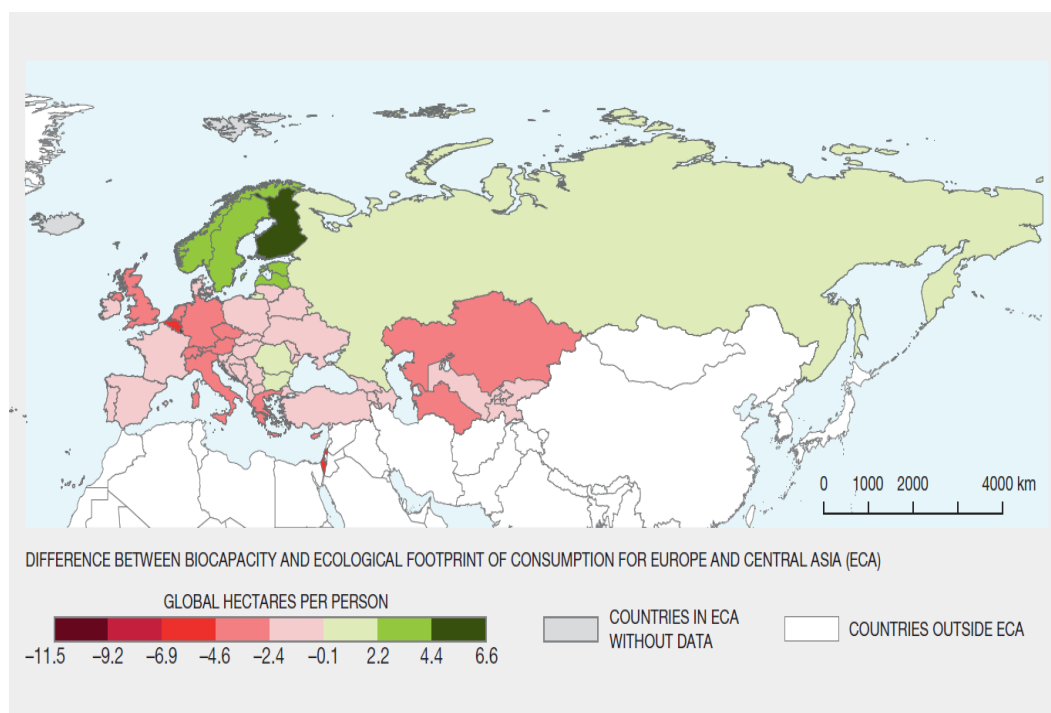
⁵ The definition that follows is for the purpose of this assessment only: "Biocapacity" has a variety of definitions, but is defined by the Global Footprint Network as "the ecosystems' capacity to produce biological materials used by people and to absorb waste material generated by humans, under current management schemes and extraction technologies." The "biocapacity" indicator used in this report is based on the Global Footprint Network unless otherwise specified.

⁶ A global hectare is a biologically productive hectare with world average biological productivity for a given year and depends on the land type.

Figure SPM.4

Difference between “biocapacity” (on average 2.9 global hectares per person in the region) and the ecological footprint of consumption (4.6 global hectares per person; average deficit 1.7 global hectares per person)

The ecological footprint quantifies the area needed to produce on a sustainable basis the renewable resources it consumes and thus can be used as a proxy for the use of certain of nature’s material or regulating contributions to people and the area needed to assimilate CO₂ and other waste sustainably. “Biocapacity” refers to the capacity of a certain area to generate an ongoing supply of renewable resources and thus is a proxy for ecosystem productivity. A positive value (green) indicates a “biocapacity” reserve; a negative value (red) indicates a deficit. A deficit derives from the overuse of local renewable resources or the net import of renewable resources for consumption. Countries shaded in green have high “biocapacity”, so they have a reserve despite having a higher ecological footprint than many other countries.



Source: Based on Global Footprint Network, 2017.

A5. Biodiversity loss impairs ecosystem functioning and, hence, nature’s contributions to people (*well established*) {3.2.1, 3.2.2, 3.2.3}. The sustained delivery of these contributions requires the maintenance of different levels of biodiversity, i.e., genetic diversity, species diversity, and the diversity of ecosystems and of landscapes and seascapes (*well established*) {3.2.4}. At each of these levels, the sustained delivery of multiple contributions generally requires higher diversity than the delivery of single contributions (*well established*) {3.2.5}.

Different organisms, species and communities differ in their contributions to ecosystem processes in Europe and Central Asia. Higher biodiversity therefore increases the capacity of terrestrial, freshwater and marine ecosystems to provide nature’s contributions to people, such as soil formation, pollination, regulation of hazards, regulation of air and water quality, or the provision of materials, learning and inspiration (*well established*) {3.2.1, 3.2.2}. Higher biodiversity also stabilizes ecosystem functioning and improves capacity for evolutionary adaptation (*well established*) {3.2.3, 3.2.4}. The higher the number of nature’s contributions to people to be provided, and the longer the time span and the larger the area of their provision, the more biodiversity is required (*well established*) {3.2.5}.

Ecosystem functioning is affected by genetic and phenotypic biodiversity within species, and by functional, taxonomic and phylogenetic diversity between species (*well established*) {3.2.4}. At the landscape and larger spatial scales, the increasing similarity of the sets of organisms found at different places, e.g., owing to the application of similar and intensive land use over large spatial scales, reduces nature’s overall contributions to people (*established but incomplete*) because different sets of organisms contribute to different contributions of nature to people (*well established*) {3.2.5}. Thus, the supply of multiple contributions of nature to people requires the maintenance and promotion of high biodiversity at the landscape level (*established but incomplete*) {3.2.5}.

B. Trends in biodiversity and attribution to direct drivers

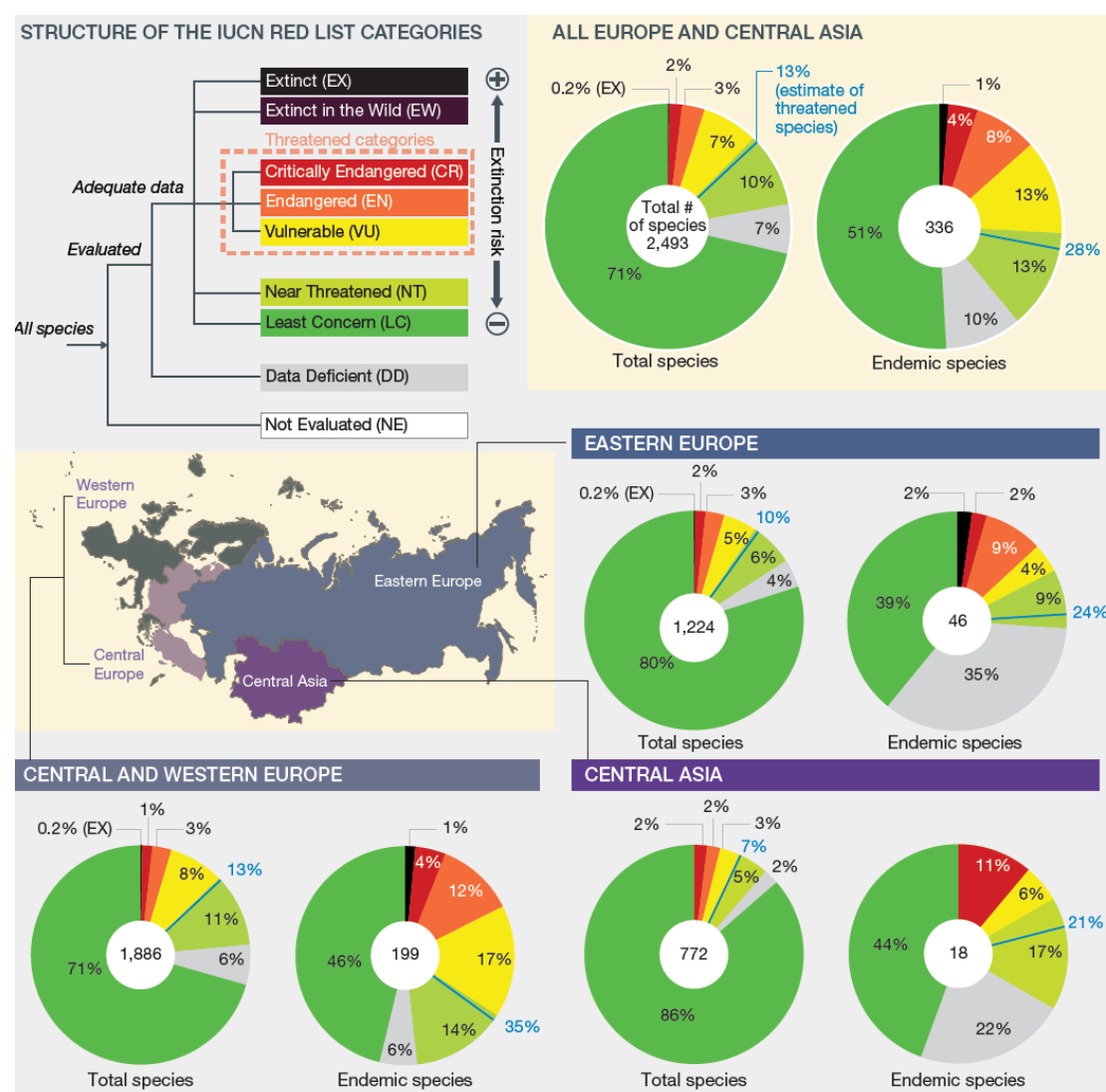
Figure SPM.5

Upper graph: Extinction risk of species in Europe and Central Asia according to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species in 2015

EX: extinct, CR: critically endangered, EN: endangered, VU: vulnerable, NT: near threatened, DD: data deficient, LC: least concern. Species in categories CR, EN, VU are considered threatened. The blue bar is the best estimate of the proportion of threatened and extinct species, assuming that the same proportion of DD species is threatened or extinct as of species with sufficient data (i.e., EX, CR, EN, VU, NT, LC). Only species in comprehensively assessed taxonomic groups are considered. Source: IUCN, 2017.⁷

Lower graph: Trend in Red List Indices of species survival weighted by the fraction of the distribution of each species within the region

The position on the vertical axis indicates the aggregate risk of extinction, the closer to one the lower the aggregate extinction risk. The slope indicates how rapidly this extinction risk is changing. For the region, the risk of extinction of species has increased over the last 20 years. Each line represents the most likely Red List Index value, considering uncertainty in the number of species threatened. The shading around each line represents the extremes, if all data deficient species were threatened with extinction (above the line), or if none of them were (below the line). Only birds, mammals and amphibians are considered here, as these are the only groups that have been comprehensively assessed at least twice. Source: IUCN, Red List of Threatened Species, version 2017-3.⁷



⁷ Available from www.iucnredlist.org.

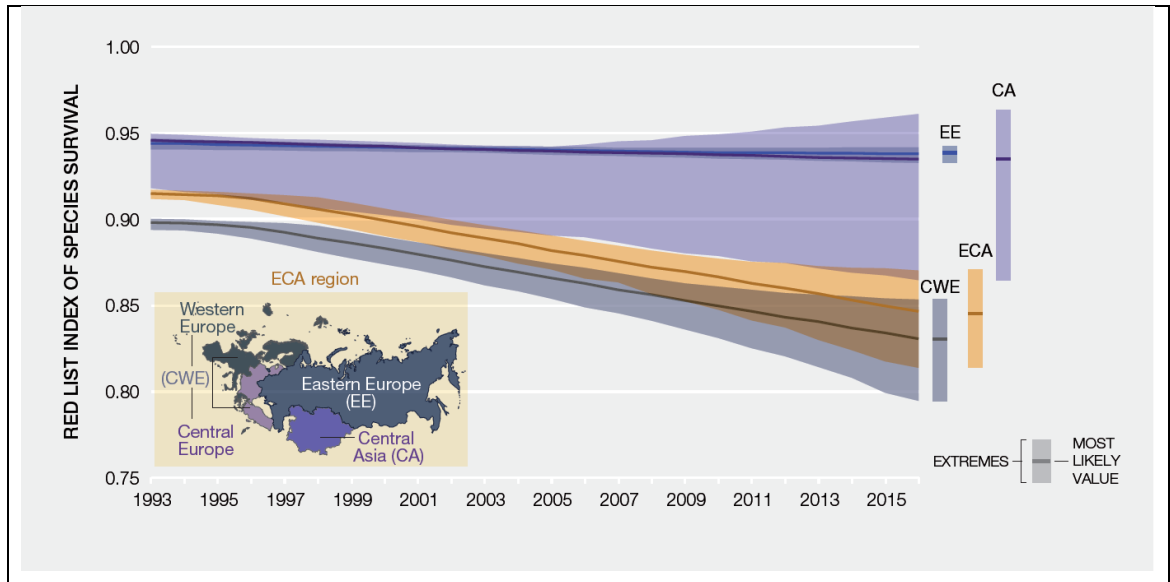


Figure SPM.6

Assessment of past (~1950–2000) and current (~2001–2017) trends in biodiversity status of marine, inland surface water and terrestrial ecosystems for the four subregions and the whole of Europe and Central Asia

The figure summarizes the trends in biodiversity status of the assessed units of analysis (habitat types). Biodiversity status represents the expert assessment of available indicators of habitat intactness, species richness and the status of endangered species. The trends are presented by unit of analysis and subregion for terrestrial and inland surface-water ecosystems, and by sea or ocean area for marine ecosystems {3.3, Box 3.3}.

