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INFORMING THE SCIENTIFIC AND TECHNICAL EVIDENCE BASE FOR THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK

OVERVIEW OF THE FINDINGS OF THE GLOBAL ASSESSMENT REPORT OF THE INTERGOVERNMENTAL SCIENCE-POLICY PLATFORM ON BIODIVERSITY AND ECOSYSTEM SERVICES AND OTHER RELEVANT ASSESSMENTS, AND IMPLICATIONS FOR THE WORK OF THE CONVENTION AND THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK

Note by the Executive Secretary

Addendum

I. INTRODUCTION

1. In decision 14/34, the Conference of the Parties requested the Subsidiary Body on Scientific, Technical and Technological Advice at its twenty-third and twenty-fourth meetings to contribute to the development of the post-2020 global biodiversity framework and in support of the work of the open-ended intersessional working group (para. 16). Further, the preparatory process for the development of the post-2020 global biodiversity framework adopted by decision 14/34 requires that the process be knowledge-based and that it includes provision for analytical work prepared in accordance with recommendation SBSTTA-XXI/1 and decision 14/35. Among the key information sources identified in the preparatory process are national reports, assessments prepared by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and other bodies and relevant peer reviewed literature, as well as the fifth edition of the *Global Biodiversity Outlook*.

2. In decision 14/1, the Conference of the Parties requested the Executive Secretary to use and analyse the review of scientific information and the outcomes of all products of IPBES in the preparation of the post-2020 global biodiversity framework, and to provide the results to the Subsidiary Body on Scientific, Technical and Technological Advice at a meeting held prior to the fifteenth meeting of the Conference of the Parties.

3. In response to the requests referred to above, the present addendum provides a synthesis of the main findings of relevant assessments.[1] It primarily considers:

(a) The *IPBES Global Assessment Report on Biodiversity and Ecosystem Services*[2] – The report assesses the global status and trends of biodiversity and ecosystem services, the impact of

* CBD/SBSTTA/23/1.

[1] Unless otherwise indicated, the information in this addendum is derived from the IPBES *Global Assessment Report on Biodiversity and Ecosystem Services*.

[2] The assessment, including its summary for policymakers and chapters, are accessible from https://www.ipbes.net/global-assessment-report-biodiversity-ecosystem-services

biodiversity and ecosystem services on human well-being and the effectiveness of responses, including the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets;

(b) The *IPBES Regional Assessment Reports on Biodiversity and Ecosystem Services for Africa, the Americas, Asia and the Pacific, and Europe and Central Asia*[3] – These reports assess, at the regional level, the status and trends of biodiversity, ecosystem functions and ecosystem services and their interlinkages, the impact of biodiversity, ecosystem functions and ecosystem services and threats to them on the quality of life, and the effectiveness of responses, including the Strategic Plan for Biodiversity 2011–2020 and its Aichi Biodiversity Targets, the Sustainable Development Goals, and the national biodiversity strategies and action plans developed under the Convention on Biological Diversity;

(c) The *IPBES Assessment Report on Pollinators, Pollination and Food Production*[4] – This report covers changes in animal pollination as a regulating ecosystem service that underpins food production and its contribution to gene flows and restoration of ecosystems. It addresses the role of native and exotic pollinators, the status of and trends in pollinators and pollination networks and services, drivers of change, impacts on human well-being, food production due to pollination declines and deficits and the effectiveness of responses to pollination declines and deficits;

(d) The *IPBES Assessment Report on Land Degradation and Restoration*[5] – This report covers the global status of and trends in land degradation, by region and land cover type, the effect of degradation on biodiversity values, ecosystem services and human well-being, and the state of knowledge, by region and land cover type, of ecosystem restoration extent and options;

(e) The *IPBES Methodological Assessment Report on Scenarios and Models of Biodiversity and Ecosystem Services*[6] – The assessment presents a best-practice 'toolkit' of the approaches that can be used to decide on policies and actions by Governments, the private sector and civil society;

(f) The *IPCC special report on Global Warming of 1.5 ºC*[7] – This report provides information on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty;

(g) The *IPCC special report on Climate Change and Land*[8] – This report provides information on greenhouse gas fluxes in land-based ecosystems, land use and sustainable land management in relation to climate change adaptation and mitigation, desertification, land degradation and food security;

(h) The *IPCC special report on the Ocean and Cryosphere in a Changing Climate*[9] – The report assesses scientific information on the physical science basis and impacts of climate change on ocean, coastal, polar and mountain ecosystems, and the human communities that depend on them and presents information on their vulnerabilities, adaptation capacities and options for achieving climate-resilient development pathways;

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[3] These assessments are accessible from https://www.ipbes.net/assessment-reports and were previously considered by the Subsidiary Body on Scientific, Technical and Technological Advice in recommendation 22/4.

[4] This assessment is accessible from https://www.ipbes.net/assessment-reports/pollinators and was previously considered by the Subsidiary Body on Scientific, Technical and Technological Advice in recommendation XX/9.

[5] This assessment is accessible from https://www.ipbes.net/assessment-reports/ldr and was previously considered by the Subsidiary Body on Scientific, Technical and Technological Advice in recommendation 22/4.

[6] This assessment is accessible from https://www.ipbes.net/assessment-reports/scenarios and was previously considered by the Subsidiary Body on Scientific, Technical and Technological Advice in recommendation XXI/1.

[7] This assessment is accessible from https://www.ipcc.ch/sr15/ and will be considered by the Subsidiary Body on Scientific, Technical and Technological Advice at its twenty-third meeting under agenda item 4.

[8] This assessment is accessible from https://www.ipcc.ch/report/srccl/ and will be considered by the Subsidiary Body on Scientific, Technical and Technological Advice at its twenty-third meeting under agenda item 4.

[9] This assessment is accessible from https://www.ipcc.ch/srocc/home/

(i) The *International Resource Panel Global Resources Outlook*[10] – The report presents the impacts of growing resource use, and scenario projections for resource efficiency and sustainable production and consumption that decouple economic growth from environmental degradation;

(j) The *FAO report on the State of the World's Biodiversity for Food and Agriculture*[11] – This report provides an assessment of biodiversity for food and agriculture and its management worldwide. It describes the contributions that biodiversity makes to food security and nutrition, livelihoods, the resilience of production systems, the sustainable intensification of food production and the supply of multiple ecosystem services. It also addresses the major drivers of change affecting biodiversity for food and agriculture, the status and trends of various components of biodiversity for food and agriculture as well as its state of management, policies, institutions and capacities that support sustainable use and conservation.

