Key Findings from the Global Assessment of the Intergovernmental Panel for Biodiversity and Ecosystem Services

Robert T. Watson, Former chair of IPBES

This testimony is based on the Summary for Policymakers (SPM) of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (the key findings of the SPM are attached in an Annex). IPBES is independent of the UN system. The findings of this report are based on a critical assessment of 15,000 publications by nearly 500 experts.

The evidence is unequivocal – biodiversity, which is important in its own right and essential for human well-being is being destroyed by human activities at a rate unprecedented in human history. Biodiversity, which plays a critical role in providing food, fiber, water, energy, medicines and other genetic materials, is also important in regulating climate, pollution, water quality, pollination services, flood control, and storm surges. It also has important social dimensions, including physical and mental well-being when walking through forests or by rivers, or green spaces in cities.

Since 1970, trends in agricultural production, fish harvest, bioenergy production and harvest of materials have increased, but most of the regulating contributions (e.g., water quality) and social dimensions have declined (Figure 1). Human activities have continued to destroy forests, grasslands, wetlands and other important ecosystems (e.g., seventy-five per cent of the land surface is significantly altered and over 85 per cent of the area of wetlands has been lost, and this destruction has led to 500,000 to 1,000,000 species being threatened with extinction over the coming decades to centuries.

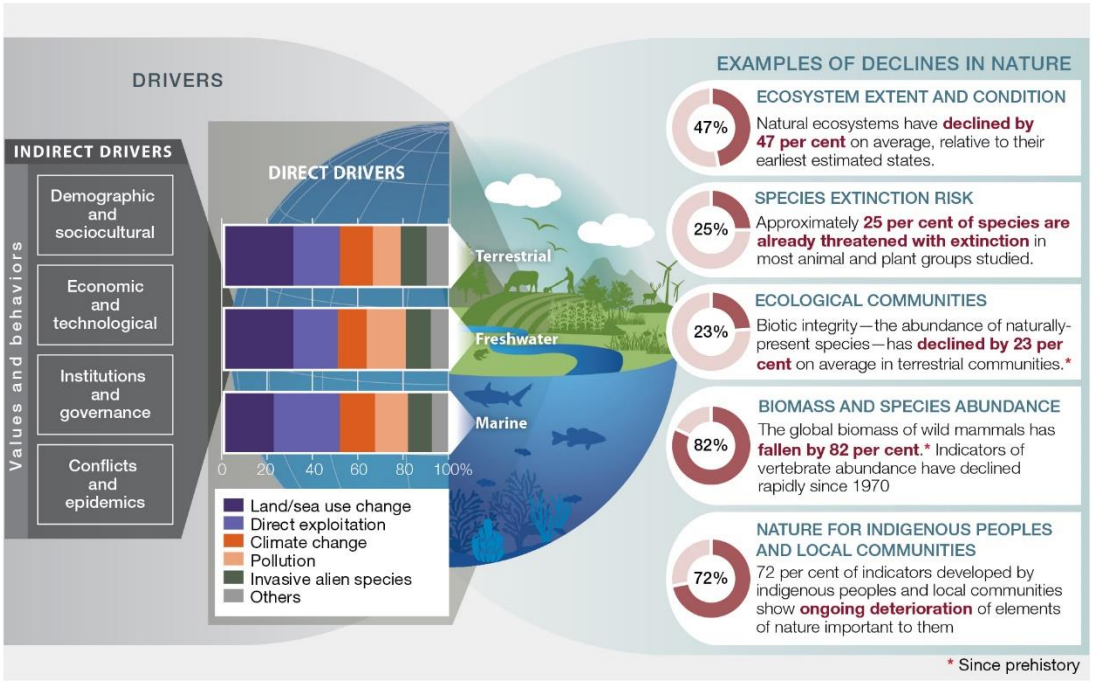
The loss of biodiversity is not only an environmental issue, but an economic, development, social, security, moral and ethical issue. Biodiversity has significant economic value, which should be recognized in national accounting systems; it is central to development, through food, water and energy security; it is a security issue in so-far-as loss of natural resources, especially in poor developing countries can lead to conflict; it is an ethical issue because loss of biodiversity hurts the poorest of people who depend on it, further exacerbating an already inequitable world; and it is a moral issue because we should not destroy it.