		PAST					PRESENT				
		WE	CE	EE	CA	ECA	WE	CE	EE	CA	ECA
TERRESTRIAL	Agroecosystems	↓	↘	↘	↓	↓	↘	↘	↕	↕	↘
	Alpine and subalpine systems	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Boreal peatlands	↓	•	↓	•	↓	↘	•	↘	•	↘
	Deserts	↘	•	↘	↘	↘	↘	•	↘	↘	↘
	Forest-steppe, steppe and other southern peatlands	↓	↓	↓	↓	↓	↘	↘	↘	↘	↘
	Mediterranean forests and scrubs	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Permafrost peatlands	→	•	→	•	→	↘	•	↘	•	↘
	Snow and ice-dominated systems	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Subterranean habitats	↘	↘	↘	↘	↘	↘	↓	↓	↓	↓
	Temperate and boreal forests and woodlands	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Temperate grasslands	↓	↓	↓	↓	↓	↓	↘	↕	↕	↕
	Temperate peatlands	↘	↘	↘	•	↘	→	→	→	•	→
	Tropical and subtropical dry and humid forests	↓	↓	↓	↓	↓	↕	↕	↕	↕	↕
	Tundra	↘	•	↘	•	↘	↘	•	↘	•	↘
	Urban ecosystems	↓	↓	↓	↓	↓	↘	↘	↓	↓	↘
INLAND SURFACE WATER	Aral Sea	•	•	•	↓	↓	•	•	•	↘	↘
	Caspian Sea	•	•	↘	↘	↘	•	•	↘	↘	↘
	Inland surface water	↓	↓	↓	↓	↓	↘	↕	↓	↓	↘
	Saline lakes	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘
MARINE	Northeast Atlantic										
	Baltic Sea										
	Mediterranean Sea										
	Black and Azov Seas										
PAST	Arctic Ocean						↕				↕
	Northwest Pacific Ocean						↘				
PRESENT	ECA deep-sea						↘				↘

↑	Strong and consistent increase in indicator	↓	Strong and consistent decrease in indicator	→	Stable indicator	•	Not applicable	→	Well established
↗	Moderate and consistent increase in indicator	↘	Moderate and consistent decrease in indicator	↕	Variable trend in indicator			→	Established but incomplete/unresolved
								→	Inconclusive

Abbreviations: WE - Western Europe, CE - Central Europe, EE - Eastern Europe, CA - Central Asia, ECA - Europe and Central Asia.

B1. Of the assessed marine habitats and species, a high percentage are threatened (*established but incomplete*), varying between marine areas (*well established*) {3.3.4.1–7} (Figure SPM.6). The abundance, range and habitat size of many marine species is shrinking under human pressures, including overfishing, climate change, pollution and invasive alien species (*well established*) {3.3.4.1–7, 3.4.6.1}. Present positive trends, mainly due to improved fishing practices, the establishment of marine protected areas and a reduction in eutrophication, include increases in some fish stocks in the North Sea and in plankton diversity in the Black Sea (*well established*) {3.3.4.1, 3.3.4.4}. However, monitoring data are generally missing for most marine habitats and species (*well established*) {3.3.4}.

In all, 53 per cent of the benthic shallow habitats in Western and Central Europe are data deficient. The corresponding figure is 87 per cent in the Black Sea, 60 per cent in the North East Atlantic, 59 per cent in the Mediterranean Sea and 5 per cent in the Baltic Sea (*well established*) {3.3.4.1–7}. Of the assessed benthic habitats, 38 per cent are classified as threatened (critically endangered, endangered or vulnerable), most of them in the Black Sea (67 per cent) and Mediterranean Sea (74 per cent), followed by the North East Atlantic (59 per cent) and the Baltic Sea (8 per cent) (*established but incomplete*) {3.3.4.1–7}. In the European Union, among assessments of the conservation status of species and habitat types of conservation interest covered by the European Union Habitats Directive, only 7 per cent of marine species and 9 per cent of marine habitat types show a “favourable conservation status”. Moreover 27 per cent of species and 66 per cent of assessments of habitat types show an “unfavourable conservation status” and the remainder are categorized as “unknown” (*established but incomplete*) {3.3.4}.

In Europe and Central Asia, 26 per cent of the marine fish species have known trend data. Of those, 72 per cent are stable, 26 per cent have declining populations and 2 per cent have been increasing over the last decade (*well established*) {3.4.6.1}. Seabirds, marine mammals and turtles, and habitat formers, such as seagrasses and kelps, also declined in abundance (*well established*) {3.4.2–4}. The distribution or phenology of marine phytoplankton, zooplankton, algae, benthic invertebrates, fishes, seabirds and mammals has shifted (*well established*) {3.3.4.1}. In all, 48 per cent of marine animal and plant species with known population trends (436 decreasing, 59 increasing, 410 stable) have been declining in the last decade, increasing the extinction risk of monitored species (Figure SPM.5) (*established but incomplete*) {3.4.1}. Most of these present trends are consistent with the individual and combined effects of mainly overfishing, climate change, pollution and invasive alien species (*established but incomplete*) {3.3.4.1–7}. The impact of pollution by microplastics on ecosystems was not known until recently, and evidence of those impacts is only now being assessed {3.3.4}.

B2. Freshwater species and inland surface water habitats are particularly threatened in Europe and Central Asia (*well established*). A total of 53 per cent of the European Union’s rivers and lakes achieved good ecological status in 2015 as defined by the European Union Water Framework Directive. Similarly 30 per cent of water samples in the Russian Federation were above water quality standards (*well established*). A total of 73 per cent of the assessments of the European Union’s freshwater habitat types show an unfavourable conservation status (*well established*) {3.3.3.1}. Across Europe and Central Asia, lakes, ponds and streams are altered and disappearing as a consequence of agricultural intensification, irrigation and urban development combined with climate change (*well established*) {3.3.3.1}. Notable is the case of the Aral Sea, once the fourth largest lake in the world, which has now almost disappeared owing to water abstraction for crop cultivation. The extent of wetlands in Western, Central and Eastern Europe has declined by 50 per cent from 1970, while 71 per cent of fish and 60 per cent of amphibians with known population trends have been declining over the last decade {3.3.3.1, 3.4.5, 3.4.6.2}.

Over 75 per cent of catchment areas in Europe and Central Asia are heavily modified and subject to multiple pressures. In 2015, good chemical status, as defined by the European Union Water Framework Directive, was not achieved for surface water bodies by 22 European Union member States and only 53 per cent of rivers and lakes had good ecological status as defined by the European Union Water Framework Directive despite some improvements {3.3.3.1}. In Western and Central Europe and the western parts of Eastern Europe⁸ at least 37 per cent of freshwater fish and about 23 per cent of amphibians are currently threatened with extinction. In the same area, freshwater invertebrates are also threatened, with the most threatened group among those that are well monitored being gastropods (45–70 per cent of species threatened depending on whether or not data deficient

⁸ The geographical scope here is continent-wide, extending from Iceland in the west to the Urals in the east, and from Franz Josef Land in the north to the Canary Islands in the south. The Caucasus region is not included.

species are considered threatened), followed by bivalves (20–26 per cent) and dragonflies (15–19 per cent) (*established but incomplete*) {3.4.5, 3.4.6.2, 3.4.8}.

Freshwater biodiversity trends are primarily driven by habitat destruction and modification caused by infrastructure for hydropower, navigation, flood protection, agriculture, urban development and water abstraction; pollution from agriculture and industry; the introduction of invasive alien species and their pathogens; and climate change (*established but incomplete*) {3.3.2.2, 3.3.3.4, 3.3.3.5.2}. Progress has been made in water protection in the European Union part of Western and Central Europe, in particular because of the European Union Water Framework Directive. The rate of natural habitat loss (e.g., wetlands) has slowed in Western, Central and Eastern Europe due to the implementation of binding nature conservation policies or the designation of conservation areas (e.g., Ramsar sites), (*established but incomplete*) {3.3.3.1}.

B3. Terrestrial species and habitats have long-term declining trends in population size, range, habitat intactness and functioning. This decline is mainly due to land-use change, for example unsustainable agriculture and forest management, infrastructure, urban development or mining, causing habitat loss, modification and fragmentation, and due to climate change (*well established*) {3.3.2, 3.4}. The conservation status of some habitats and species that benefit from targeted conservation actions (e.g., large felids or some species listed in the European Union Birds Directive) has improved in recent years (*established but incomplete*) {3.4.13}.

Across Europe and Central Asia, 14 out of 15 habitat types have been declining in extent and biodiversity status since the 1950s (Figure SPM.6) {3.3.2.5}. These declines are continuing, albeit at a slower rate, with some exceptions in the Macaronesian and Atlantic Boreal regions of Western and Central Europe, where recoveries in habitat conservation status have been reported. Grasslands, tundra, mires and bogs have been the most affected habitats since the 1950s (*established but incomplete*) {3.3.2}.

Systematic assessments of habitat conservation status exist only for the European Union. There, 16 per cent of terrestrial habitat assessments in the period 2007–2012 had favourable conservation status; 3 per cent had unfavourable, but improving trends; 37 per cent had unfavourable, but stable trends; 29 per cent had unfavourable and declining trends; and 15 per cent had unknown or unreported trends relative to the period 2001–2006 (*well established*) {3.3.2}.

Since the 1950s, various biodiversity indicators have shown a decline in response to both abandonment of, and intensified use of, agricultural land (*well established* for Western Europe and Central Europe; *established but incomplete* for Eastern Europe and Central Asia) {3.3.2.9}. From 1980 to 2013, the abundance of farmland common bird species decreased by 57 per cent in Western and Central Europe (*well established*) {3.4.3}. The species diversity of arable crops has decreased by 20 per cent since 1950 in Western and Central Europe, and the abundance of rare arable plants has also decreased (*established but incomplete*). The genetic diversity of plants cultivated in situ declined until the 1960s, owing to the replacement of landraces by modern cultivars, and no further reduction or increase of diversity was observed after the 1980s (*well established*). Europe and Central Asia has over half of all known breeds of domesticated mammals and birds, but 75 per cent of local bird breeds and 58 per cent of local mammal breeds are threatened with extinction. The numbers of at-risk breeds have declined slightly since 1999, but exact quantification is hampered by the changing number of documented local breeds (*established but incomplete*) {3.4.13}.

Across Europe and Central Asia, 42 per cent of terrestrial animal and plant species with known trends have declined in population size over the last decade, increasing the extinction risk of monitored species (*established but incomplete*) (Figure SPM.5). The main causes of this decline are habitat loss, degradation and pollution due primarily to unsustainable agriculture and forest management, natural resource extraction and invasive alien species (*established but incomplete*) {3.4, 3.3.2}. Monocultures, and all forms of homogenization of landscapes, such as the conversion of grasslands to crops, and agricultural intensification (especially the conversion of natural and semi-natural grassland to more intensively used pastures) have caused homogenization of ecological communities by supporting generalist species and impacting habitat specialists (*well established*). Climate change is accelerating changes in species composition and local extinctions in all habitat types (*well established*), contracting glaciers, shifting the nival belt to higher altitudes (*well established*), replacing polar deserts with tundra (*well established*), expanding arid areas, and causing shifts in forest habitat types (*well established*) {3.3.2}. National and international conservation efforts have shown the potential to reverse these trends. The long-term population trends of 40 per cent of the breeding bird taxa in Annex I of the European Union Birds Directive are increasing, compared with 31 per cent for all breeding bird taxa {3.4.13}. Charismatic mammalian megafauna, such as the Amur tiger, Far-Eastern leopard,

Iberian lynx, and European bison, are all recovering from the brink of extinction because of dedicated conservation efforts {3.4.3, 3.4.13}.