II. KEY FINDINGS AND IMPLICATIONS FOR THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK

A. Ecosystem services (nature's contributions to people) are at risk and deteriorating worldwide[12]

4. Biodiversity provides a range of ecosystems services (nature's contributions to people) which are essential for human well-being. Biodiversity regulates environmental processes, including filtering pollutants, sequestering carbon, regulating ocean acidification, protecting soil quality, providing pollination and pest control, and the reduction of hazards. It also provides material, including food and feed, energy, water, medicines and genetic resources and a variety of materials fundamental for people's physical well-being and for maintaining culture. Biodiversity also makes non-material contributions, such as inspiration and learning, physical and psychological experiences, and supporting cultural identities, and helps to maintain humanity's ability to choose alternatives in the face of an uncertain future. Most of nature's contributions to people are co-produced by biophysical processes and ecological interactions with anthropogenic assets. Examples of the importance of these services are:

(a) Marine and terrestrial ecosystems are the sole sinks for anthropogenic carbon emissions, with a gross sequestration of 5.6 gigatons of carbon per year (the equivalent of some 60 per cent of global anthropogenic emissions);

(b) Most of the world's wild flowering plants (87.5%) are pollinated by insects and other animals, more than three quarters of the leading types of global food crops can benefit from animal pollination and global agriculture's reliance on pollinator-dependent crops has increased in volume by more than 300 per cent over the last five decades;[13]

(c) The combined market value of livestock and fisheries was nearly $1.3 trillion in 2016;

(d) More than 2 billion people rely on wood fuel to meet their primary energy needs;

(e) From 25 to 50 per cent of pharmaceutical products are derived from genetic resources and approximately 70 per cent of drugs used for cancer are natural or are synthetic products inspired by nature;

(f) Tourism to protected areas generates an estimated $600 billion annually;

(g) Biodiversity makes production systems and livelihoods more resilient to shocks and stresses, including to the effects of climate change.[14]

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[10] This assessment is accessible from https://www.resourcepanel.org/reports/global-resources-outlook

[11] This assessment is accessible from http://www.fao.org/state-of-biodiversity-for-food-agriculture/en/

[12] Further information on natures contributions to people is contained in chapter 2.3 of the IPBES *Global Assessment Report on Biodiversity and Ecosystem Services*.

[13] IPBES *Assessment Report on Pollinators, Pollination and Food Production*.

[14] FAO. 2019. *The State of the World's Biodiversity for Food and Agriculture*, J. Bélanger and D. Pilling (eds.). FAO Commission on Genetic Resources for Food and Agriculture Assessments. Rome. 572 pp. (http://www.fao.org/3/CA3129EN/CA3129EN.pdf) Licence: CC BY-NC-SA 3.0 IGO, Chapter 2.

5. While more food, energy and materials than ever before are now being supplied to people in most places, this is coming increasingly at the expense of nature's ability to provide such contributions in the future, and it frequently undermines nature's many other contributions, which range from water quality regulation to sense of place.

B. The status of biodiversity is declining[15]

6. Biodiversity is in decline globally and is declining more rapidly than at any other time in human history. This is occurring in all regions and is happening at the level of genes, species and habitats:

(a) *Genes*: Human actions are driving widespread changes in species traits and reductions in genetic diversity. By 2016, 559 of the 6,190 domesticated breeds of mammals used for food and agriculture (over 9 per cent) had become extinct and at least 1,000 more are threatened. Ten per cent of domesticated breeds of mammals were recorded as extinct, as well as some 3.5 per cent of domesticated breeds of birds. At the regional level, Europe and Central Asia have over half of all known breeds of domesticated mammals and birds, but 75 per cent of local bird and 58 per cent of local mammal breeds are going extinct.[16] In Western and Central Europe, the species diversity of arable plants has decreased by 20 per cent since 1950, and the abundance of rare arable plants has also decreased.[17] In Asia and the Pacific, there has been a considerable decline in the cultivation of native varieties of plants and a reduction in crop genetic resources, owing to agriculture intensification and a shift to monoculture;[18]

(b) *Species*: Human actions threaten more species with global extinction now than ever before. An average of about 25 per cent of species in assessed animal and plant groups are threatened, suggesting that about 1 million species already face extinction, many within decades, unless action is taken to reduce the intensity of drivers of biodiversity loss. Without such action, there will be a further acceleration in the global rate of species extinction, which is already at least tens to hundreds of times higher than it has averaged over the past 10 million years. The average abundance of native species in most major terrestrial biomes has fallen by at least 20 per cent and this decline has mostly taken place since 1900 and may be accelerating. Habitat loss and deterioration, largely caused by human actions, have reduced global terrestrial habitat integrity by 30 per cent relative to an unimpacted baseline. Combining this with the longstanding relationship between habitat area and species numbers suggests that about 9 per cent of the world's estimated 5.9 million terrestrial species – more than 500,000 species – have insufficient habitat for long-term survival, and are committed to extinction, many within decades, unless their habitats are restored. Population sizes of wild vertebrate species have tended to decline over the last 50 years on land, in freshwater and in the sea. Global trends in insect populations are not known but rapid declines have been well documented in some places. As a result of climate change, over the last century some species of plants and animals have increased in abundance, shifted their range, and established in new areas as glaciers receded and the snow-free season lengthened. Together with warming, these changes have increased locally the number of species in high mountains, as lower-elevation species migrate upslope. Some cold-adapted or snow-dependent species have declined in abundance, increasing their risk of extinction, notably on mountain summits. In polar and mountain regions, many species have altered seasonal activities especially in late winter and spring. Since about 1950 many marine species across various groups have undergone shifts in geographical range and seasonal activities in response to ocean warming, sea ice change and biogeochemical changes, such as oxygen loss, to their habitats. This has resulted in shifts in species composition, abundance and biomass production of ecosystems, from the equator to the poles. Altered interactions between species have caused cascading impacts on ecosystem structure and functioning;[19]

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[15] Further information on the status and trends of biodiversity is contained in chapter 2.2 of the IPBES *Global Assessment Report on Biodiversity and Ecosystem Services*.

[16] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia*.

[17] Ibid.

[18] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Asia and the Pacific*.

[19] IPCC *special report on the Ocean and Cryosphere in a Changing Climate*.