The largest driver of biodiversity loss in terrestrial systems in the last several decades has been land use change and use, primarily the conversion of native habitats into the agricultural systems that have been needed to feed the world (Figure 2 shows the 5 direct drivers of the loss of biodiversity). The challenge is to transform our agricultural practices, many of which are unsustainable today, into ones that produce the food we need while protecting and conserving biodiversity, and in particular protecting the quantity and quality of our water resources. This means not expanding into pristine natural habitats, but using sustainable agroecological practices, less chemicals, and protecting our soils and pollinators. Too often fertilizers, pesticides and other chemicals run-off into our rivers, polluting them and many coastal regions around the world – a key issue for the quantity and quality of our water resources.

The main driver of the loss of biodiversity in the oceans is exploitation, i.e., overfishing (this will be covered in the testimony of Yunne Shin).

Figure 1: Trends in Nature's Contributions to People

Figure 2: Drivers of the Loss of Biodiversity



While climate change has not been the dominant driver of the loss of biodiversity to date in most parts of the world, it is projected to become as important or more important than the other drivers in the coming decades. Climate change and the loss of biodiversity are issues that affect each other and must be addressed simultaneously. Climate change is already adversely affecting genetic variability, species richness and populations, and ecosystems and it imposes a growing risk. 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, are evident and accelerating in marine, terrestrial and freshwater systems. Almost half (47 per cent) of threatened terrestrial mammals, excluding bats, and one quarter (23 per cent) of threatened birds may have already been negatively affected by climate change in at least part of their distribution (birds in North America and Europe suggest effects of climate change in their population trends since the 1980s). Ecosystems such as tundra and taiga and regions such as Greenland, previously little affected by people directly, are increasingly experiencing impacts of climate change. Large reductions and local extinctions of populations are widespread. This indicates that many species are unable to cope locally with the rapid pace of climate change, through either evolutionary or behavioral processes, and that their continued existence will also depend on the extent to which they are able to disperse, to track suitable climatic conditions, and to preserve their capacity to evolve. Climate change shifts the boundaries of terrestrial biomes, in particular in boreal, subpolar and polar regions and semi-arid environments, and a warmer, drier climate will reduce productivity in many places. In contrast, rising atmospheric carbon dioxide concentrations can be beneficial for net primary productivity and enhance woody vegetation cover, especially in semi-arid regions. In turn loss of biodiversity can adversely affect climate, e.g., deforestation increases the atmospheric abundance of carbon dioxide, a key greenhouse gas.

Therefore, it is essential that the issues of biodiversity loss and climate change are addressed together. This can be accomplished by transforming the way energy is produced and used. Fossil fuel

energy can be replaced with cost-effective renewable energy sources, e.g., wind and solar power. There is also a need to improve the efficiency with which energy is used in transportation, buildings and industry. However, it is important to recognize that some of the suggested approaches to limit human-induced climate change, such as large-scale afforestation and bioenergy, will adversely affect biodiversity and food and water security, especially if native vegetation is replaced by monoculture bioenergy crops.

In 2010, Governments around the world agreed to a set of twenty targets to protect biodiversity by 2020, i.e., the Aichi targets. Unfortunately, the continuing loss and degradation of biodiversity means that most countries will not achieve most of the twenty biodiversity Aichi targets. There has been good progress towards the components of 4 of the 20 Aichi Targets under the Strategic Plan for Biodiversity 2011–2020. Moderate progress has been achieved towards some components of another 7 targets, but for 6 targets poor progress has been made towards all components. Every Government in the world will meet in China next year to establish a plan of action to conserve and sustainably use biodiversity. This meeting will be a critical milestone to see whether there is the political will to take the evidence gathered in this global report and start to implement the transformative changes needed. The challenge is immense but can be accomplished if every country acts individually, and collectively.

The report shows that if there is a continued loss of biodiversity, most of the UN Sustainable Development Goals (SDGs) will not be achieved given the dependence of these goals on biodiversity (Figure 3). In particular, the goals related to poverty, hunger, water, cities, climate, oceans and land will be undermined. In addition, important positive synergies were found between biodiversity and the goals associated with education, gender equality, reducing inequalities and promoting peace and justice. In addition, depending on the pathways chosen to meet the energy, economic growth, industry and infrastructure, and sustainable production and consumption goals, as well as the poverty, food security and cities goals, they could have substantial positive or negative effects on biodiversity. This is because all goals are inter-connected with both synergies and trade-offs.