C. Drivers of change in biodiversity and nature's contributions to people in Europe and Central Asia

C1. Land-use change, as one of the major direct drivers of change in biodiversity and nature's contributions to people in Europe and Central Asia, is often posing substantial risks for human well-being (*well established*) (4.2.1). There are examples of sustainable agricultural and forestry practices that are beneficial to biodiversity and nature's contributions to people in the region. However, the major trend is increasing intensity of conventional agriculture and forestry that lead to biodiversity decline (*well established*). Ceasing traditional land use reduces semi-natural habitats of high conservation value (*well established*) and associated indigenous and local knowledge and practices (*well established*) {4.5.1, 4.5.5}. Protected areas have expanded, but this alone cannot prevent biodiversity loss (*well established*) {4.5.4}.

Despite the development of more sustainable agricultural policies and practices in recent years in some countries, such as organic farming, conventional intensive agriculture, especially related to the excessive use of agrochemicals {4.5.1.1} reduces natural and semi-natural habitats, with severe negative impacts on biodiversity and ecosystem function (*well established*) {4.5.1, 4.5.2, 4.5.5}. This jeopardizes the sustainable management of land and food production (*established but incomplete*) (Figure SPM.8) {4.5.1, 4.5.2}. Agri-environmental schemes, ecological restoration and sustainable approaches to agriculture, such as agroecology and agroforestry, mitigate some of the adverse effects of intensive agriculture (*established but incomplete*) {4.5.1, 4.5.2}. The efficiency of such measures depends also on the inclusion of traditional and local knowledge, and the consideration of biophysical and social-cultural contexts (*established but incomplete*) {4.5.1, 4.5.2, 4.5.3}.

Production-based subsidies have driven growth in agriculture, forestry and natural resource extraction, but this often impinges on traditional land users (*established but incomplete*) {4.5.1, 4.5.5}. The loss of traditionally managed semi-natural habitats has resulted in a decline and loss of associated biodiversity and ecosystem functions. Demographic trends, including urbanization, continue to diminish indigenous and local communities, with concomitant negative impacts on traditional land-use knowledge, culture and identities (*established but incomplete*) (4.5.5). The economic viability of indigenous and local communities can be supported by green tourism, demand for products derived from traditional practices and subsidies for traditional land uses (*well established*) {4.5.5}.

There are examples of sustainable forestry and agroforestry practices, however, the major trend across the region is intensification of forest management that reduces biodiversity and many of nature's material and non-material contributions to people (Figure SPM.8). Logging of intact forests continues across the region (*established but incomplete*) {4.5.3}. The trade-offs between the increasing intensity of forestry and delivery of multiple ecosystem services are recognized as a major challenge for forestry in Europe and Central Asia (Table SPM.2).

Protected areas now cover 10.2 per cent of the region, 13.5 per cent of its terrestrial area and 5.2 per cent of its marine area (*well established*) {4.5.4} and their coverage of key biodiversity areas has been increasing (Fig SPM.7). The prioritization and implementation of adequate legal frameworks for protected area development has largely been driven by the adoption of international agreements, as well as increasing public environmental awareness. The perceived trade-offs with economic development goals, however, have in many cases delayed the development of, or weakened, adequate nature conservation policies although this is variable across the region (*well established*). The efficacy, connectivity and representativeness of protected areas are as important as their coverage, however, and conservation would also require fostering biodiversity outside protected areas (*well established*) {4.5.4, 3.3}. Eastern Europe and the Balkans have recently experienced armed conflicts, which negatively affect nature and its contributions to people {4.5.4.2}.

Figure SPM.7

Trends in the proportion of key biodiversity areas completely covered by protected areas in Europe and Central Asia

There are two types of key biodiversity areas, Important Bird and Biodiversity Areas (IBAs) and Alliance for Zero Extinctions sites (AZE).s).

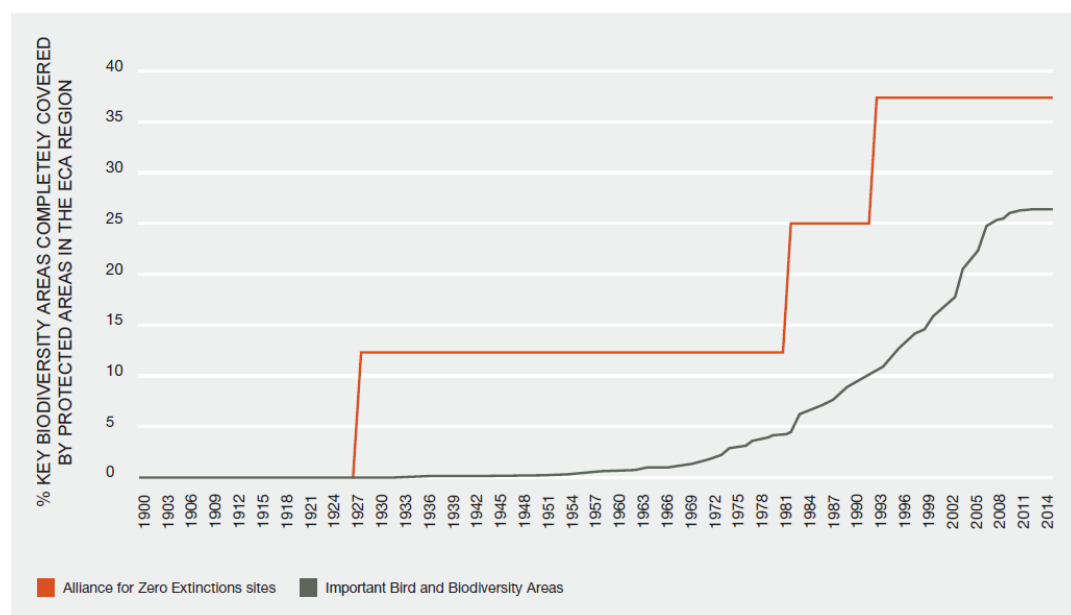
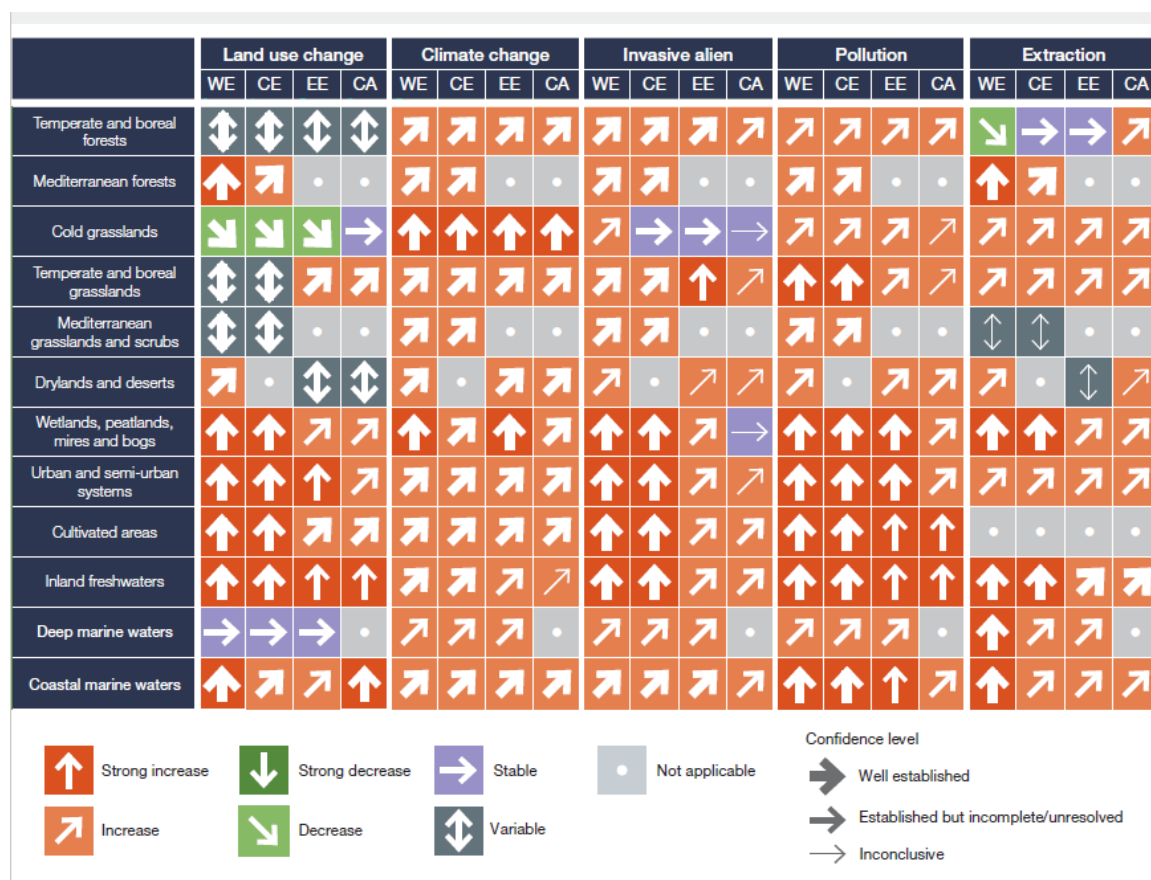


Figure SPM.8

Trends in direct drivers of biodiversity and nature's contributions to people in the last 20 years

The figure summarizes the trends in the five direct drivers for each of the assessed units of analysis (habitat types). The trends are presented by unit of analysis and subregion {see 4.2.1, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9.2}.



Abbreviations: WE - Western Europe, CE - Central Europe, EE - Eastern Europe, CA - Central Asia.

C2. The impact of climate change on biodiversity and nature's contributions to people is increasing rapidly and is likely to be among the most important drivers in the future, in particular in combination with other drivers (*established but incomplete*) {4.7.1, 4.7.2, 4.9.2}.

The region's climate is expected to be on average 1°C–3°C warmer in 2041–2060 than in 1986–2005, with larger increases in the north of the region (*well established*) {4.7.2.1}. Summers will be drier in the south of the region and winters wetter in the north, with increasing risks of extreme climatic events such as droughts and storms (*established but incomplete*) {4.7.1.2} (Figure SPM.8). Indirect climate change effects, such as increased fire and flood risks and loss of permafrost, are already affecting biodiversity and nature's contributions to people (*well established*) {4.7.1.3, 4.7.2.5}. The extent of near-surface permafrost at high latitudes could decrease by between 37 and 81 per cent by 2100 (*established but incomplete*) {4.7.2.4}. In Arctic and alpine regions, permafrost melting will cause large greenhouse gas emissions, while short-term heat waves reduce biomass productivity and food availability for wildlife and livestock (*unresolved*) {4.7.1}.

Climate change shifts seasonal timing, growth and productivity, species ranges and habitat location, which affects biodiversity, agriculture, forestry, and fisheries (*well established*) {4.7.1.1, 4.7.1.3}. Many species will not migrate or adapt fast enough to keep pace with projected rates of climate change (*established but incomplete*) {4.7.1}. Droughts decrease biomass productivity, increase biodiversity loss and net carbon flux to the atmosphere, and decrease water quality in aquatic systems (*established but incomplete*) {4.7.1.2, 5.2}. Climate change causes ocean acidification, rising sea levels and changes ocean stratification, reducing biodiversity, growth and productivity, impairing fisheries and increasing CO₂ release into the atmosphere (*established but incomplete*) {4.7.1.1, 4.7.1.3}.

Global economic growth is the main indirect driver of greenhouse gas emissions and hence climate change (*well established*) {4.7.3}. In contrast to global trends, primary energy consumption and fossil CO₂ emissions within the region have declined since 1990. Small increases in gross domestic product growth with simultaneously decreasing energy production and CO₂ emissions from 2011 to 2014 suggest the decoupling of CO₂ emissions from gross domestic product growth (*well established*)

{4.7.3}. These apparent decreases may be explained, however, by increased transportation-related emissions in other regions and their inter-regional flows to Europe and Central Asia (*inconclusive*) {4.7.3} (Table SPM.2).

C3. Natural resource extraction, pollution and invasive alien species continue to reduce biodiversity and nature's contributions to people, and they increase with gross domestic product and global trade. Recent policy intervention has reversed some negative impacts of these direct drivers.

Extraction of biotic and abiotic natural resources has continued to reduce biodiversity and nature's contribution to people both within Europe and Central Asia and beyond. For biotic resources, the demand for fish in Western and Central Europe, coupled with the European Union Common Fisheries Policy that restricts extraction, contributes to unsustainable fishing practices and resource depletion outside Western and Central Europe. While awareness of local resource shortages, such as fish in Europe, would be expected to be prompted by price increases, displacement from interregional imports masks these feedbacks (*established but incomplete*) {4.2.5, 4.3.1, 4.4.1}.

As an example for abiotic resources, trade liberalization and increasing world market prices have increased extraction of mineral resources in Central Asia. Although this has resulted in the mining industry being one of the largest contributors to GDP in the subregion, this has led to the depletion of mineral resources and the loss of ecosystem services important to human health and well-being (*well established*) {4.4.4.2}.