(c) *Habitats*: Humanity is a dominant global influence on life on Earth and has caused natural terrestrial, freshwater and marine ecosystems to decline. Global indicators of ecosystem extent and condition have shown a decrease by an average of 47 per cent of their estimated natural baselines, with many continuing to decline by at least 4 per cent per decade. A total of 75 per cent of the land surface is significantly altered, 66 per cent of the ocean area is experiencing increasing cumulative impacts, and over 85 per cent of wetlands (area) has been lost. Further, land degradation through human activities is negatively impacting the well-being of at least 3.2 billion people and costing more than 10 per cent of the annual global gross product in loss of biodiversity and ecosystem services.[20] Only about 25 per cent of land is sufficiently unimpacted that ecological and evolutionary processes still operate with minimal human intervention. In terrestrial "hotspots" of endemic species, natural habitats have generally undergone greater reductions to date in extent and condition and tend to be experiencing more rapid ongoing decline on average than other terrestrial regions. Globally, the net rate of forest loss has halved since the 1990s, largely because of net increases in temperate and high latitude forests. However, there are regional differences. For example, across much of the highly biodiverse tropics, 32 million hectares of primary or recovering forest were lost between 2010 and 2015. Further, forests and natural mosaics sufficiently undamaged to be classed as "intact" were reduced by 7 per cent (919,000 km^2) between 2000 and 2013, shrinking in both developed and developing countries. In marine ecosystems, only 3 per cent of the ocean was described as free from human pressure in 2014, over 40 per cent of ocean area was strongly affected by multiple drivers in 2008, and 66 per cent was experiencing increasing cumulative impacts in 2014. Approximately half the live coral cover has been lost since the 1870s, with accelerating losses in recent decades due to climate change exacerbating other drivers. Nearly 50 per cent of coastal wetlands have been lost over the last 100 years, as a result of the combined effects of localized human pressures, sea level rise, warming and extreme climate events.[21] At the regional level many terrestrial biomes, or large parts thereof, in the Americas have lost about 50 per cent or more of habitat, leading to losses in biodiversity and ecosystem functions.[22] Similarly, wetland cover in Western, Central and Eastern Europe has declined by 50 per cent from 1970.[23]

C. Biodiversity loss is being driven by direct and indirect pressures[24]

7. The direct drivers of change in biodiversity with the largest global impact have been (starting with those with most impact):

(a) *Changes in land and sea use* – In terrestrial ecosystems changes in land use, relative to other drivers of change, are having the greatest negative impact. Over 40 per cent of the world's land is now agricultural or urban and only 13 per cent of the ocean and 23 per cent of land is still classified as "wilderness". People currently use one quarter to one third of land's potential net primary production for food, feed, fibre, timber and energy.[25] Net primary productivity of ecosystem biomass and of agriculture is presently lower than it would have been under natural state on 23 per cent of the global terrestrial area, amounting to a 5 per cent reduction in total global net primary productivity;[26]

(b) *Direct exploitation of organisms* – The direct exploitation of organisms affects species in all ecosystems. However, in marine ecosystems the direct exploitation of organisms, mainly through fishing activities, has had the largest relative impact, followed by land-/sea-use change. Severe impacts to ocean ecosystems are illustrated by 33 per cent of fish stocks being classified as overexploited and more than 55 per cent of the ocean area being subjected to industrial fishing. At the regional level, in Africa,

[20] IPBES *Assessment Report on Land Degradation and Restoration*.

[21] IPPCC *special report on the Ocean and Cryosphere in a Changing Climate*.

[22] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for the Americas*.

[23] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia*.

[24] Further information on the drivers of biodiversity loss is contained in chapter 2.1 of the IPBES *Global Assessment Report on Biodiversity and Ecosystem Services*.

[25] IPCC *special report on Climate Change and Land*.

[26] IPBES *Assessment Report on Land Degradation and Restoration*.

poaching and illegal trafficking of animals (e.g., pangolins, rhinos, elephants, primates), plants (e.g., orchids, rosewood, sandalwood, and many medicinal species) and derived products is driven by illicit trade, imposing negative impacts on biodiversity and nature's contributions to people and leading to loss of income and the loss of Africa's natural and cultural heritage.[27] In Asia and the Pacific, non-timber forest product resources are under heavy pressure due to poor harvesting practices, overexploitation and increasing market demand for medicinal and ornamental plants, impacting on the livelihoods of forest-dependent communities;[28]

(c) *Climate change* – Human-induced climate change is projected to become an increasingly important direct driver of biodiversity loss. Humans are estimated to have caused an observed warming of approximately 1°C by 2017 relative to pre-industrial levels, with average temperatures over the past 30 years rising by 0.2°C per decade. Warming greater than the global annual average is being experienced in many land regions and seasons, including two to three times higher in the Arctic and warming is generally higher over land than over the ocean.[29] Further, there has been an observed increased in wildfire and abrupt permafrost thaw.[30] These changes have resulted in shifts in species distribution, changes in phenology, altered population dynamics and changes in the composition of species assemblage or the structure and function of ecosystems.[31] For example, 47 per cent of threatened terrestrial mammals, excluding bats, and 23 per cent of threatened birds may have already been negatively affected by climate change in at least part of their distribution. Several pollinator species have moved their ranges, altered their abundances and shifted their seasonal activities in response to observed climate change over recent decades.[32] In polar regions, ice associated marine mammals and seabirds have experienced habitat contraction linked to sea ice changes. Cascading effects of multiple climate-related drivers on polar zooplankton have affected food web structure and function, biodiversity as well as fisheries.[33] At the regional level, climate change is becoming an increasingly important direct driver, amplifying the impacts of other drivers through changes in temperature precipitation and the nature of some extreme events.[34] There is also strong evidence that the climate of Europe and Central Asia will have warmer temperatures and regionally changed precipitation.[35] The biodiversity and ecosystems of Africa are among the most vulnerable to climate change, with severe impacts already experienced on water availability and food production.[36] In Asia and the Pacific, climate change and associated extreme events are impacting species distribution, population sizes and the timing of reproduction or migration, and increased frequency of pest and disease outbreaks;[37]

(d) *Pollution* – Although global trends are mixed, pollution has been increasing at least as rapidly as the total population, with key differences by region and by type of pollution. Specifically, with regard to water pollution, over 80 per cent of global wastewater is being discharged back into the environment without treatment, while 300–400 million tons of heavy metals, solvents, toxic sludge and other wastes from industrial facilities are dumped into the world's waters each year. Further, the excessive or inappropriate application of fertilizer can lead to run-off from fields and enter freshwater and coastal ecosystems, producing more than 400 hypoxic zones that affected a total area of more than 245,000 km^2 as early as 2008. Relatedly, pesticides, particularly insecticides, have been demonstrated to have a broad

[27] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Africa*.