Business-as-usual is not an option if the world wants to conserve and sustainably use biodiversity. Business-as-usual will cause a continued loss of biodiversity. Scenarios that focus on economic growth and regional competition lead to an increase in material well-being, e.g., food production, but even greater loss of biodiversity. Plausible future scenarios that are more sustainable with low population growth coupled with sustainable and consumption practices, can slow, but not completely eliminate the future loss of biodiversity, in part, because climate is projected to warm in all scenarios.

Biodiversity and other societal goals, such as the UN SDGs, can be achieved, but will require transformative change, i.e., there is a need to change the way we change. Incremental changes will not suffice. There will be a need to address the challenges of food, water and energy security, human health and well-being, mitigating and adapting to climate change, and conserving and sustainably using biodiversity together. These issues are all inter-connected and need to be addressed synergistically from local to global levels. This can be accomplished by rapid implementation of existing instruments and bold decisions for transformative change. A concerted effort will need to be made to address both the indirect drivers of change (e.g., population, per capita consumption, governance, economic systems, cross-sectoral planning and societal values) as well as the direct drivers of change (e.g., land and sea use change, exploitation, climate change, pollution and invasive alien species). The issues of sustainable agriculture and climate change were addressed above.

Figure 3: Summary of recent status of, and trends in, aspects of nature and nature's contributions to people that support progress towards achieving selected targets of the Sustainable Development Goals

Selected Sustainable Development Goals	Selected targets (abbreviated)	Recent status and trends in aspects of nature and nature's contributions to people that support progress towards target *		Uncertain relationship
		Poor/Declining support	Partial support	
No poverty	1.1 Eradicate extreme poverty			U
	1.2 Halve the proportion of people in poverty			U
	1.4 Ensure that all have equal rights to economic resources			
	1.5 Build the resilience of the poor			
Zero hunger	2.1 End hunger and ensure access to food all year round			
	2.3 Double productivity and incomes of small-scale food producers			
	2.4 Ensure sustainable food production systems			
	2.5 Maintain genetic diversity of cultivated plants and farmed animals			
Good health and well-being	3.2 End preventable deaths of newborns and children			U
	3.3 End AIDS, tuberculosis, malaria and neglected tropical diseases			U
	3.4 Reduce premature mortality from non-communicable diseases	Unknown		
	3.9 Reduce deaths and illnesses from pollution	Unknown		
Clean water and sanitation	6.3 Improve water quality			
	6.4 Increase water use and ensure sustainable withdrawals			
	6.5 Implement integrated water resource management			
	6.6 Protect and restore water-related ecosystems			
Sustainable cities and communities	11.3 Enhance inclusive and sustainable urbanization			
	11.4 Protect and safeguard cultural and natural heritage			
	11.5 Reduce deaths and the number of people affected by disasters			
	11.6 Reduce the adverse environmental impact of cities			
	11.7 Provide universal access to green and public spaces			
Climate action	13.1 Strengthen resilience to climate-related hazards			
	13.2 Integrate climate change into policies, strategies and planning			
	13.3 Improve education and capacity on mitigation and adaptation	Unknown		
	13a Mobilize US$100 billion/year for mitigation by developing countries	Unknown		
	13b Raise capacity for climate change planning and management	Unknown		
Life below water	14.1 Prevent and reduce marine pollution			
	14.2 Sustainably manage and protect marine and coastal ecosystems			
	14.3 Minimize and address ocean acidification			
	14.4 Regulate harvesting and end overfishing			
	14.5 Conserve at least 10 per cent of coastal and marine areas			
	14.6 Prohibit subsidies contributing to overfishing			
	14.7 Increase economic benefits from sustainable use of marine resources			
Life on land	15.1 Ensure conservation of terrestrial and freshwater ecosystems			
	15.2 Sustainably manage and restore degraded forests and halt deforestation			
	15.3 Combat desertification and restore degraded land			
	15.4 Conserve mountain ecosystems			
	15.5 Reduce degradation of natural habitats and prevent extinctions			
	15.6 Promote fair sharing of benefits from use of genetic resources			
	15.7 End poaching and trafficking			
	15.8 Prevent introduction and reduce impact of invasive alien species			
	15.9 Integrate biodiversity values into planning and poverty reduction			
	15a Increase financial resources to conserve and sustainably use biodiversity			
	15b Mobilize resources for sustainable forest management			