These examples demonstrate that the depletion of natural resources may not be immediately apparent, due to factors such as global trade, which then masks or delays effective policy responses. In addition, harmful subsidies in the fishing and mineral industries reduce extraction prices and accelerate extraction levels despite declining stocks (*well established*) {4.4.1, 4.4.4}. The European Union and the Russian Federation continue to pay in total about \$6 billion annually in such fishing subsidies (*well established*) {4.4.1.3}.

Recent regulations have reduced some pollution (for example, sulphur oxides, nitrogen oxides and heavy metals), but other pollution (ammonia, organic pollution and pesticides) and time-lag effects of pollution still threaten biodiversity. In Western and Central Europe terrestrial acidification has decreased since 1990 (from 30 per cent to 3 per cent of areas exceeding critical loads, while terrestrial eutrophication has decreased from 78 per cent to 55 per cent of areas exceeding critical loads (*well established*) {4.6.1, 4.6.3}. Marine and coastal eutrophication has decreased, but the proportion of marine dead zones due to oxygen depletion from nutrient and organic pollutants has increased markedly, reaching, for example, about 100 sites around Western European shores alone (*established but incomplete*) {4.6.1, 4.6.2}. Numbers of invasive alien species have increased for all taxonomic groups (*well established*) {4.8.2.1}. In Western and Central Europe, invasive alien species are increasing, although the recently adopted European Union regulation on invasive alien species could curb the trend in the future {4.8.2, 4.8.3}. In Eastern Europe and Central Asia, rates of invasion are lower than in Western and Central Europe, but are expected to increase with increasing gross domestic product and trade (*established but incomplete*) {4.8.1, 4.8.2} (Table SPM.2). As direct drivers can have chronic, prolonged and delayed consequences for biodiversity and ecosystem services, owing to time lags in ecosystem response (*well established*) {4.5.1, 4.9.1}, phosphorous and nitrogen (except ammonia) pollution is decreasing but, owing to time lags, many lakes, rivers and coastal areas in Western and Central Europe still do not have a good ecological status {4.6.1, 4.6.2}. Time lags also occur between the initial introduction of invasive alien species and their impact (*well established*) {4.8.1}.

C4. Economic growth is generally not decoupled from environmental degradation. This decoupling would require a transformation in policies and tax reforms across the region (*established but incomplete*) {4.3.1, 4.3.2, 4.3.4}.

There is evidence of growth in GDP across Europe and Central Asia (*well established*). For example, since 2000, gross domestic material consumption has increased across European Union member States, much of which has been driven by growth-oriented policies (*well established*) {4.3.2}. However, this economic growth has indirectly reinforced drivers of biodiversity loss, which in turn has reduced nature's contributions to people. Such drivers have included land-use change, climate change, natural resource extraction, pollution and invasive alien species (Table SPM.2).

Awareness of sustainability challenges has led to some institutional change in the region, including policies on climate agreements and a range of environmental policies. Furthermore, recent policy initiatives have suggested a focus on decoupling economic growth from environmental degradation {4.3.2, 4.3.4}. This decoupling would require a transformation in policies and tax reforms at the global and national levels. Across the region, a range of policies for resource efficiency, including





environmental taxation, have been implemented. The total revenue from environmental taxes in the European Union has declined from 6.8 per cent of the total revenues derived from all taxes and social contributions in 2002 down to 6.3 per cent in 2016 (*well established*) {4.3.1, 4.3.2}. Furthermore, there still exist policy instruments, such as harmful agricultural and fishing subsidies, which continue to impede transitions towards a sustainable future (*established but incomplete*). Decoupling would be assisted by new indicators that incorporate well-being, environmental quality, employment and equity, biodiversity conservation and nature's ability to contribute to people.

Table SPM.2

Impact of indirect drivers (rows) on direct drivers (columns) of biodiversity loss and nature's contributions to people in Europe and Central Asia

	LAND USE CHANGE															
	Agricultural land use				Forestry				Traditional land use				Protected area development			
	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA
INSTITUTIONAL	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	~	~	✓	✓	~	~
ECONOMIC	~	~	~	~	✗	~	✗	~	✓	✓	✗	✗			✗	✗
DEMOGRAPHIC			~	~					✗	✗	✗	✗				
CULTURAL	✓	~	✗	✗	✓	✓	✓	✗	~	~	~	~	✓	✓	✗	✗
TECHNOLOGICAL	~	~	~	~												
	Climate change				Pollution				Natural resource extraction				Invasive alien species			
	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA
	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA
INSTITUTIONAL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✗	✓	✓	~	~
ECONOMIC	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗		✗	✗	✗	✗	✗
DEMOGRAPHIC					✗	✗	✗	✗	✗	✗	✗	✗				
CULTURAL					~	~	~	~	~	~	~	~	✗	✗	✗	✗
TECHNOLOGICAL	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗				

The colour shows the impact of an indirect driver on a direct driver's effect on biodiversity and nature's contributions to people along a gradient from negative to positive effects. WE = Western Europe, CE = Central Europe, EE = Eastern Europe, CA = Central Asia

 Negative
  Both ways
  Positive
  Lack of evidence

D. Futures for Europe and Central Asia

D1. Scenario studies for Europe and Central Asia, with time horizons up to 2100, show trade-offs between different ecosystem services with implications for biodiversity (Box SPM.3, Figure SPM.9) {2.2.6, 3.5, 5.3.3, 5.3.4}. Political and societal value judgements embedded within scenarios will determine how these trade-offs are resolved. Scenarios that assume proactive, environmental decision-making; promote environmental management approaches that support multifunctionality; and mainstream environmental issues across sectors, can mitigate undesirable trade-offs (*established but incomplete*) {5.3.3}. Moreover, scenarios that assume cooperation between countries or regions are more effective in mitigating negative impacts across geographic scales (*established but incomplete*) {5.3.3}. Such scenarios project more positive impacts across a broad range of indicators of biodiversity, nature's contributions to people and good quality of life than others (*established but incomplete*) {5.3.3, 5.6.1}.

Scenario studies (see Box SPM.3 on scenario archetypes) suggest that reactive approaches to environmental issues will have mixed impacts. *Economic optimism* scenarios generally lead to declines in biodiversity and regulating ecosystem services, but to increases in provisioning ecosystem services (*established but incomplete*) {5.3.3, 5.6.1}. *Regional competition* scenarios lead to the most negative impacts, particularly for non-material nature's contributions to people and indicators of good quality of life (*established but incomplete*) {5.3.3, 5.6.1}. In both types of scenarios, development is

driven by economic growth, leading to strong positive effects for nature's contributions to people with market values and negative effects for contributions without market values (*established but incomplete*) {5.3.3, 5.6.1}. For example, scenarios for Western and Central Europe, which prioritize increases in food provision through agricultural expansion or intensification, lead to trade-offs with regulating contributions to people and biodiversity. Likewise, scenarios for Eastern Europe that focus on timber extraction lead to highly managed forests with decreased climate regulation and value for cultural or recreational purposes.

Sustainability-focused scenarios (e.g., *global sustainable development* or *regional sustainability*) assume a proactive approach to environmental issues that anticipates change and thereby minimizes adverse impacts and capitalizes on opportunities {5.1.1}. Such scenarios cause increases in most of nature's contributions to people and good quality of life, but have mixed biodiversity trends (*established but incomplete*) {5.3.3, 5.6.1}. Trade-offs occur in these scenarios, especially involving land and water use (such as the effects of reduced agricultural intensity or of increases in bioenergy cropland, on other land uses and biodiversity) {5.3.3, 5.6.1}.

Impacts under *business-as-usual* scenarios are highly variable regionally. In general, the impacts on biodiversity, nature's contributions to people and good quality of life are more positive than for *economic optimism* and *regional competition*, but more negative than for *regional sustainability* and *global sustainable development* (*established but incomplete*) {5.3.3, 5.6.1}.

Scenarios considering climate change indicate increases in agricultural production for food, feed and bioenergy in the northern part of the European Union, but decreases in agricultural and timber production in the southern part (Figure SPM.10). Major water shortages are projected in the long term for Central Asia, parts of Central Europe, and the Mediterranean, leading to key trade-offs for water use and management in different sectors, including the maintenance of environmental flows (*established but incomplete*) {5.3.3}.

Trade-offs depend on scenario assumptions about lifestyle and consumption, which affect the demand for nature's contributions to people, and policies affecting the management and governance of resources. For example, *global sustainable development* scenarios assume changes in dietary preferences towards reducing meat consumption, behavioural changes to save water and energy, and the implementation of integrated and sustainable land and water management practices. These lead to positive outcomes for biodiversity, nature's contributions to people and good quality of life. Scenarios that assume strong international or transboundary coordination of adaptive measures between multiple stakeholders lead to more sustainable solutions across scales and regions. Scenario assumptions in *inequality* scenarios also affect how different social groups appropriate nature's contributions to people (*established but incomplete*) {5.2.3, 5.3.3}.

D2. Future impacts on biodiversity and nature's contributions to people are underestimated because most scenarios consider only a few drivers, notably climate change (*well established*) {5.2.2, 5.3.2}. Single-driver scenarios also fail to capture driver interactions (*well established*) {5.2.2, 5.3.2}. Single-driver and single-sector approaches are likely to misrepresent the direction, magnitude or spatial pattern of impacts on biodiversity and nature's contributions to people, leading to poor management or policy decisions (*established but incomplete*) {5.3.1}.

Many scenarios consider climate change as a single driver (*well established*). The few multi-driver scenarios are largely based on the Special Report on Emissions Scenarios of the Intergovernmental Panel on Climate Change and, hence, focus on long-term climate change issues (to 2100). Pollution and invasive alien species are poorly represented in scenarios (*well established*) {5.2.2}. Land-use change is rarely considered as a direct driver of biodiversity and nature's contributions to people because land-use change scenarios focus more on the effects of indirect drivers (e.g., policy, social preferences and economics) on land use per se (*established but incomplete*) {5.2.1}. There are fewer scenarios of future land-use change impacts on biodiversity and nature's contributions to people than empirical studies of past trends (*established but incomplete*). Single-driver scenarios fail to capture feedbacks and synergies between and amongst indirect and direct drivers operating across different scales (*established but incomplete*) {5.3.4}. Integrated scenarios and models are explicit about nature and cover multiple drivers, sectors and scales. This enhances the understanding of complex interdependencies between human and environmental systems to support coordinated decision-making {5.2.2, 5.3.1}.

Box SPM.3

Scenario archetypes

The scenario and modelling studies in the literature {5.2.3, 5.3.3.} were mapped to six existing scenario archetypes {5.2.2. - Box 5.3}, which represent diverse plausible futures for Europe and Central Asia:

- *Business-as-usual* assumes the continuation of past and current trends in indirect and direct drivers.
- *Economic optimism* assumes global developments steered by economic growth, resulting in a strong dominance of international markets with a small degree of regulation.
- *Regional⁹ competition* assumes an increasingly fragmented world with a growing gap between rich and poor; increasing problems with crime, violence and terrorism; and strong trade barriers.
- *Regional⁹ sustainability* assumes a shift towards local and regional decision-making that is strongly influenced by environmentally aware citizens. A proactive attitude to environmental management prevails, but poor international collaboration obstructs coordination to solve global environmental issues.
- *Global sustainable development* assumes an increasingly proactive attitude by policymakers and the public towards environmental issues, a high level of international cooperation and strong regulation.
- *Inequality* assumes increasing economic, political and social inequalities with power concentrated in a relatively small political and business elite who invest in green technology.

Each scenario archetype consists of different assumptions about future changes in direct and indirect drivers as shown in Table SPM.3.

⁹ Here the term “regional” is not meant to denote “IPBES regions”, but reflects a more general meaning across the assessed literature, where it is used with reference to subnational, national or larger areas.

Table SPM.3

Trends in indirect and direct drivers assumed in six scenario archetypes covering time horizons up to 2100

Arrows in the table represent the expert interpretation of the magnitude of trends in drivers across all scenarios found within the archetypes. Colour coding represents the expert interpretation of the impact of the trend on biodiversity and nature's contributions to people {5.2.3}.