[28] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services Asia and the Pacific*.

[29] IPCC *special report on Global Warming of 1.5 ºC*.

[30] IPCC *special report on the Ocean and Cryosphere in a Changing Climate*.

[31] IPCC *special report on Global Warming of 1.5 ºC*.

[32] IPBES *Assessment Report on Pollinators, Pollination and Food Production*.

[33] IPCC *special report on the Ocean and Cryosphere in a Changing Climate*.

[34] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for the Americas*.

[35] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia*.

[36] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Africa*.

[37] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Asia and the Pacific*.

range of lethal and sublethal effects on pollinators.[38] Specifically with regard to marine plastic pollution, this has increased tenfold since 1980, affecting at least 267 species, including 86 per cent of marine turtles, 44 per cent of seabirds and 43 per cent of marine mammals;

(e) *Invasive alien species* – Alien species are increasingly recorded across continents, although less in Africa given variable rates of species "invisibility" and monitoring capacity. Cumulative records of alien species have increased by 40 per cent since 1980, associated with increased trade and human population dynamics and trends. Nearly one fifth of the Earth's surface is at risk of plant and animal invasions and the rate of introduction of new invasive alien species seems higher than ever before and shows no signs of slowing. With regard to pollinators, commercial management, mass breeding, transport and trade in pollinators outside their original ranges have resulted in new invasions, transmission of pathogens and parasites and regional extinctions of native pollinator species.[39] At the regional level, invasive alien species continue to appear in terrestrial, freshwater, and marine habitats in the Americas, but the rates of introduction differ among subregions.[40] In Eastern Europe and Central Asia, invasive alien species have increased in number for all taxonomic groups and while the rate of invasion has been less severe than in Western and Central Europe, it is expected to increase at a rate that strongly depends on the development of gross domestic product.[41] In Africa, the spread of invasive alien species in terrestrial and aquatic ecosystems is rapidly increasing, with impacts on native species, rural livelihoods and production systems.[42] In Asia and the Pacific, the areas most impacted by invasive alien species are islands and coastlines as well as agricultural heartlands and large affluent cities.[43]

8. The five direct drivers of biodiversity result from an array of underlying societal causes or indirect drivers of change, which are, in turn, underpinned by societal values and behaviours. The main indirect drivers of biodiversity loss are:

(a) *Production and consumption patterns* – Today, humans extract more from the Earth and produce more waste than ever before. The use of natural resources has more than tripled from 1970 and continues to grow, and the cultivation and processing of biomass is now responsible for almost 90 per cent of global water stress and land-use related biodiversity loss.[44] Global trends in the capacity of nature to sustain contributions to good quality of life from 1970 to the present show a decline for 14 of the 18 categories of nature's contributions to people. Agriculture, forestry and other land use activities accounted for about 13 per cent of CO_2, 44 per cent of methane (CH_4), and 82 per cent of nitrous oxide (N_2O) emissions from human activities globally during 2007-2016, representing 23 per cent of total net anthropogenic emissions of greenhouse gases. Further, if emissions associated with pre- and post-production activities in the global food system are included, the emissions are estimated to be 21-37 per cent of total net anthropogenic greenhouse gas emissions.[45] Since 1961, the total production of food (cereal crops) has increased by 240 per cent (until 2017) due to land area expansion and increasing yields. Fibre production (cotton) increased by 162 per cent (until 2013). Data available since 1961 shows the per capita supply of vegetable oils and meat has more than doubled and the supply of food calories per capita has increased by about one third. Currently, 25-30 per cent of total food produced is lost or wasted. Agricultural expansion is by far the most widespread form of land cover change, with over one third of the terrestrial land surface currently being used for cropping or animal husbandry nearly three quarters of available freshwater resources devoted to crop or livestock production. Further, a main driver of deforestation is agricultural production, especially animal farming and soy/palm oil plantations, which

[38] IPBES *Assessment Report on Pollinators, Pollination and Food Production*.

[39] Ibid.

[40] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for the Americas*.

[41] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia*.

[42] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Africa*.

[43] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Asia and the Pacific*.

[44] International Resource Panel, *Global Resources Outlook*.

[45] IPCC *special report on Climate Change and Land*.

cause between 70 per cent and 80 per cent of total deforestation globally. Permanent crop production (such as multiannual crops, coffee, for example) causes total global species loss of 1.1 per cent.[46] Approximately 25 per cent of global greenhouse gas emissions come from land clearing, crop production and fertilization, with animal-based food contributing 75 per cent of that. Intensified land-management systems have greatly increased crop and livestock yields in many areas of the world, but, when inappropriately managed, can result in high levels of land degradation, including soil erosion, fertility loss, excessive ground and surface water extraction, salinization, and eutrophication of aquatic systems. Erosion and the leaching of agricultural chemicals due to poor land management has profound off-site impacts on wetland, river systems, coastal waters and groundwater;[47]

(b) *Human population dynamics and trends* – In the past 50 years, the human population has doubled, the global economy has grown nearly fourfold and global trade has grown tenfold, together driving up the demand for energy and materials. However, this growth has been uneven across countries and regions. Along with this increase in global population, per capita consumption has also grown, and is also unequal, with wide variations in lifestyles and access to resources across and within regions. For example, per capita environmental impacts of material consumption are three to six times greater in high-income countries than in low-income countries.[48] In terms of direct exploitation, approximately 60 billion tons of renewable and non-renewable resources are being extracted each year. That number has nearly doubled since 1980, as the population has grown considerably while the average per capita consumption of materials has risen by 15 per cent since 1980. Population growth has also resulted in a rapid increase in urbanization with consequences on the spatial patterns of land and resource use. Agricultural expansion, alongside a doubling of urban area since 1992 and an unprecedented expansion of infrastructure linked to growing population and consumption, has come mostly at the expense of forests (largely old-growth tropical forests), wetlands and grasslands;