* There were no targets that were scored as good/positive status and trends

The report shows that if biodiversity is to be conserved and sustainably used, there is a need for our financial and economic systems to evolve. For example, there is a need to eliminate agricultural, energy and transportation subsidies that are harmful to the environment, and to introduce short- term economic incentives to stimulate sustainable production and consumption. The economic system needs to evolve from one only focused on Gross Domestic Product (GDP), and be complemented by one that recognizes

and incorporates the value of natural capital into economic accounting and incorporates the monetary and non-monetary values of biodiversity and its contributions to people into decision-making. Rarely do decision makers recognize the importance of nature's regulating services, i.e., the regulation of the climate, pollution, pollination, flood control, storm surges, and water purification - these all have significant non-market economic value and some of these services are irreplaceable. And of course, there is the wide range of social values associated with nature, which cannot be fully captured in economic terms.

To realize the transformative changes needed to conserve and sustainably use biodiversity, there is a need to fully involve all stakeholders in decision-making, including governments (at different levels), the private sector, Indigenous Peoples and Local Communities and the public. All have a role to play. For example, individuals can reduce food waste and the excessive use of energy and water, especially in high income countries. Also, our choices of diet have profound implications for the environment, and of course our own health.

Because loss of biodiversity and climate change are environmental, development, economic, security, social, and equity issues they must be addressed together. This means that these issues are not just the domain of environment ministers, but of equal importance for ministries of agriculture, forestry, energy, finance, transportation, water and tourism. Therefore, Government departments are encouraged to work together to realize a sustainable world.

Annex: Key Findings of the IPBES Global Assessment of Biodiversity and Ecosystem Services

A. Nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide.

Nature embodies different concepts for different people, including biodiversity, ecosystems, Mother Earth, systems of life and other analogous concepts. Nature's contributions to people embody different concepts such as ecosystem goods and services, and nature's gifts. Both nature and nature's contributions to people are vital for human existence and good quality of life (human well-being, living in harmony with nature, living well in balance and harmony with Mother Earth, and other analogous concepts).While more food, energy and materials than ever before are now being supplied to people in most places, this is increasingly at the expense of nature's ability to provide such contributions in the future and frequently undermines nature's many other contributions, which range from water quality regulation to sense of place. The biosphere, upon which humanity as a whole depends, is being altered to an unparalleled degree across all spatial scales. Biodiversity – the diversity within species, between species and of ecosystems – is declining faster than at any time in human history.

A1 Nature is essential for human existence and good quality of life. Most of nature's contributions to people are not fully replaceable, and some are irreplaceable. Nature plays a critical role in providing food and feed, energy, medicines and genetic resources and a variety of materials fundamental for people's physical well-being and for maintaining culture. For example, more than 2 billion people rely on wood fuel to meet their primary energy needs, an estimated 4 billion people rely primarily on natural medicines for their health care and some 70 per cent of drugs used for cancer are natural or are synthetic products inspired by nature. Nature, through its ecological and evolutionary processes, sustains the quality of the air, fresh water and soils on which humanity depends, distributes fresh water, regulates the climate, provides pollination and pest control and reduces the impact of natural hazards. For example, more than 75 per cent of global food crop types, including fruits and vegetables and some of the most important cash crops such as coffee, cocoa and almonds, rely on animal pollination. 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). Nature underpins all dimensions of human health and contributes to non-material aspects of quality of life – inspiration and learning, physical and psychological experiences, and supporting identities – that are central to quality of life and cultural integrity, even if their aggregated value is difficult to quantify. Most of nature's contributions are co-produced with people, but while anthropogenic assets – knowledge and institutions, technology infrastructure and financial capital – can enhance or partially replace some of those contributions, some are irreplaceable. The diversity of nature maintains humanity's ability to choose alternatives in the face of an uncertain future.