Scenario archetype	INDIRECT DRIVERS					DIRECT DRIVERS				
	INSTITUTIONAL (Environmental proactivity)	ECONOMIC (Gross domestic product)	DEMOGRAPHIC (Population)	CULTURAL (Sustainable consumption)	TECHNOLOGY	CLIMATE CHANGE (Temperature)	LAND USE CHANGE (Landscape homogeneity)	NATURAL RESOURCE EXTRACTION	POLLUTION	INVASIVE ALIEN SPECIES
Business-as-usual	↗↘	↗	↗	↘	↗↘	↗	↗	↗	↗	↗
Economic optimism	↘	↗	↗	↘	↗↗	↗	↗	↗	↗	↗
Regional competition	↘	→	→	→	↘	↗	↗	↗	↗	↗
Regional sustainability	↗	↗	↗	↗	→	↗	↘	↘	→	↘
Global sustainable development	↗	↗	→	↗	↗	↗	↗	↘	↘	↘
Inequality	↘	↗	↘	→	→	↗		↗		

↑ Strong increase	↗ Increase	→ Stable	↘ Decrease	↓ Strong decrease
→ Positive	→ Neutral	→ Negative	→ Not interpreted in terms of impacts	→ Lack of evidence

Figure SPM.9

Projected future impacts on biodiversity, nature's contributions to people and good quality of life according to six scenario archetypes for Europe and Central Asia up to 2100 (see Box SPM.3 for details of the scenario archetypes) {2.2.6, 3.5, 5.3.3}

Green symbols with upward arrow indicate an increase, purple symbols with horizontal arrow a stable trend, and orange symbols with downward arrow a decrease. Thick arrows indicate evidence from the literature based on ten or more model indicators per scenario archetype, thin arrows indicate evidence based on fewer than ten.

		Business-as-usual	Economic optimism	Regional competition	Regional sustainability	Global sustainable development	Inequality
NATURE	Biodiversity, biophysical assemblages and processes	↘	↘	↕	↕	↗	↕
REGULATING NATURE'S CONTRIBUTIONS TO PEOPLE	Pollination		↘	↘	↗	↗	
	Regulation of air quality		↗	↕	↗	↗	
	Regulation of climate	↕	↘	↕	↗	↗	
	Regulation of freshwater quantity		→	↗	↗	↗	
	Regulation of freshwater quality	↘	↘	↘	↘	↗	
	Formation of soils	↕	↘	↘	↗	↗	
	Regulation of hazards	↘	↕	↕	↕	↘	↘
	Regulation of organisms detrimental to human		↘	↘	↗	↗	
MATERIAL NATURE'S CONTRIBUTIONS TO PEOPLE	Food and feed	↕	↗	↗	↘	↗	↗
	Materials (forest products)	↘	↕	↘	↗	↕	↘
	Water resources	↘	↗	↘	↗	↕	↘
NON-MATERIAL NATURE'S CONTRIBUTIONS TO PEOPLE	Learning and inspiration		↗	↘	↗	↗	
	Physical and psychological experiences	→	↕	↕	↗	↗	
	Supporting identities		↘	↕	↗	↕	
GOOD QUALITY OF LIFE	Education and knowledge		→	↘	↗	↗	
	Physical, mental and emotional health		→	↘	↗	↗	
	Security and livelihoods	↘	↗	↗	↗	↗	

Increase > 50%
 Stable > 50%
 Lack of evidence

Decrease > 50%
 Variable (no one class > 50%)

Confidence level
 n ≥ 10
 n < 10

Figure SPM.10

Trends in impacts on biodiversity, nature's contributions to people and good quality of life indicators that are consistent across most scenario archetypes (see Box SPM.3 for details of the scenario archetypes) {5.3.3}

The Western European region has been divided into four parts (northern, Atlantic, Alpine and southern), in view of the greater number of available studies.



D3. Pathways propose coherent sets of actions towards the sustainable futures envisioned for the region (established but incomplete) {5.1.2, 5.4.3, 5.5.2}. The most effective pathways stress long-term societal transformation (behavioural change) through education, knowledge sharing and participatory decision-making. These pathways emphasize nature's regulating contributions to people and the importance of considering diverse values (established but incomplete) {5.5.2, 5.5.3, 5.5.4}.

Four types of pathways are specified. Two types of pathways do not challenge the economic growth paradigm (*green economy* and *low carbon transformation* pathways). They include actions related to technological innovation, land sparing or land sharing, and focus on combinations of top-down legal and regulatory instruments and economic and financial instruments. These pathways do not fully mitigate trade-offs and may not be able to achieve sustainable futures (*established but incomplete*) {5.5.2, 5.5.4, 5.6.1}. The third type of pathways focus on radical social innovation to achieve local food and energy self-sufficiency and local supply of nature's contributions to people (*ecotopian solutions*). They emphasize local multifunctionality, green infrastructure, urban design and food production (*established but incomplete*) {5.5.2, 5.5.4, 5.6.1}. The fourth type of pathways emphasize a change towards diverse values, promoting resource-sparing lifestyles, continuous education and innovative forms of agriculture where different knowledge systems combine with technological innovation (*transition movements*). They achieve transformation using social and information-based policy instruments focusing on participatory processes, community actions and voluntary agreements. Rights-based instruments and customary norms, including indigenous and local knowledge, are used in combination with legal, regulatory and economic instruments (*established but incomplete*) {5.5.3, 5.6.1}. Actions proposed in all of the pathways can be combined. For example, short-term, incremental actions in *green economy* and *low carbon transformation* pathways may pave the way for more transformative *transition movements* pathways (*established but incomplete*) {5.5.4}. Despite distinct differences, all pathways stress some of the governance options highlighted in section E,

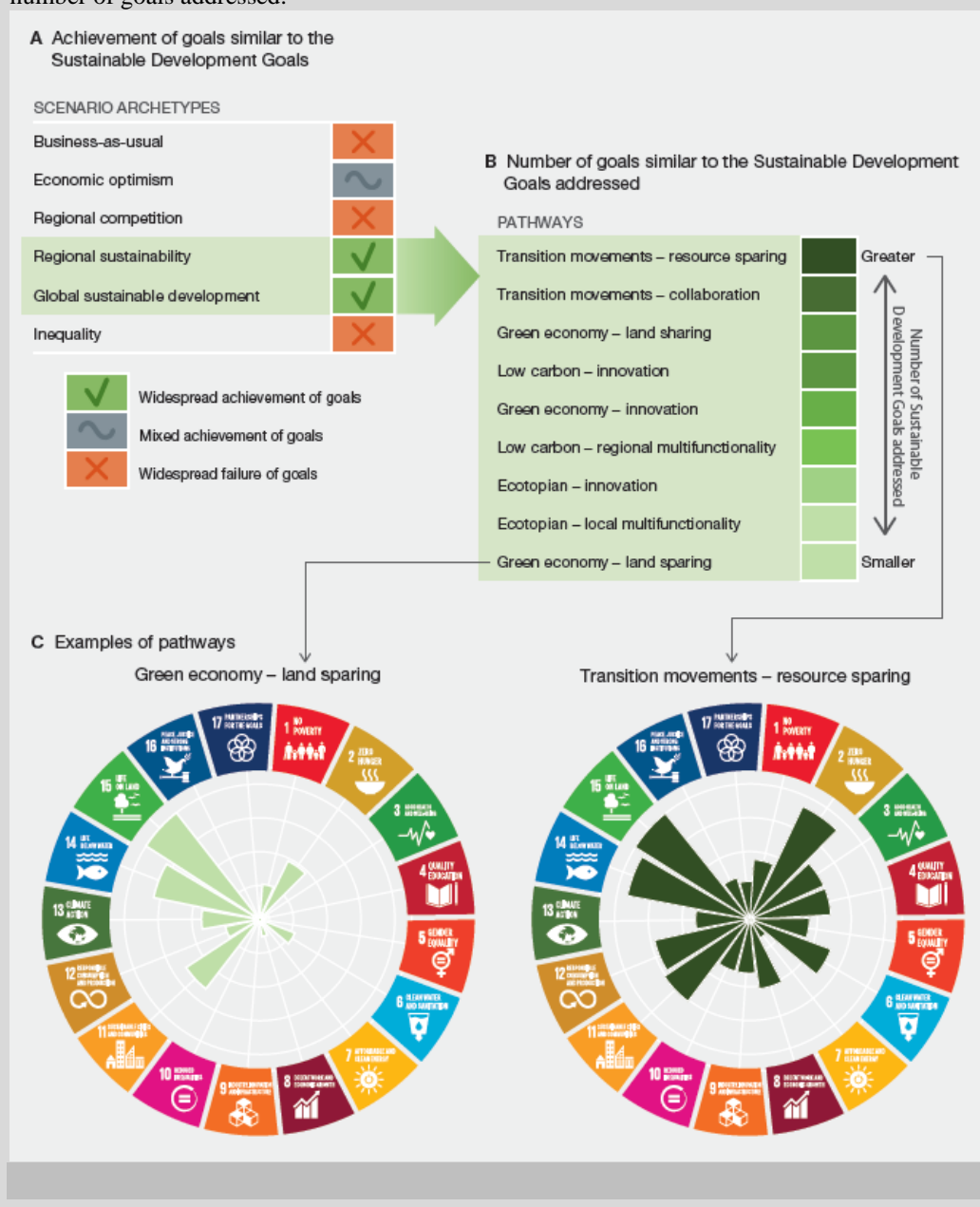
including mainstreaming, integrated approaches that cut across sectoral boundaries, awareness-raising tools, education and participation to facilitate multi-actor governance (*established but incomplete*) {5.5.3}.

Figure SPM.11

Summary of the extent to which goals similar to the Sustainable Development Goals are expected to be achieved under the scenario archetypes up to 2100 and pathways to sustainability up to 2050 for Europe and Central Asia {5.3.4, 5.5.4}

Part A shows that the scenario archetypes *regional sustainability* and *global sustainable development* project a widespread achievement of goals (see Box SPM.3 for description of the scenario archetypes). Part B introduces pathways that support the achievement of goals albeit to a different extent. This is exemplified in part C, where the wedges indicate the extent to which the pathways address each goal (see D3 for description of the pathways).

A: orange = widespread failure in the achievement of goals; green = widespread achievement of goals; grey = mixed achievement of goals. B: darker shades of green indicate a greater number of goals are addressed by the pathways. C: two examples of pathways with smaller and greater number of goals addressed.



Box SPM.4

Evidence from this regional assessment for Europe and Central Asia relevant in the context of the Aichi Biodiversity Targets and the Sustainable Development Goals

The Strategic Plan for Biodiversity 2011–2020, including its 20 Aichi Biodiversity Targets under five Strategic Goals, provides a framework for the United Nations system, including national Governments and others, for management and policy development on biodiversity. The 2030 Agenda for Sustainable Development, with its 17 Sustainable Development Goals, sets out the broader strategy towards global sustainability for the United Nations. This assessment summarizes the progress that the literature has reported towards these goals, as far as they pertain to the region and as far as there is sufficient evidence.

Evidence relevant in the context of the Aichi Biodiversity Targets

Evidence suggests progress in addressing the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society (Strategic Goal A) (*established but incomplete*), although subsidies with negative impacts have not yet been reformed (*well established*). Public awareness about the importance of biodiversity and ecosystem services (Aichi Biodiversity Target 1) appears to be increasing. Progress has also been reported in integrating biodiversity and ecosystem services into planning processes and national accounting in Western and Central Europe (Target 2) (*established but incomplete*) {6.6.2}. Substantial reforms could reduce the negative impacts of subsidies (table SPM.4) {4.4.1}. Increasing positive incentives for conservation could also improve progress towards Target 3 (harmful incentives eliminated, positive incentives developed and applied) (table SPM.4) {6.2, 6.4.1}. Several countries have implemented ecological fiscal reforms, with mixed results (*established but incomplete*) {6.2, 6.4.1, 6.4.2}, but some policy instruments continue to have negative environmental impacts (*well established*) {4.3.1}. Without complementary strategies for reducing the impacts of consumption and production, more efficient resource use alone is unlikely to render current production and consumption patterns sustainable (Target 4 - sustainable consumption and production) (table SPM.4) {6.5.4, 6.6.2, 6.6.3.2}.

Pressure from direct drivers on biodiversity is unlikely to be reduced (*established but incomplete*) and the use of biodiversity is not yet sustainable (*well established*) (Strategic Goal B). The evidence base in Europe and Central Asia related to the global Aichi Biodiversity Target 5 (habitat loss halved or brought close to zero) shows negative trends in biodiversity in agricultural areas {3.3.2.9}, important ecosystems such as seagrass beds {3.3.4}, and many fish stocks {4.4.1} (*established but incomplete*). Target 5 (habitat loss halved or brought close to zero) could, however, be achieved for terrestrial biodiversity in all subregions through, inter alia, effective and representative protected areas (see Target 11), mainstreaming biodiversity considerations into and across all sectors and policies and integrated conservation management (*established but incomplete*). Contributions toward Targets 6 (sustainable management of marine living resources) and 10 (pressures on vulnerable ecosystems reduced) for the deep-sea are hampered by increased habitat degradation, and declines in biodiversity and ecosystem functioning. More effective fisheries management and increasing protected areas could improve this situation (*well established*) {3.3.4, 6.5.3}. Current trends in freshwater and terrestrial biodiversity suggest that it is highly unlikely that Europe and Central Asia will be able to fully contribute to Targets 7 (sustainable agriculture, aquaculture and forestry), 8 (pollution reduced) and 9 (invasive alien species prevented and controlled) (*well established*) {3.4.3}.