(c) *Trade* – In the past 50 years, the global economy has grown nearly fourfold and global trade has grown tenfold. This has resulted in negative consequences for nature overall. For example, the rise in airborne and seaborne transportation of both goods and people, including a threefold increase in travel from developed and developing countries in particular, has increased pollution and significantly increased the presence of invasive alien species. Moreover, distant areas of the world are increasingly connected, as consumption, production and governance decisions increasingly influence materials, waste, energy, and information flows in other countries — known as "telecouplings". Global trade and the spatial decoupling of production from consumption have shifted the economic and environmental gains and losses of production and consumption, contributing to new economic opportunities, but also to impacts on nature and its contributions to people. Further, these telecouplings can often obscure the true environmental impacts of consumption and production patterns. For example, 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 gross domestic product, it has also led to the depletion of mineral resources and the loss of ecosystem services that are important to human health and well-being. 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;[49]

(d) *Technological innovations* – Technological innovation can have both positive (i.e. can enhance or partially replace some of nature's contributions to people) and negative effects on biodiversity loss. For example, technology-driven increases in agricultural output per unit area (i.e. crop yield) can reduce the pressure on land. However, modern agriculture has tended to homogenize the genetic diversity

[46] International Resource Panel, *Global Resources Outlook*.

[47] IPBES *Assessment Report on Land Degradation and Restoration*.

[49] IPBES *Regional Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia*.

of crops and herds. Further, replacing fuelwood with hydropower aids forests and indoor air quality by reducing the demand for and use of fuelwood but has negative effects on biodiversity in inland water ecosystems;

(e) *Local to global governance* – Local to global governance initiatives can and have improved ecological, economic and social outcomes by supporting policies and incentives that are in line with the multiple values of ecosystem functions and of nature's contribution to people. Generally, economic incentives have favoured expanding economic activity, and often environmental harm, over conservation or restoration. Harmful economic incentives and policies associated with unsustainable practices in fisheries, aquaculture, agriculture (including fertilizer and pesticide use), livestock management, forestry, mining and energy (including fossil fuels and biofuels) are often associated with land-/sea-use change and overexploitation of natural resources, as well as inefficient production and waste management. For example, in 2015, agricultural support potentially harmful to biodiversity amounted to $100 billion in countries belonging to the Organization for Economic Cooperation and Development, although some subsidy reforms to reduce unsustainable pesticide uses and adjust several other consequential development practices have been introduced. Further, many of the drivers that have negative impacts on biodiversity for food and agriculture — including overexploitation, overharvesting, pollution, overuse of external inputs, and land use change — are at least partially caused by inappropriate agricultural practices.[50] However, some drivers are also reported to open opportunities to make food systems more sustainable, for example through the development of markets for biodiversity-friendly products.[51] Another example is fossil fuel subsidies, valued at $345 billion, which result in global costs of $5 trillion when the reduction of nature's contributions is included (coal accounts for about half of these costs, petroleum for about one third and natural gas for about one tenth). In fisheries, subsidies to increase and maintain capacity, which, in turn, often lead to the degradation of nature, constitute perhaps a majority of the tens of billions of dollars spent on supports.

D. Business-as-usual trends will not allow the 2050 vision to be reached[52]

9. The scenarios examined in the assessments noted above are consistent in their observation that the current trajectories of the direct and indirect pressures on biodiversity are unsustainable. The IPBES Global Assessment found that significant changes at all biodiversity levels – from genetic diversity to biomes – are expected to continue under future global changes. Despite projections of some local increases in species richness and ecosystem productivity, the overall effect of global changes on biodiversity is projected to be negative. Examples of these types of changes include:

(a) *Species* – A substantial fraction of wild species is simulated to be at risk of extinction during the twenty-first century due to climate change, land use, natural resource extraction and impact of other direct drivers. Expected species range shifts, local species extinctions, changes in species abundances will lead to disruptions of species relations, including disturbance of trophic webs, plant-pollinator and other mutualistic relations;

(b) *Marine environment* – Climate change and business-as-usual fishing scenarios are expected to worsen the status of marine biodiversity. All anthropogenic greenhouse gas emission scenarios result in a global increase in sea temperature, ocean acidification, deoxygenation and sea level rise. Climate change alone is projected to decrease ocean net primary production by 3 to 10 per cent, and fish biomass by 3 to 25 per cent (in low and high warming scenarios, respectively) by the end of the century. Scenarios project that business-as-usual fisheries exploitation is will increase the proportion of overexploited and collapsed species as well as species impacted by bycatch. In addition, concerns about rapidly increasing plastic pollution now match or exceed those for other persistent organic pollutants. If

[50] FAO *Assessment on Biodiversity for Food and Agriculture*.

[51] Ibid.

[52] Further information on scenarios and pathways is contained in chapter 4 of the IPBES *Global Assessment Report on Biodiversity and Ecosystem Services*.

current production and waste management trends continue, about 12,000 Mt of plastic waste will accumulate in the environment by 2050, especially in the ocean which acts as a sink. The harmful effects of plastics have been evidenced at all levels of marine food webs from plankton to top predators but are not yet projected into the future;

(c) *Freshwater ecosystems* – Projected changes point to a decrease in freshwater biodiversity and substantial changes in ecosystem state and function, especially in tropical regions. Given that all scenarios are based on continued growth of human population density until 2050, impacts due to combined anthropogenic drivers on freshwater biodiversity and ecosystems are projected to increase worldwide, and to be strongest in tropical regions where human population growth and biodiversity are concentrated. Increases in land area used for urbanization, mining, cropland and intensification of agriculture are projected to boost the risk of pollution and eutrophication of waters, leading to extirpation of local populations, changes in community structure and stability (e.g. algal blooms) and establishment and spread of pathogens;

(d) *Terrestrial ecosystems* – Projected changes point to a continued decline in global terrestrial biodiversity and regionally highly variable changes in ecosystem state and functioning. Land-use change, and invasive alien species will continue to cause biodiversity loss across the globe in the future, with climate change rapidly emerging as an additional driver of loss that is increasing over the coming decades in relative importance across all scenarios. Although large uncertainties exist regarding the exact magnitude of loss, it is well established that increasing global warming will accelerate species loss. Already, for relatively minor global warming, biodiversity indices are projected to decline. Substantial climate change driven shifts of biome boundaries, in particular in boreal and sub-arctic regions, and (semi)arid environments are projected for the next decades. The relative impacts of climate change versus land-use change on biodiversity and ecosystems are context-specific and vary between scenarios, regions, and indicators of biodiversity and ecosystem functioning. Land-use change pressures differ between scenarios, but managed land area continues to increase, with exception of some scenarios exploring sustainability trajectories. Scenarios of large-scale, land-based climate change mitigation rely on large increases of bioenergy crop area or large reforestation or afforestation with potentially detrimental consequences for biodiversity and some ecosystem functioning. Interactions of land-cover change and future climate change enhance the negative impacts on biodiversity and affect multiple ecosystem functions.