A2 Nature's contributions to people are often distributed unequally across space and time and among different segments of society. There are often trade-offs in the production and use of nature's contributions. Benefits and burdens associated with co-production and use of nature's contributions are distributed and experienced differently among social groups, countries and regions. Giving priority to one of nature's contributions to people, such as food production, can result in ecological changes that reduce other contributions. Some of these changes may benefit some people at the expense of others, particularly the most vulnerable, as may changes in technological and institutional arrangements. For example, although food production today is sufficient to satisfy global needs, approximately 11 per cent of the world's population is undernourished, and diet-related disease drives 20 per cent of premature mortality, related both to undernourishment and to obesity. The great expansion in

the production of food, feed, fibre and bioenergy has occurred at the cost of many other contributions of nature to quality of life, including regulation of air and water quality, climate regulation and habitat provision. Synergies also exist, such as sustainable agricultural practices that enhance soil quality, thereby improving productivity and other ecosystem functions and services such as carbon sequestration and water quality regulation.

A3 Since 1970, trends in agricultural production, fish harvest, bioenergy production and harvest of materials have increased, but 14 of the 18 categories of contributions of nature that were assessed, mostly regulating and non-material contributions, have declined. The value of agricultural crop production ($2.6 trillion in 2016) has increased approximately threefold since 1970, and raw timber harvest has increased by 45 per cent, reaching some 4 billion cubic metres in 2017, with the forestry industry providing about 13.2 million jobs. However, indicators of regulating contributions, such as soil organic carbon and pollinator diversity, have declined, indicating that gains in material contributions are often not sustainable. Currently, land degradation has reduced productivity in 23 per cent of the global terrestrial area, and between $235 billion and $577 billion in annual global crop output is at risk as a result of pollinator loss. Moreover, loss of coastal habitats and coral reefs reduces coastal protection, which increases the risk from floods and hurricanes to life and property for the 100 million–300 million people living within coastal 100-year flood zones.

A4 Nature across most of the globe has now been significantly altered by multiple human drivers, with the great majority of indicators of ecosystems and biodiversity showing rapid decline. Seventy-five 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. While the rate of forest loss has slowed globally since 2000, this is distributed unequally. Across much of the highly biodiverse tropics, 32 million hectares of primary or recovering forest were lost between 2010 and 2015. The extent of tropical and subtropical forests is increasing within some countries, and the global extent of temperate and boreal forests is increasing. A range of actions – from restoration of natural forest to planting of monocultures – contribute to these increases but have very different consequences for biodiversity and its contributions to people. Approximately half the live coral cover on coral reefs has been lost since the 1870s, with accelerating losses in recent decades due to climate change exacerbating other drivers. The average abundance of native species in most major terrestrial biomes has fallen by at least 20 per cent, potentially affecting ecosystem processes and hence nature's contributions to people; this decline has mostly taken place since 1900 and may be accelerating. In areas of high endemism, native biodiversity has often been severely impacted by invasive alien species. 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. {BG 4, 5}

A5 Human actions threaten more species with global extinction now than ever before. An average of around 25 per cent of species in assessed animal and plant groups are threatened (figure SPM.3), suggesting that around 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. {Fig SPM4, BG 6}

A6 Globally, local varieties and breeds of domesticated plants and animals are disappearing. This loss of diversity, including genetic diversity, poses a serious risk to global food security by undermining the resilience of many agricultural systems to threats such as pests, pathogens and climate change. Fewer and fewer varieties and breeds of plants and animals are being cultivated, raised,

traded and maintained around the world, despite many local efforts, which include those by indigenous peoples and local communities. 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. In addition, many crop wild relatives that are important for long-term food security lack effective protection, and the conservation status of wild relatives of domesticated mammals and birds is worsening. Reductions in the diversity of cultivated crops, crop wild relatives and domesticated breeds mean that agroecosystems are less resilient against future climate change, pests and pathogens.

A7 **Biological communities are becoming more similar to each other in both managed and unmanaged systems within and across regions.** This human-caused process leads to losses of local biodiversity, including endemic species, ecosystem functions and nature's contributions to people.