Progress has been made toward improving the status of biodiversity by safeguarding ecosystems, species and genetic diversity (Strategic Goal C) through protected areas (*well established*). The extinction risk of domestic breeds is increasing and the genetic diversity of cultivated plants is decreasing, in spite of measures to counter this (*well established*). Overall trends in biodiversity are still negative, however. Europe and Central Asia appears to achieve protected area coverage of 17 per cent of its terrestrial surface (Target 11) {3.2.9}, notwithstanding great variability in the level of protection. The European Union already protects about 25 per cent of its terrestrial surface. There has been a general increase in the number and extent of marine protected areas in the region. In 2017, 15 countries protected more than 10 per cent of their marine waters, and 12 per cent of the Baltic Sea area is protected (*well established*) {3.3.4.7}. Other marine systems, especially those further from the coast, are less protected (*well established*). The ecological representativeness, connectivity and management of protected areas have improved, but most still lack management measures to protect biodiversity, such as no-take zones (*well established*) {3.3.4}. In spite of some progress, current trends in biodiversity make it highly unlikely that the region will be able to contribute fully to achieving Targets 10, 11 and 12 (extinction prevented) {3.4, 3.5}. Downward trends in the Red List Index

(increasing aggregate extinction risk) and Living Planet Index (decreasing population trends) also indicate that Europe and Central Asia will not be able to fully contribute to meeting Target 12. Europe and Central Asia are contributing to Target 13 (genetic diversity maintained) through the development of safeguards for rare domestic breeds and germplasms of cultivated plants. The extinction risk of domestic animal breeds is increasing, however, and there is evidence of the genetic erosion of cultivated plants under modern production systems (*established but incomplete*).

The Europe and Central Asia region has not advanced in enhancing the benefits to all people from biodiversity and ecosystem services (Strategic Goal D), as a consequence of the deterioration of nature's capacity to provide certain contributions to people (*well established*) {2.2.5} and the unequal distribution of nature's contributions (*established but incomplete*) {2.3.4}. Owing to biodiversity trends in freshwater, marine and terrestrial ecosystems, it is highly unlikely that Europe and Central Asia will fully contribute to achieving Target 14 (ecosystems and essential services safeguarded) {3.3, Figure SPM.6}. Progress is being made towards contributing to Target 16 (Nagoya Protocol in force and operational). By 2014, when the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization to the Convention on Biological Diversity entered into force, eight parties to the Protocol (15 per cent) in Europe and Central Asia had ratified the Protocol, while by 2017, the number had grown to 25 (46 per cent), including the European Union {6.4.1}.

Enhanced implementation through participatory planning, knowledge management and capacity-building (Strategic Goal E) has been positive where the Aichi Biodiversity Targets have informed the development of national-level targets. This has not been achieved, however, where indigenous and local knowledge and practices have declined or not been fully respected in relation to traditional land use (*well established*). The Aichi Biodiversity Targets have been translated into national-level targets in all but 13 countries in the region. This suggests progress towards Target 17 (national biodiversity strategies and action plans adopted as policy instruments) {6.4.1}. The practices and knowledge of indigenous peoples and local communities in Western and Central Europe have continued to decline since the 1960s and have often not been fully respected or even marginalized, in contrast to Target 18 (traditional knowledge respected) (*well established*). Evidence suggests that the further mobilization of financial resources (Target 20) is key for increasing the success of policy to achieve biodiversity conservation objectives (*well established*) {6.3.2, 6.3.3, 6.4.1, 6.5.4, 6.6.2, 6.6.4}.

Evidence relevant in the context of the Sustainable Development Goals

Progress in contributing towards achieving the Sustainable Development Goals has generally been positive in Europe and Central Asia in terms of environmental protection, human health, food security and water security (particularly in Europe) {2.3.1, 2.3.2} (*well established*). Nature offers various contributions to good quality of life, supporting the achievement of Goal 3 (good health and well-being) (*well established*) {2.3.2}. Conversely, the consumption of natural resources in Western Europe has increased large-scale land acquisition in other parts of the world, including Eastern Europe and Central Asia (*established but incomplete*) {2.2.4 and 2.3.1.1}. This may contribute to not achieving Goal 2 (zero hunger), Goal 7 (affordable and clean energy) and Goal 12 (responsible consumption and production). The erosion of indigenous and local knowledge and the associated decline in sustainable traditional land use threatens the region's contribution to accomplishing Goal 2 and Goal 4 (quality education) (*established but incomplete*) {2.2.3.1.2}. Future climate and land-use change will decrease water security (Goal 6 - clean water and sanitation), with the number of water-stressed countries in Europe and Central Asia expected to increase by 2030 (*well established*) {2.3.1.2}. Some advances have been made towards accomplishing environmental protection goals (Goals 14 – life below water and 15 – life on land), but the negative trend of biodiversity especially in agricultural areas currently restricts progress towards contributing to Goal 15 {3.3.2.9}. Despite some recent progress, the conservation of at least 10 per cent of coastal and marine areas by 2020, a target under Goal 14, has not been reached for all marine systems (*well established*), although it has already been surpassed in some coastal areas of the North and Baltic Seas and by 15 countries (*well established*).

Beyond the Aichi Biodiversity Targets and Sustainable Development Goals

Looking beyond the 2030 timescale of the Sustainable Development Goals up to 2100, scenario analysis highlights that the continuation of past and current trends in drivers (as represented in *business-as-usual* scenarios) will inhibit the region from contributing to the widespread achievement of goals similar to and including the Sustainable Development

Goals. In contrast, scenarios which focus on achieving a balanced supply of nature's contributions to people and incorporate a diversity of values are more likely to contribute to achieving the majority of such goals (*established but incomplete*). A continuation of the business-as-usual approach in Europe and Central Asia is expected to result in failure to contribute to achieving most of the Sustainable Development Goals (contribution to achieving 4 out of 17), and Aichi Biodiversity Targets (contribution to achieving 8 out of 20) (*established but incomplete*). Scenarios of *economic optimism* are expected to enable the region to contribute to achieving 8 of the Goals, but only 4 of the 20 Targets. Scenarios of *regional competition* are expected to enable the region to contribute to achieving only two of the Goals and only one of the Targets (*established but incomplete*). By contrast, scenarios of *sustainability* are expected to enable the region to contribute to achieving the majority of the Goals (14) and Targets (14) (*established but incomplete*) {5.4, 5.6.}. A more comprehensive visual summary is provided in figure SPM.11.

E. Promising governance options for Europe and Central Asia

E1. Mainstreaming the conservation and sustainable use of biodiversity and the sustained provision of nature's contributions to people into policies, plans, programmes, strategies and practices of public and private actors could be achieved with more proactive, focused and goal-oriented environmental action, including quantitative goals (*well established*) {6.1, 6.3, 6.4, 6.5, 6.6, Figure 6.15}.

The conservation and sustainable use of biodiversity in the more than 80 per cent of landscapes and seascapes outside protected areas would benefit from embedding biodiversity considerations into policies, strategies and practices of public and private actors that impact or rely on biodiversity {Table 6.1; Figure 6.2, Figure 6.15}. These considerations are equally important inside protected areas. Although progress has been made towards mainstreaming by setting up, reviewing and updating biodiversity strategies and action plans at multiple levels, existing legislation in all economic sectors could be implemented more effectively {6.3, 6.4.1} (Table SPM.4). Mainstreaming the conservation and sustainable use of biodiversity would benefit environmental policies {6.4.2}, economic sectors and business actors depending on, or influencing, biodiversity {6.4.1, 6.5, 6.6; Table 6.10} (Table SPM.4). Opportunities to successfully mainstream biodiversity and nature's contributions to people, in public and private policy and decision-making (Table SPM.4) {6.6, 6.6.1; Figure 6.13}, could be harnessed by: first, raising awareness of the dependence of good quality of life on nature, enhancing capacity-building and strengthening participation of affected actors in decision processes; second, defining policy objectives concerning the ecological, economic and sociocultural needs for achieving sustainable living, taking account of the diverse values of nature for different stakeholder groups; and, third, designing instruments and policy mixes to support the implementation of effective, efficient and equitable policy and decision-making for nature and a good quality of life {6.6, 6.6.1}. Taking the European Union Common Agricultural Policy as an example, a number of factors would increase the effectiveness, efficiency and equity of related policy instruments. These factors include a better definition of clear and coherent objectives for the Common Agricultural Policy, simultaneously addressing multiple ecosystem services; a more defined focus on biodiversity conservation and the delivery of nature's contributions to people at the landscape level; a more explicit disclosure of trade-offs and synergies between different objectives; and more balanced and transparent funding between the production of agricultural commodities and the delivery of public goods {6.5.1.3}.

Table SPM.4

Policy options and opportunities for mainstreaming the conservation and sustainable use of biodiversity and the sustained provision of nature's contributions to people in Europe and Central Asia

Building on three key steps of mainstreaming, options and opportunities for mainstreaming are provided for seven policy and economic sectors. The evidence shows that biodiversity and nature conservation will benefit from being mainstreamed in environmental policies and all economic sectors and their policies and that nature's contributions to people will benefit from being mainstreamed in all economic sectors, as well as the conservation sector. The table synthesizes those policy options and opportunities from the sectoral analyses in chapter 6 that are relevant to all sectors. It can be used by policymakers of the subregions as a checklist to identify potential for improvement and for new policy instruments not yet initiated within the subregion. Although they have scope for improvement, legal and regulatory instruments are the most widely applied policy instrument category in all sectors and subregions, emphasizing their role as the backbone of policy mixes. Social and information-based instruments have been partly implemented in some subregions. There is also considerable scope for new or improved economic and financial instruments. Rights-based approaches and customary norms are the least developed and applied instrument category, indicating knowledge gaps (see SPM.5) or possibly a lack of attention or even acknowledgement to indigenous and local knowledge and practices.

STEPS	OPTIONS AND OPPORTUNITIES	Sub-regions	CONSERVATION				ENVIRONMENT ¹				AGRICULTURE			
			WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA
STEP 1: Raising awareness	Encourage education, joint learning and common understanding													
	Promote information sharing, transparency, knowledge management and training													
	Make trade-offs and tipping points visible at the relevant spatial scales													
	Encourage participation and dialogue among different actors													
	Make diverse values visible through national and business accounting													
	Mainstream recognition of need for profound societal transformation towards sustainability													
STEP 2: Defining policy objectives	Adopt and translate international and regional targets and standards into national and local strategies and action plans													
	Improve integration and coherence of legislation, sectoral policies and planning processes, to account for trade-offs and synergies													
	Develop context appropriate targets and objectives to stimulate positive change													
	Increase transparency and participation of a wide range of actors including indigenous peoples and local communities in decision making													
STEP 3: Designing instruments and policy mixes	Legal and regulatory instruments													
	Define and ensure property and access rights and responsibility													
	Set up, adjust and enforce legal and regulatory standards to sustain biodiversity and NCP													
	Set up areas to protect biodiversity and NCP													
	Economic and financial instruments													
	Phase out harmful subsidies		NA	NA	NA	NA								
	Tax and charge negative environmental impacts		NA	NA	NA	NA								
	Redistribute public revenues considering ecological objectives													
	Reward socio-economic activities delivering public goods													
	Secure conservation financing						NA	NA	NA	NA				
	Foster sustainable technological and social innovation													
	Social and information-based instruments													
	Promote eco-labelling and certification schemes and improve their transparency and accountability													
	Promote voluntary agreements and partnerships for responsible management, which include self-enforcement mechanisms													
	Promote sense of agency and efficacy through the enhancement of public participation													
	Support social norms that promote sustainable lifestyles and practices													
	Rights-based approaches and customary norms													
	Strengthen the use of indigenous and local knowledge and practices													
	Strengthen the consideration of cultural properties and heritage in protecting sites and landscapes						NA	NA	NA	NA				
	Strengthen the use of Social License to Operate or similar approaches to recognise the needs of indigenous peoples and local communities													

1. Include the following policy areas: Marine and freshwater quality and quantity, flood management, air and wider environmental pollution (including eutrophication and acidification), waste management, mitigation of and adaptation to climate change, soil management and land degradation. Options and opportunities in rows left blank have been covered by the other sectors, also in relation to their environmental outcomes.