10. Biodiversity and regulating ecosystem services (nature's regulating contributions to people) are projected to decline further in most scenarios of global change over the coming decades, while the supply and demand for provisioning ecosystem services (nature's material contributions to people) that have current market value (food, feed, timber and bioenergy) are projected to increase. These changes arise from continued human population growth, increasing purchasing power, and increasing per capita consumption. Assumptions about population growth and increase in per capita consumption are projected to lead to rising demand for material services, especially food, materials and bioenergy, and are projected to reduce regulating contributions such as provision of clean water, pollination, or ecosystem carbon storage. In the long term, substantial decreases in regulating ecosystem services (regulating contributions) may have detrimental effects on provisioning ecosystem services (material contributions); for example, climate change impacts on all systems will be increased if climate regulation by forests or oceans is weakened.

11. Specifically, with regard to climate change, scenarios project mostly adverse climate change effects on biodiversity and ecosystem functioning, which worsen, in some cases exponentially, with incremental global warming. Even for global warming of 1.5°C to 2°C, the majority of terrestrial species ranges are projected to shrink dramatically. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate.[53] Climate-related risks for natural and human systems are higher for global warming of 1.5°C than at present, but lower than at 2°C.[54] Of 105,000 species

[53] IPCC *special report on Global Warming of 1.5 ºC*.

[54] Ibid.

studied, 6 per cent of insects, 8 per cent of plants and 4 per cent of vertebrates are projected to lose over half of their climatically determined geographic range for global warming of 1.5°C, compared with 18 per cent of insects, 16 per cent of plants and 8 per cent of vertebrates for global warming of 2°C.[55] Impacts associated with other biodiversity-related risks, such as forest fires and the spread of invasive species, are lower at 1.5°C compared to 2°C of global warming. Further, under all climate change scenarios for the second half of the twenty-first century, pollinator community composition is expected to change as a result of decreases in the abundance of some species and increases in others, and the seasonal activity of many species is predicted to change differentially, potentially disrupting life cycles and species interactions between plants and pollinators.[56] Changes in composition and seasonality are both projected to alter ecosystem function. In the marine environment, climate change alone is projected to decrease ocean net primary production by 3 to 10 per cent, and fish biomass by 3 to 25 per cent, by the end of the century. However, limiting global warming to 1.5°C compared to 2°C is projected to reduce increases in ocean temperature as well as associated increases in ocean acidity and decreases in ocean oxygen levels. Consequently, limiting global warming to 1.5°C is projected to reduce risks to marine biodiversity, fisheries, and ecosystems, and their functions and services to humans. Further, global warming of 1.5°C is projected to shift the ranges of many marine species to higher latitudes and to increase the amount of damage to many ecosystems. It is also expected to drive the loss of coastal resources and reduce the productivity of fisheries and aquaculture (especially at low latitudes). For example, coral reefs are projected to decline by a further 70 to 90 per cent at 1.5°C with larger losses (>99%) at 2°C.[57] The risk of irreversible loss of many marine and coastal ecosystems increases with global warming, especially at 2°C or more.

12. Most internationally agreed policy goals and targets for biodiversity are missed by most countries under business-as-usual scenarios because the current patterns and future trends of production and consumption are not environmentally sustainable. Indeed, the trajectories of most biodiversity indicators under business as usual increasingly deviate from targets over time. The achievement of most biodiversity targets therefore requires a steer away from the current socio-economic trajectory and the worldviews and values that underpin it.

E. There are possible positive futures and pathways to reach them[58]

13. The assessments noted above also provide information on pathways that would allow for a more positive future. These pathways vary with geographic contexts but imply major deviations from current trends and indicate the need for sustained efforts over decades to meet internationally agreed objectives. They point to the need:

(a) *To limit global warming to well below 2°C*. Land-based climate change mitigation activities can be effective and support conservation goals. However, the large-scale deployment of bioenergy plantations and afforestation of non-forest ecosystems can come with negative side effects for biodiversity and ecosystem functions. Nature-based solutions with safeguards are estimated to provide 37 per cent of the climate change mitigation needed until 2030 to meet the goal of keeping climate warming below 2°C, with likely co-benefits for biodiversity. Therefore, land-use actions are indispensable in addition to strong actions to reduce greenhouse gas emissions from fossil fuel use and other industrial and agricultural activities. However, the large-scale deployment of intensive bioenergy plantations, including monocultures, replacing natural forests and subsistence farmlands, will likely have negative impacts on biodiversity and can threaten food and water security as well as local livelihoods, including by intensifying social conflict. In addition, given that climate change is projected to become increasingly important as a direct driver of change in nature and its contributions to people in the next decades, scenarios show that

[55] IPCC *special report on Global Warming of 1.5 ºC*.

[56] IPBES *Assessment Report on Pollinators, Pollination and Food Production*.

[57] IPCC *special report on Global Warming of 1.5 ºC*.

[58] Further information on and pathways is contained in chapters 4 and 5 of the IPBES *Global Assessment Report on Biodiversity and Ecosystem Services*.

meeting the Sustainable Development Goals and the 2050 Vision for biodiversity depends on considering climate change impacts in the definition of future goals and objectives;

(b) *For substantial shifts towards the sustainable management of resource exploitation and land use, market reform, globally equitable and moderate animal protein consumption, and reduction of food waste and losses*. For example, currently 25 to 30 per cent of total food produced is lost or wasted. Changes in consumption patterns have contributed to about 2 billion adults now being overweight or obese while an estimated 821 million people are still undernourished.[59] Sustainability scenarios that explore moderate and equitable consumption result in substantially lower negative impacts on biodiversity and ecosystems due to food, feed and timber production;

(c) *To conserve, restore and sustainably use marine ecosystems*, rebuilding overfished stocks (including through targeted limits on catches or fishing efforts and moratoria), reducing pollution (including plastics), managing destructive extractive activities, eliminating harmful subsidies and illegal, unreported and unregulated fishing, adapting fisheries management to climate change impacts and reducing the environmental impact of aquaculture;