A8 **Human-induced changes are creating conditions for fast biological evolution - so rapid that its effects can be seen in only a few years or even more quickly. The consequences can be positive or negative for biodiversity and ecosystems, but can create uncertainty about the sustainability of species, ecosystem functions and the delivery of nature's contributions to people.** Understanding and monitoring these biological evolutionary changes are as important for informed policy decisions as in cases of ecological change. Sustainable management strategies then can be designed to influence evolutionary trajectories so as to protect vulnerable species and reduce the impact of unwanted species (such as weeds, pests or pathogens). The widespread declines in geographic distribution and population sizes of many species make clear that, although evolutionary adaptation to human-caused drivers can be rapid, it has often not been sufficient to mitigate them fully.

B. Direct and indirect drivers of change have accelerated during the past 50 years

The rate of global change in nature during the past 50 years is unprecedented in human history. The direct drivers of change in nature with the largest global impact have been (starting with those with most impact): changes in land and sea use; direct exploitation of organisms; climate change; pollution; and invasion of alien species. Those five direct drivers result from an array of underlying causes – the indirect drivers of change – which are in turn underpinned by societal values and behaviours that include production and consumption patterns, human population dynamics and trends, trade, technological innovations and local through global governance. The rate of change in the direct and indirect drivers differs among regions and countries.

B1 **For terrestrial and freshwater ecosystems, land-use change has had the largest relative negative impact on nature since 1970, followed by the direct exploitation, in particular overexploitation, of animals, plants and other organisms mainly via harvesting, logging, hunting and fishing. In marine ecosystems, direct exploitation of organisms (mainly fishing) has had the largest relative impact, followed by land/sea-use change**. Agricultural expansion is the most widespread form of land-use change, with over one third of the terrestrial land surface being used for cropping or animal husbandry. This 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. In freshwater ecosystems, a series of combined threats that include land-use change, including water extraction, exploitation, pollution, climate change and invasive species, are prevalent. Human activities have had a large and widespread impact on the world's oceans. These include direct exploitation, in particular overexploitation, of fish, shellfish and other organisms, land- and sea-based pollution, including from river networks, and land/sea-use change, including coastal development for infrastructure and aquaculture.

B2 Climate change is a direct driver that is increasingly exacerbating the impact of other drivers on nature and human well-being. Humans are estimated to have caused an observed warming of approximately 1.0°C by 2017 relative to pre-industrial levels, with average temperatures over the past 30 years rising by 0.2°C per decade. The frequency and intensity of extreme weather events, and the fires, floods and droughts that they can bring, have increased in the past 50 years, while the global average sea level has risen by 16 to 21 cm since 1900, and at a rate of more than 3 mm per year over the past two decades. These changes have contributed to widespread impacts in many aspects of biodiversity, including species distributions, phenology, population dynamics, community structure and ecosystem function. According to observational evidence, the effects are accelerating in marine, terrestrial and freshwater ecosystems and are already impacting agriculture, aquaculture, fisheries and nature's contributions to people. Compounding effects of drivers such as climate change, land/sea-use change, overexploitation of resources, pollution and invasive alien species are likely to exacerbate negative impacts on nature, as has been seen in different ecosystems such as coral reefs, the arctic systems and savannas.

B3 Many types of pollution, as well as invasive alien species, are increasing, with negative impacts for nature. Although global trends are mixed, air, water and soil pollution have continued to increase in some areas. Marine plastic pollution in particular 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. This can affect humans through food chains. Greenhouse gas emissions, untreated urban and rural waste, pollutants from industrial, mining and agricultural activities, oil spills and toxic dumping have had strong negative effects on soil, freshwater and marine water quality and the global atmosphere. 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, impacting native species, ecosystem functions and nature's contributions to people, as well as economies and human health. The rate of introduction of new invasive alien species seems higher than ever before and with no signs of slowing.

B4 In the past 50 years, the human population has doubled, the global economy has grown nearly 4-fold and global trade has grown 10-fold, together driving up the demands for energy and materials. A variety of economic, political and social factors, including 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 impacts on nature and its contributions to people. Levels of consumption of material goods (food, feed, timber and fibre) vary greatly, and unequal access to material goods can be associated with inequity and may lead to social conflict. Economic exchange contributes to aggregate economic development, yet often is negotiated between actors and institutions of unequal power, which influences the distribution of benefits and long-term impacts. Countries at different levels of development have experienced different levels of deterioration of nature for any given gain in economic growth. Exclusion, scarcities and/or unequal distributions of nature's contributions to people may, and in a complex interaction with other factors, fuel social instability and conflict. Armed conflicts have an impact on ecosystems beyond destabilizing effects on societies and a range of indirect impacts, including displacement of people and activities.