WE – WESTERN EUROPE CE – CENTRAL EUROPE EE – EASTERN EUROPE CA – CENTRAL ASIA
 ■ EFFECTIVELY IMPLEMENTED ■ UNDER DEVELOPMENT OR STARTED ■ NOT ASSESSED
 ■ IMPLEMENTED WITH SCOPE FOR IMPROVEMENT ■ NOT YET INITIATED ■ NA – NOT APPLICABLE

		Sectors	FORESTRY				FISHERIES				EXTRACTIVE & MANUFACTURING ²				SERVICES ³			
STEPS	OPTIONS AND OPPORTUNITIES	Sub-regions	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA	WE	CE	EE	CA
STEP 1: Raising awareness	Encourage education, joint learning and common understanding																	
	Promote information sharing, transparency, knowledge management and training																	
	Make trade-offs and tipping points visible at the relevant spatial scales																	
	Encourage participation and dialogue among different actors																	
	Make diverse values visible through national and business accounting																	
	Mainstream recognition of need for profound societal transformation towards sustainability																	
STEP 2: Defining policy objectives	Adopt and translate international and regional targets and standards into national and local strategies and action plans																	
	Improve integration and coherence of legislation, sectoral policies and planning processes, to account for trade-offs and synergies																	
	Develop context appropriate targets and objectives to stimulate positive change																	
	Increase transparency and participation of a wide range of actors including indigenous peoples and local communities in decision making																	
STEP 3: Designing instruments and policy mixes	Legal and regulatory instruments																	
	Define and ensure property and access rights and responsibility																	
	Set up, adjust and enforce legal and regulatory standards to sustain biodiversity and NCP																	
	Set up areas to protect biodiversity and NCP																	
	Economic and financial instruments																	
	Phase out harmful subsidies																	
	Tax and charge negative environmental impacts																	
	Redistribute public revenues considering ecological objectives																	
	Reward socio-economic activities delivering public goods																	
	Secure conservation financing																	
	Foster sustainable technological and social innovation																	
	Social and information-based instruments																	
	Promote eco-labelling and certification schemes and improve their transparency and accountability																	
	Promote voluntary agreements and partnerships for responsible management, which include self-enforcement mechanisms																	
	Promote sense of agency and efficacy through the enhancement of public participation																	
	Support social norms that promote sustainable lifestyles and practices																	
Rights-based approaches and customary norms																		
Strengthen the use of indigenous and local knowledge and practices																		
Strengthen the consideration of cultural properties and heritage in protecting sites and landscapes																		
Strengthen the use of Social License to Operate or similar approaches to recognise the needs of indigenous peoples and local communities																		

2. Include the following policy areas: Energy, mining, manufacturing.

3. Include the following policy areas: Health, education and research, transport, tourism, finance.

WE - WESTERN EUROPE

CE - CENTRAL EUROPE

EE - EASTERN EUROPE

CA - CENTRAL ASIA

EFFECTIVELY IMPLEMENTED

UNDER DEVELOPMENT OR STARTED

NOT ASSESSED

IMPLEMENTED WITH SCOPE FOR IMPROVEMENT

NOT YET INITIATED

NA - NOT APPLICABLE

E2. Developing integrated approaches across sectors would enable more systematic consideration of biodiversity and nature's contributions to people by public and private decision makers (*well established*) {6.1, 6.2, 6.4, 6.5, 6.6, 6.6.4.1; Figure 6.2}. This includes further options to measure national welfare beyond current economic indicators, taking account of the diverse values of nature {6.6.3.1}. Ecological fiscal reforms would provide an integrated set of incentives to support the shift to sustainable development (*established but incomplete*) {4.3–4.8, 6.4.1, 6.4.2, 6.6.2}.

Conventional sectoral approaches are insufficient to tackle interlinked environmental, economic and social challenges. Actions in one sector may affect other sectors, because policy design, instrument choice, or policy implementation rarely consider trade-offs {6.2, 6.4.1, 6.4.2, 6.6, 6.6.4.1, 6.6.4.2; Box 6.1, Box 6.9}. Without coordination between, and sustainable management practices within, sectors, there is evidence that agriculture, forestry, fisheries, mining, energy, manufacturing and the services sector may exert negative impacts on biodiversity, on nature's contributions to people and on the livelihoods of indigenous peoples and local communities {4.2.2, 6.4.2, 6.5.1–6.5.5, 6.6.4.1; Table 6.6}. Taking individual sectors as an example, a mismatch has been detected between the low

degree of forest sector integration with other policy sectors on the one hand, and on the other its high potential to contribute to policy integration {6.5.2.3}. While some instruments of the European Union Common Agricultural Policy support extensive management practices, others are less well suited to, or implemented by, particularly, Central European countries of the European Union, to support indigenous and local knowledge and practices of small and semi-subsistence farms in high nature value farmland {6.5.1.2}. With regard to economy-wide policy integration, reflecting the real changes in the diverse values of nature's contributions to people in national income accounts is one option to provide better information and help to mitigate trade-offs {6.6.3.1}. Another option would be complementing national income accounts with satellite accounts containing information on the costs of ecosystem degradation. Ecological fiscal reform that creates an integrated set of incentives by redirecting taxation from labour to environment, including ecological indicators in intergovernmental fiscal relations and by greening public expenditure programmes, could support the shift to sustainable development {6.4.1, 6.4.2, 6.6.2}. Designing, implementing and assessing instruments in relation to their role in the overall policy mix would help to mitigate conflicting policy goals and trade-offs {6.2, 6.4.1, 6.5.5, 6.6.1, 6.6.2, 6.6.4.1, 6.6.5.5; Box 6.1}. The use of proactive strategies, tools and methodologies to account for diverse values and criteria, and of participatory processes can support trade-off analyses and facilitate policy integration {6.4.1, 6.4.2, 6.6.4, 6.6.5}.

E3. Effective governance of biodiversity and nature's contributions to people would benefit from well-designed mixes of policy instruments, suited to the context (*well established*). Legal and regulatory instruments are the backbone of policy mixes, and economic, financial, social and information-based instruments provide additional incentives for Governments, businesses, non-governmental organizations and citizens. Further efforts would help to develop better rights-based approaches. {6.2, 6.3, 6.4, 6.5, 6.6; Figure 6.2; Boxes 6.2, 6.4} (Table SPM.4). A key factor constraining the effectiveness of existing policy mixes is limited enforcement owing, for example, to a lack of human resources, institutional capacity and financial means, or corruption (*well established*) {6.3.1, 6.4.1, 6.4.2}.

Where legal and regulatory instruments are concerned, the ratification and implementation of international treaties and transboundary agreements provide strong impetus for improving national and subnational policies in all sectors {6.3}. Marine protected areas, however, need more attention {4.5.4, 6.4.1}. For freshwater ecosystems, the European Union Water Framework Directive is of particular importance for achieving a good status for surface and groundwater {6.3.2.3, 6.4.2, 6.5.1, 6.5.2, 6.5.3, 6.5.4, 6.6.3, 6.6.5.5}, although integration and implementation of such novel governance approaches often remain incomplete, and ineffective when member States retain existing structures and procedures without transferring responsibilities and power to the river basin authorities {6.4.2}. Similar structures have been developed in non-European Union countries, such as Ukraine, which share river basins with European Union countries {6.4.2}. Targeted spatial and urban planning integrated across sectors and scales can support the conservation of biodiversity and nature's contributions to people, and enhance the quality of life of urban dwellers {6.6.4.2}.

Economic and financial instruments complement regulatory and other policy instruments by balancing conservation benefits and costs between actors and regions (*well established*) {5.5.3, 6.2, 6.3, 6.4, 6.5, 6.6}. Improving existing policies and developing and implementing new policies could help to avoid biodiversity loss and ecosystem degradation (*established, but incomplete*) {6.2, 6.4.1, 6.4.2, 6.5, 6.6.2, 6.6.5.2; Tables 6.5, 6.6} (Table SPM.4). Since markets undervalue nature's contributions to people, economic and financial instruments aim to change the behaviour of businesses, land users, citizens and public-sector actors, through incentives and disincentives to correct price signals. Environmental taxes, charges and fees make environmental pollution and habitat degradation more expensive, thereby making the polluter pay, whereas payments for ecosystem services or compensation payments reward conservation-friendly behaviour that is otherwise not profitable or affordable {6.4.1, 6.4.2, 6.6.5.2}. Reforming environmentally harmful subsidies in sectors that negatively affect ecosystems (e.g., agriculture, fisheries, energy) would support more cost-effective use of public funds in reaching conservation objectives. Innovative economic and financial instruments include biodiversity offsets and habitat banking, tax reliefs, ecological fiscal transfers and integrated funding for biodiversity and climate-change adaptation {5.5.3, 6.4.1, 6.4.2, 6.5.1–6.5.5, 6.6.2, 6.6.3.2, 6.6.5.2}. Economic and financial instruments are more effective if customized to relevant scales, from global to national and local conditions in achieving conservation targets, while considering social impacts {6.2, 6.4, 6.6.2, 6.6.5}.

Social and information-based policy instruments have the capacity to integrate environmental concerns and to trigger behavioural change at the local, national and international levels, and to include consumers and producers in policy development (*established, but incomplete*) {6.2, 6.3, 6.4, 6.5, 6.6.5.3; Table 6.5; Table 6.6} (Table SPM.4). Enhanced consumer awareness, media coverage, business commitment and sustainable government procurement have increased the market shares of

certified products {6.6.5.3}. Progress with certification is more advanced in countries with developed market economies and less so in countries in economic transition (Table SPM.4). Owing to the lack of compliance mechanisms and clearly assigned responsibilities, there is a trade-off between the effectiveness of certification schemes and their accountability and impact. Efforts to change social norms through education and information-based campaigns promoting pro-environment behaviour have also been important {4.5.3, 5.5.3, 6.2, 6.4.1, 6.4.2.3, 6.5.1.2, 6.5.2–6.5.5, 6.6.5.3}.

Rights-based instruments and customary norms are increasingly supported and promoted by a wide range of multilateral environmental agreements, and by human rights (*established, but incomplete*) {6.2, 6.3, 6.3.2.5, 6.3.2.6, 6.4, 6.5, 6.6, 6.6.5.4} (Table SPM.4). Those instruments integrate rights, norms, standards, and principles into policy, planning, implementation and evaluation, and offer ways to reconcile biodiversity conservation and human rights standards {6.2; Table 6.2}. While decisions by multilateral environmental agreements are implemented at the national level, the recognition of human rights, and in particular the rights of indigenous peoples, in relation to sustainable use of biodiversity varies considerably between countries in Europe and Central Asia (Table SPM.4). Further efforts would be required for the full integration of the fundamental principles of good governance; equalizing power relations and facilitating capacity-building.

For all these instruments and their combination in policy mixes, ecosystem-based approaches, such as successfully implemented in the Norwegian system of fisheries management {Box 6.11}, the concept of nature-based solutions, as promoted by the European Union, or the idea of a circular economy adopt a more systemic perspective to environmental problems rather than addressing single issues {2.2.1.7, 6.4.2.1}.

E4. A wide range of actors and stakeholders is increasingly integrated into governance processes. This can have a positive effect on biodiversity and nature's contributions to people if the effectiveness, efficiency and equity implications of such integration are carefully monitored, evaluated and improved (*well established*) {6.2, 6.4, 6.5, 6.6}. Lack of adequate financing is a major constraint on efforts to achieve biodiversity conservation and ecosystem restoration (*well established*) {6.4.1}.

The role of multi-actor environmental governance is recognized in Western and Central Europe, and increasingly also in Eastern Europe and Central Asia. In parallel to top-down governance, decision-making concerning biodiversity and nature's contributions to people is increasingly devolved to public-private partnerships, co-management arrangements or even private governance, involving many stakeholders {6.2, 6.4, 6.5, 6.6; Tables 6.1, 6.8}. Promising developments include the establishment of new protected areas, and the protection of cultural landscapes through the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Convention, the European Landscape Convention, and the International Union for Conservation of Nature (IUCN) protected landscape approach, where various forms of knowledge are integrated into management. Assessing the effectiveness, efficiency and equity of promising governance arrangements and taking power relationships and asymmetries into consideration require careful evaluation and monitoring {6.2, 6.4.2.2, 6.5.1.2, 6.5.1.5, 6.5.1.6, 6.2.2.2; Table 6.8; Boxes 6.7, 6.11}. This holds especially true for environmental governance in Central Europe, Eastern Europe and Central Asia with their rapid transformation processes since the early 1990s, moving from hierarchical, state-dominated processes to more collaborative governance processes {6.4.2; 6.5.1.4}. Another key challenge for policy success is posed by sufficient mobilization of financial resources. Increased funding from both public and private sources, together with innovative financing mechanisms, such as ecological fiscal transfers, would help to strengthen institutional capacities; to invest in research, training, capacity-building and education; to employ necessary staff; and to secure monitoring activities {6.3.2, 6.3.3, 6.4.1, 6.5.4, 6.6.2, 6.6.4}.