(d) *To conserve, effectively manage and sustainably use terrestrial landscapes while contributing positively to human well-being*. This could include important measures such as the expansion and strengthening of ecologically representative, well connected protected-area networks and of other effective area-based conservation measures, the protection of watersheds, and incentives and sanctions to reduce pollution. However, to accommodate conservation and restoration where land is an increasingly limited resource, using an extensive, proactive and participatory landscape-scale spatial planning approach could prioritize land uses that balance and further safeguard nature and protect and manage key biodiversity areas and other important sites for present and future biodiversity. Possible actions that may achieve sustainability also include promoting inclusive governance approaches through stakeholder engagement and the inclusion of indigenous peoples and local communities to ensure equity and participation. For example, at least one quarter of the global land area is traditionally managed, owned, used or occupied by indigenous peoples. These areas include approximately 35 per cent of the area that is formally protected, and approximately 35 per cent of all remaining terrestrial areas with very low human intervention;

(e) *To maintain freshwater through both cross-sectoral and sector-specific interventions that improve water-use efficiency, increase storage, reduce sources of pollution, improve water quality, minimize disruption and foster the restoration of natural habitats and flow regimes*. Promising interventions include practising integrated water resource management and landscape planning across scales, protecting wetland biodiversity areas, guiding and limiting the expansion of unsustainable agriculture and mining, slowing and reversing the de-vegetation of catchments, and mainstreaming practices that reduce erosion, sedimentation, and pollution run-off and minimize the negative impact of dams;

(f) *To increase the sustainability of cities and managing urban transformation*. This can be achieved by strengthening local- and landscape-level governance and enabling transdisciplinary planning to bridge sectors and departments, and to engage businesses and other organizations in protecting public goods.

14. According to the International Resource Panel, the decoupling of natural resource use and environmental impacts from economic activity and human well-being is an essential element in the transition to a sustainable future. Concerted resource efficiency, climate mitigation and biodiversity protection measures can deliver on decoupling ambitions. Resource-efficiency and sustainable resource-management measures can reduce resource extraction by 25 per cent, significantly mitigate negative impacts and boost the economy by 8 per cent by 2060.[60] Potential measures for the simultaneous reduction

[59] IPCC *special report on Climate Change and Land*.

[60] International Resource Panel, *Global Resources Outlook*.

of agricultural impacts include food waste reduction and shifts in diets towards less meat and animal products. Focusing on long-term material use of sustainably grown wood in the construction sector can lead to co-benefits in terms of climate change and biodiversity. Similarly, conserving valuable forest ecosystems and avoiding deforestation contribute to reducing both climate change and biodiversity impacts. The targets adopted under the United Nations Framework Convention on Climate Change may result in increased bioenergy use (with or without carbon sequestration and storage) and intensification of forestry, thereby impacting biodiversity. These impacts can be mitigated through nature-based solutions to climate change, achieving the goals of both the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change. Adopting a combination of societal changes and resource efficiency policies, climate mitigation and carbon removal policies and biodiversity protection measures can lead to an absolute decoupling of negative environmental impacts from natural resource use and economic growth.[61]

15. With regard to climate change, scenarios or pathways limiting global warming to 1.5° C with limited or no overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems. These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options.[62] Further, the impacts of climate change depend on both the level of warming and how population, consumption, production, technological development, and land management patterns evolve. Pathways with higher demand for food, feed, and water, more resource-intensive consumption and production, and more limited technological improvements in agriculture yields result in higher risks from water scarcity in drylands, land degradation, and food insecurity.[63] Development pathways in which incomes increase and the demand for land conversion is reduced, either through reduced agricultural demand or improved productivity, can lead to reductions in food insecurity.[64]

F. Policy responses need to be scaled up to reach the 2050 Vision[65]

16. Analysis of the actions taken to address biodiversity loss show that in the absence of such actions, biodiversity conditions are likely to have been worse. For example, conservation investment during the period between 1996 and 2008 reduced the extinction risk for mammals and birds in 109 countries by a median value of 29 per cent per country, and the rate of decrease in extinction risk for birds, mammals and amphibians would have been at least 20 per cent higher without conservation action in recent decades. Similarly, it is likely that at least six species of ungulate would now be extinct or surviving only in captivity without conservation measures. Further, at least 107 highly threatened birds, mammals and reptiles are estimated to have benefited from invasive mammal eradication on islands. These examples provide evidence that when conservation actions are taken, they can be successful. However, while there have been some successes, overall the implementation of policy responses and actions to conserve nature and manage it more sustainably have not been enough to stem the loss of biodiversity.

17. While trends related to biodiversity and the direct and indirect pressures on it, are largely negative, the assessments noted above identify a range of actions which can be taken to bring about a transformational change in society's relationship with biodiversity and to put it on track to reach the 2050 Vision. Generally, the assessments highlight the imperative of addressing both the direct and indirect drivers of biodiversity loss, the latter being largely in common with the drivers of climate change and land degradation. In turn, this means addressing values and institutions, in order to ensure a paradigm, shift in society's relationship with nature.

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[61] International Resource Panel, *Global Resources Outlook*.

[62] IPCC *special report on Global Warming of 1.5 ºC*.

[63] IPCC *special report on Climate Change and Land*.

[64] IPCC *special report on Global Warming of 1.5 ºC*.

[65] Additional information on policy responses is contained in chapter 6 of the IPBES *Global Assessment Report on Biodiversity and Ecosystem Services*.

18. Goals for biodiversity and society can be achieved through the rapid and improved deployment of existing policy instruments and new initiatives that more effectively enlist individual and collective action. Some actions need to be put in place in the short term (i.e. before 2030), while others will require longer-term efforts. For example, in the short term (before 2030), all decision makers could contribute to sustainability transformations, including through enhanced and improved implementation and enforcement of effective existing policy instruments and regulations, and the reform and removal of harmful policies and subsidies. Additional measures are necessary to enable transformative change over the long term (up to 2050) to address the indirect drivers that are the root causes of the deterioration of nature, including changes in social, economic and technological structures within and across society. By its very nature, transformative change can expect opposition from those with interests vested in the status quo, but such opposition can be overcome for the broader public good.