B5 **Economic incentives generally have favoured expanding economic activity, and often environmental harm, over conservation or restoration. Incorporating the consideration of the multiple values of ecosystem functions and of nature's contribution to people into economic incentives has, in the economy, been shown to permit better ecological, economic and social outcomes.** Local, national, regional and global governance have improved outcomes in this way by supporting policies, innovation and the elimination of environmentally harmful subsidies, introducing incentives in line with the value of nature's contribution to people, increasing sustainable land/sea-use management and enforcing regulations, among other measures. Harmful economic incentives and policies associated with unsustainable practices of fisheries, aquaculture, agriculture (including fertilizer and pesticide use), livestock, 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. Vested interests may oppose the removal of subsidies or the introduction of other policies. Yet, policy reforms to deal with such causes of environmental harm offer the potential to both conserve nature and provide economic benefits, including when policies are based upon more and better understanding of the multiple values of nature's contributions.

B6 **Nature managed by indigenous peoples and local communities is under increasing pressure. Nature is generally declining less rapidly in indigenous peoples' land than in other lands, but is nevertheless declining, as is the knowledge of how to manage it. At least a quarter of the global land area is traditionally owned, managed,[1] 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. In addition, a diverse array of local communities, including farmers, fishers, herders, hunters, ranchers and forest-users, manage significant areas under various property and access regimes. Among the local indicators developed and used by indigenous peoples and local communities, 72 per cent show negative trends in nature that underpin local livelihoods and well-being. The areas managed (under various types of tenure and access regimes) by indigenous peoples and local communities are facing growing resource extraction, commodity production, mining and transport and energy infrastructure, with various consequences for local livelihoods and health. Some climate change mitigation programmes have had negative impacts on indigenous peoples and local communities. The negative impacts of all these pressures include continued loss of subsistence and traditional livelihoods from ongoing deforestation, loss of wetlands, mining, the spread of unsustainable agriculture, forestry and fishing practices and impacts on health and well-being from pollution and water insecurity. These impacts also challenge traditional management, the transmission of indigenous and local knowledge, the potential for sharing of benefits arising from the use of, and the ability of indigenous peoples and local communities to conserve and sustainably manage, wild and domesticated biodiversity that are also relevant to the broader society.

C. Goals for conserving and sustainably using nature and achieving sustainability cannot be met by current trajectories, and goals for 2030 and beyond may only be achieved through transformative[2] changes across economic, social, political and technological factors

Past and ongoing rapid declines in biodiversity, ecosystem functions and many of nature's contributions to people mean that most international societal and environmental goals, such as

[1] These data sources define land management here as the process of determining the use, development and care of land resources in a manner that fulfils material and non-material cultural needs, including livelihood activities such as hunting, fishing, gathering, resource harvesting, pastoralism and small-scale agriculture and horticulture.

[2] A fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values.

those embodied in the Aichi Biodiversity Targets and the 2030 Agenda for Sustainable Development, will not be achieved based on current trajectories. These declines will also undermine other goals, such as those specified in the Paris Agreement adopted under the United Nations Framework Convention on Climate Change and the 2050 Vision for Biodiversity. The negative trends in biodiversity and ecosystem functions 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. In contrast, scenarios and pathways that explore the effects of a low-to-moderate population growth, and transformative changes in production and consumption of energy, food, feed, fibre and water, sustainable use, equitable sharing of the benefits arising from use and nature-friendly climate adaptation and mitigation, will better support the achievement of future societal and environmental objectives.

C1 Implementation of policy responses and actions to conserve nature and manage it more sustainably has progressed, yielding positive outcomes relative to scenarios of no intervention, but not sufficiently to stem the direct and indirect drivers of nature deterioration. It is therefore likely that most of the Aichi Biodiversity Targets for 2020 will be missed. Some of the Aichi Biodiversity Targets will be partially achieved, for example those related to policy responses such as the spatial extent of terrestrial and marine protected areas, identification and prioritization of invasive alien species, national biodiversity strategies and action plans and 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. However, while protected areas now cover 15 per cent of terrestrial and freshwater environments and 7 per cent of the marine realm, they only partly cover important sites for biodiversity and are not yet fully ecologically representative and effectively or equitably managed. There has been significant growth in official development assistance in support of the Convention on Biological Diversity and funding provided by the Global Environment Facility, with biodiversity aid flows reaching $8.7 billion annually. However, current resource mobilization from all sources is not sufficient to achieve the Aichi Biodiversity Targets. In addition, only one in five of the strategic objective and goals across six global agreements[3] relating to nature and the protection of the global environment are demonstrably on track to be met. For nearly one third of the goals of these conventions there has been little or no progress towards them or, instead, movement away from them.