E5. Dealing with change is a matter of societal choice (see D1). The way in which we choose to organize our societies and institutions, in both public and private spheres, is key to the realization of pathways towards the sustainable future envisioned by a diverse range of actors in Europe and Central Asia (*well established*) {6.6.6}.

The design of promising governance options and smart institutional arrangements supports the effective involvement of different actors in policy and decision-making with the aim of promoting shared responsibility for our common future. Developing pathways and corresponding experiments in a participatory manner, including all relevant stakeholder groups and indigenous peoples and local communities, enables the inclusion of a diversity of perspectives and promotes the necessary deliberation of strategic planning and agenda-setting {5.4.3, 5.5.1, 5.5.2, 5.5.6, 5.6.2}. Governing direct and indirect drivers in complex adaptive systems, a process which often includes various forms of incomplete knowledge, would benefit from limiting institutional failures and promoting policy processes that stimulate adaptation and learning. Hence, policies, programmes and strategies may be

seen as experiments that require governance and management for – rather than against – change, and systematic monitoring and evaluation. This can be achieved incrementally through adaptive governance and management and the systematic improvement of policy implementation, or via transition governance and management, and the organization of evolutionary processes of societal change {6.2, 6.4.2, 6.6, 6.6.6}.

Box SPM.5

Key knowledge gaps

In the course of conducting this assessment, key information and data were not always available. Knowledge gaps are especially acute in the subregions of Central Asia and Eastern Europe, and in the Balkan countries in Central Europe {1.3, 1.6.1, 3.6, 5.6.2}. If future assessments are to provide a more comprehensive account of the status and trends in nature and its contributions to people, the following knowledge gaps would need to be addressed:

- **Gaps in our understanding of nature’s contributions to people:** There is a need for better understanding, quantification and integrated monitoring of the diverse values of nature’s contributions to people. Moreover, there is limited understanding of how these diverse values are endorsed by different social groups and genders. Indigenous and local knowledge systems and scientific knowledge could co-produce such understanding in the future {2.5}. There is also a lack of understanding about how biodiversity contributes to ecosystem services, especially in marine systems.
- **Gaps in our understanding of the contribution of indigenous and local knowledge:** Little research has been conducted on the integration of indigenous and local knowledge into national and international policy frameworks and initiatives to create synergies across knowledge systems. These knowledge gaps exist not only for biodiversity, but also in sectors of direct relevance to biodiversity, such as agriculture, forestry, fisheries, water and climate change {6.4.1.3, 6.4.2.4, 6.6.2}.
- **Gaps in our understanding of the status and trends of nature:** These gaps include habitat extent and intactness, and species conservation status and trends for the whole region, but critically for Eastern Europe and Central Asia. In addition, systematic and integrated biodiversity monitoring of fungi, non-vascular plants, invertebrates, marine and freshwater species and soil organisms are required to better assess the status and trends for the whole region. Monitoring ecosystem functioning and species interactions is necessary to better understand the cascading effects of biodiversity changes and anticipate ecological tipping points.
- **Gaps in our understanding of drivers of biodiversity change:** A better understanding is needed of ways in which combinations of interacting indirect and direct drivers influence biodiversity and nature’s contributions to people in various contexts. Furthermore, it is critical to understand time lags in the effect of drivers on biodiversity and nature’s contributions to people to comprehend their real impact. In addition, there is a key gap in the identification, quantification and assessment of trends in drivers over time owing to their high spatial and temporal variability. There are also gaps in understanding the impact of climate change in combination with context-specific drivers on biodiversity and ecosystem services, especially with respect to tipping points and planetary boundaries. Moreover, there are gaps in understanding of the effects of interregional flows, especially the effects of global trade on ecological footprints and invasive alien species {4.7.1, 5.6.2}.
- **Lack of integrated scenario and modelling studies:** Scenarios rarely account for effects of multiple drivers and their interactions on impacts on the different components of biodiversity, nature’s contributions to people and a good quality of life {5.6.2}. There is also a significant gap in terms of exploring the full range of synergies and trade-offs between the multiple aspects of biodiversity, ecosystem services and a good quality of life under different scenario archetypes and across different scales. It is also important to develop and couple process-based models of ecosystem functioning with the human dimensions of socioecological systems and to thoroughly evaluate these models, including the assessment of uncertainties {5.6.2}.
- **Gaps in the quantification and timing of pathways towards desired futures:** Pathways and envisioning studies are often not supported by modelling and, so, lack detailed quantification of goals and actions. Detailed description and sequencing of actions within pathways is rare, as is information on combinations of policy instruments to implement specific actions {5.6.2}. The incorporation of combinations of exemplary *transition movements* pathways into large-scale scenario exercises and into participatory scenario development is suggested as a way forward for better resolving trade-offs and for scaling-up local or sectoral solutions {5.6.2}.

- **Inadequate understanding of how to mainstream policy objectives within different sectors and integrate them across sectors and scales:** This requires a better understanding of the interaction between different policy instruments in existing policy mixes, not just the optimization of single instruments. More knowledge is needed about the effectiveness and efficiency of policy instruments that also consider institutional contexts, social impacts and how equity can be improved. There are further knowledge gaps on the effects of policy instruments on behaviour (e.g., of households and of companies) and on the economic and social systems within which these stakeholders operate {6.6.5}.

Appendix I

Communication of the degree of confidence

In this assessment, the degree of confidence in each main finding is based on the quantity and quality of evidence and the level of agreement regarding that evidence (Figure SPM.A1). The evidence includes data, theory, models and expert judgement. Further details of the approach are documented in the note by the secretariat on the information on work related to the guide on the production of assessments (IPBES/6/INF/17).

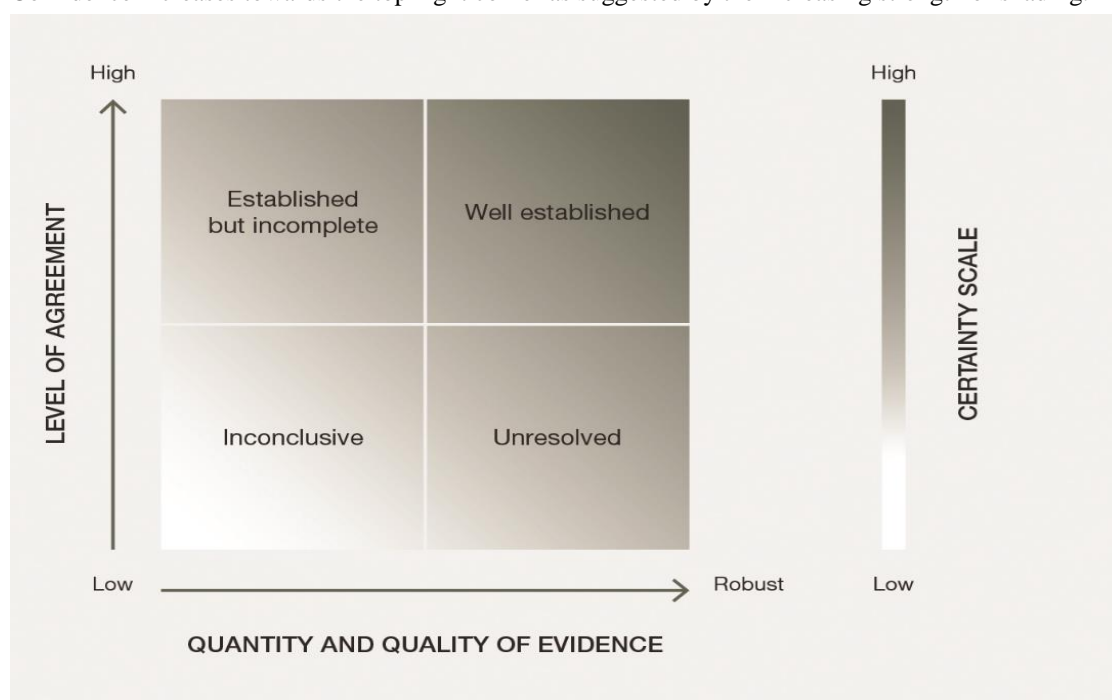
The summary terms to describe the evidence are:

- Well established: comprehensive meta-analysis or other synthesis or multiple independent studies that agree.
- Established but incomplete: general agreement although only a limited number of studies exist; no comprehensive synthesis and/or the studies that exist address the question imprecisely.
- Unresolved: multiple independent studies exist but conclusions do not agree.
- Inconclusive: limited evidence, recognizing major knowledge gaps.

Figure SPM.A1

The four-box model for the qualitative communication of confidence.

Confidence increases towards the top-right corner as suggested by the increasing strength of shading.



Source: IPBES, 2016.¹⁰

¹⁰ IPBES, Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production. S.G. Potts, V. L. Imperatriz-Fonseca, H. T. Ngo, J. C. Biesmeijer, T. D. Breeze, L. V. Dicks, L. A. Garibaldi, R. Hill, J. Settele, A. J. Vanbergen, M. A. Aizen, S. A. Cunningham, C. Eardley, B. M. Freitas, N. Gallai, P. G. Kevan, A. Kovács-Hostyánszki, P. K. Kwapong, J. Li, X. Li, D. J. Martins, G. Nates-Parra, J. S. Pettis, R. Rader, and B. F. Viana (eds.), secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany, 2016. Available from www.ipbes.net/sites/default/files/downloads/pdf/spm_deliverable_3a_pollination_20170222.pdf.

Appendix II

Nature's contributions to people

This appendix describes the evolving concept of nature's contributions to people and its relevance to this IPBES regional assessment.¹¹

Nature's contributions to people are all the contributions, both positive and negative, of living nature (i.e., diversity of organisms, ecosystems and their associated ecological and evolutionary processes) to the quality of life of people. Beneficial contributions from nature include such things as food provision, water purification, flood control and artistic inspiration, whereas detrimental contributions include disease transmission and predation that damages people or their assets. Many of nature's contributions to people may be perceived as benefits or detriments depending on the cultural, temporal or spatial context.

The concept of nature's contributions to people is intended to broaden the scope of the widely-used ecosystem services framework by more extensively considering views held by other knowledge systems on human-nature interactions. It is not intended to replace the concept of ecosystem services. The concept of nature's contributions to people is intended to engage a wide range of social sciences and humanities through a more integrated cultural perspective on ecosystem services.

Ecosystem services has always included a cultural component. For example, the Millennium Assessment¹² defined four broad groups of ecosystem services:

- Supporting services (now part of “nature” in the IPBES Conceptual Framework)
- Provisioning services
- Regulating services
- Cultural services

At the same time, there has been a long-standing debate in the ecosystem services science community, and in policy circles, about how to deal with culture. The social science community emphasizes that culture is the lens through which ecosystem services are perceived and valued. In addition, the groups of ecosystem services have tended to be discrete, while nature's contributions to people allow for a more fluid connection across the groups. For example, food production, traditionally considered to be a provisioning service, can now be categorized both as a material and a non-material contribution by nature to people. In many – but not all – societies, people's identities and social cohesion are strongly linked to growing, gathering, preparing and eating food together. It is thus the cultural context that determines whether food is a material contribution by nature to people, or one that is both material and non-material.

The concept of nature's contributions to people was developed to address the need to recognize the cultural and spiritual impacts of biodiversity, in ways that are not restricted to a discrete cultural ecosystem services category, but instead encompass diverse world views of human-nature relations. Nature's contributions to people also make it possible to consider negative impacts or contributions, such as disease.

There are 18 categories of nature's contributions to people, many of which closely map onto classifications of ecosystem services, especially for provisioning and regulating services. These 18 categories of nature's contributions to people are illustrated in Figure SPM.2. The 18 categories fall into one or more of three broad groups of nature's contributions to people - regulating, material and non-material.

¹¹ Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R.T., Molnár, Z., Hill, R., Chan, K.M.A., Baste, I.A., Brauman, K.A., Polasky, S., Church, A., Lonsdale, M., Larigauderie, A., Leadley, P.W., van Oudenhoven, A.P.E., van der Plaats, F., Schröter, M., Lavorel, S., Aumeeruddy-Thomas, Y., Bukvareva, E., Davies, K., Demissew, S., Erpul, G., Failler, P., Guerra, C.A., Hewitt, C.L., Keune, H., Lindley, S., Shirayama, Y., 2018. Assessing nature's contributions to people. *Science* 359, 270–272. <https://doi.org/10.1126/science.aap8826>.

¹² Millennium Ecosystem Assessment (2005). *Ecosystems and human well-being*. (Island Press, Washington, D.C.).