19. To help operationalize these scenarios, the IPBES global assessment identifies five main "levers" to generate transformative change by tackling the underlying indirect drivers of nature deterioration and which could help to inform the development of the post-2020 global biodiversity framework. These levers are:

(a) Developing incentives and widespread capacity for environmental responsibility and eliminating perverse incentives;

(b) Reforming sectoral and segmented decision-making to promote integration across sectors and jurisdictions;

(c) Taking pre-emptive and precautionary actions in regulatory and management institutions and businesses to avoid, mitigate and remedy the deterioration of nature, and monitoring their outcomes;

(d) Managing for resilient social and ecological systems in the face of uncertainty and complexity to deliver decisions that are robust in a wide range of scenarios;

(e) Strengthening environmental laws and policies and their implementation, and the rule of law more generally.

20. The IPBES global assessment further concludes that the levers for transformations noted above could be further supported by:

(f) Enabling visions of a good quality of life that do not entail ever-increasing material consumption;

(g) Lowering total consumption and waste, including by addressing both population growth and per capita consumption differently in different contexts;

(h) Unleashing existing widely held values of responsibility to effect new social norms for sustainability, especially by extending notions of responsibility to include impacts associated with consumption;

(i) Addressing inequalities, especially regarding income and gender, which undermine capacity for sustainability;

(j) Ensuring inclusive decision-making, fair and equitable sharing of benefits arising from the use of and adherence to human rights in conservation decisions;

(k) Accounting for nature deterioration from local economic activities and socioeconomic-environmental interactions over distances (telecouplings), including, for example, international trade;

(l) Ensuring environmentally friendly technological and social innovation, taking into account potential rebound effects and investment regimes;

(m) Promoting education, knowledge generation and maintenance of different knowledge systems, including the sciences and indigenous and local knowledge regarding nature, conservation and its sustainable use.

21. The IPBES global assessment further identified possible actions and pathways to achieve transformative change. These are presented in detail in that report and are organized around a set of more general approaches for sustainability:

(a) Enabling integrative governance to ensure policy coherence and effectiveness;

(b) Promoting inclusive governance approaches through stakeholder engagement and the inclusion of indigenous peoples and local communities to ensure equity and participation;

(c) Practicing informed governance for nature and nature's contributions to people;

(d) Promoting adaptive governance and management;

(e) Producing and consuming food sustainably;

(f) Integrating multiple uses for sustainable forests;

(g) Conserving, effectively managing and sustainably using terrestrial landscapes;

(h) Promoting sustainable governance and management of seascapes, oceans and marine systems;

(i) Improving freshwater management, protection and connectivity;

(j) Building sustainable cities that address critical needs while conserving nature, restoring biodiversity, maintaining and enhancing ecosystem services;

(k) Promoting sustainable energy and infrastructure projects and production;

(l) Improving the sustainability of economic and financial systems.

22. The *Assessment on Biodiversity for Food and Agriculture* of the Food and Agriculture Organization of the United Nations suggests that research on food and agricultural systems needs to become more multidisciplinary, participatory and focused on interactions between different components of biodiversity for food and agriculture, taking into account the interactions between sectors, between wild and domesticated biodiversity, and between the ecological and socioeconomic components of production systems. Cooperation across disciplines at the national, regional and international levels and greater involvement of producers and other stakeholders is therefore necessary to overcome knowledge gaps.[66]

23. In addition, the reports of the Intergovernmental Panel on Climate Change have identified various adaptation options that reduce the vulnerability of human and natural systems to the effects of climate change while having many synergies with sustainable development, if well managed, including ensuring food and water security, reducing disaster risks, improving health conditions, maintaining ecosystem services and reducing poverty and inequality. Many of the responses to climate change related to biodiversity centre on the issue of land management.[67] These options include:

(a) Establishing networks of protected areas to help maintain ecosystem services, including carbon uptake and storage;

(b) Restoring terrestrial and marine habitats and introducing ecosystem management tools, such as assisted species relocation and coral gardening;

(c) Strengthening precautionary approaches, such as rebuilding overexploited or depleted fisheries, and responsiveness of existing fisheries management strategies;

(d) Restoring vegetated coastal ecosystems, such as mangroves, tidal marshes and seagrass meadows;

(e) Investing in ocean renewable energy;

[66] FAO *Assessment on Biodiversity for Food and Agriculture*.

[67] IPCC *special report on Climate Change and Land*.

(f) Integrated water management approaches across multiple scales;

(g) Reducing local drivers of exposure and vulnerability, such as coastal urbanization and human-induced subsidence;[68]

(h) Strengthening the capacities for climate action of national and subnational authorities, civil society, the private sector, and indigenous peoples and local communities;[69]

(i) Improve land management through better management of cropland and grazing lands, improved and sustainable forest management, and increased soil organic carbon content;[70]

(j) Improving food productivity, dietary choices, and food losses and waste reduction;

(k) Preserving and restoring natural ecosystems, such as peatland, coastal lands and forests, biodiversity conservation, reducing competition for land, fire management, soil management, and most risk management options;

(l) Ecosystem-based adaptation;

(m) Making greater use of agroforestry, perennial pasture phases and use of perennial grains, and cover crops;

(n) Acknowledging co-benefits and trade-offs when designing land and food policies.

III. CONCLUSION

24. The different assessments used in this analysis have drawn on different source materials and used different methodologies for evaluating the evidence. Even in the absence of standardized methodologies across assessments, general trends and findings have similar conclusions (i.e. they do not contradict one another), namely that the pressures on biodiversity are increasing and are threatening the continued provision of ecosystems services and the prospects for reaching the 2030 Agenda for Sustainable Development and the 2050 Vision. These trends will also undermine other goals, such as those specified in the Paris Agreement[71] adopted under the United Nations Framework Convention on Climate Change. Further, these negative trends in biodiversity and ecosystem functions and services are projected to continue or worsen in many future scenarios in response to indirect drivers, such as rapid human population growth, unsustainable production and consumption and associated technological development. While current trends are negative, the assessments also provide options for pathways, transitions and actions that can help reach the 2050 Vision. In some cases, these will require scaling up existing approaches, while, in other cases, they will require urgent and concerted efforts fostering transformative change.

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[68] IPCC *special report on the Ocean and Cryosphere in a Changing Climate*.

[69] IPCC *special report on Global Warming of 1.5 ºC*.

[70] IPCC *special report on Climate Change and Land*.

[71] United Nations, *Treaty Series*, Registration No. I-54113.