C2 Nature is essential for achieving the Sustainable Development Goals. However, taking into consideration that the Sustainable Development Goals are integrated and indivisible, as well as implemented nationally, current negative trends in biodiversity and ecosystems will undermine progress towards 80 per cent (35 out of 44) of the assessed targets of goals related to poverty, hunger, health, water, cities, climate, oceans and land (Sustainable Development Goals 1, 2, 3, 6, 11, 13, 14, and 15). Important positive synergies between nature and goals on education, gender equality, reducing inequalities and promoting peace and justice (Sustainable Development Goals 4, 5, 10 and 16) were found. Land or resource tenure insecurity, as well as declines in nature, have greater impacts on women and girls, who are most often negatively impacted. However, current focus and wording of targets in these goals obscures or omits their relationship to nature, thereby preventing their assessment here. There is a critical need for future policy targets, indicators and datasets to more explicitly account for aspects of nature and their relevance to human well-being in order to more effectively track the

[3] Convention on the Conservation of Migratory Species of Wild Animals, Convention on International Trade in Endangered Species of Wild Fauna and Flora, Convention concerning the Protection of the World Cultural and Natural Heritage, International Plant Protection Convention, United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, and Convention on Wetlands of International Importance especially as Waterfowl Habitat.

consequences of trends in nature on Sustainable Development Goals. Some pathways chosen to achieve the goals related to energy, economic growth, industry and infrastructure and sustainable consumption and production (Sustainable Development Goals 7, 8, 9 and 12), as well as targets related to poverty, food security and cities (Sustainable Development Goals 1, 2 and 11), could have substantial positive or negative impacts on nature and therefore on the achievement of other Sustainable Development Goals.

C3 **Areas of the world projected to experience significant negative effects from global changes in climate, biodiversity, ecosystem functions and nature's contributions to people are also home to large concentrations of indigenous peoples and many of the world's poorest communities.** Because of their strong dependency on nature and its contributions for subsistence, livelihoods and health, those communities will be disproportionately hard hit by those negative changes. Those negative effects also influence the ability of indigenous peoples and local communities to manage and conserve wild and domesticated biodiversity and nature's contributions to people. Indigenous peoples and local communities have been proactively confronting such challenges in partnership with each other and with an array of other stakeholders, through co-management systems and local and regional monitoring networks and by revitalizing and adapting local management systems. Regional and global scenarios lack an explicit consideration of the views, perspectives and rights of indigenous peoples and local communities, their knowledge and understanding of large regions and ecosystems and their desired future development pathways.

C4 **Except in scenarios that include transformative change, negative trends in nature, ecosystem functions and in many of nature's contributions to people are projected to continue to 2050 and beyond, due to the projected impacts of increasing land/and sea-use change, exploitation of organisms and climate change**. Negative impacts arising from pollution and invasive alien species will likely exacerbate these trends. There are large regional differences in the projected patterns of future biodiversity and ecosystem functions and loss and changes in nature's contributions to people. These differences arise from direct and indirect drivers of change, which are projected to impact regions in different ways. While regions worldwide face further declines in biodiversity in future projections, tropical regions face particular combined risks of declines due to interactions of climate change, land-use change and fisheries exploitation. Marine and terrestrial biodiversity in boreal, subpolar and polar regions is projected to decline mostly because of warming, sea ice retreat and enhanced ocean acidification. The magnitude of impacts and the differences between regions are much greater in scenarios with rapid increases in consumption or human population than in scenarios based on sustainability. Acting immediately and simultaneously on multiple indirect and direct drivers has the potential to slow, halt and even reverse some aspects of biodiversity and ecosystem loss.

C5 **Climate change is projected to become increasingly important as a direct driver of changes in nature and its contributions to people in the next decades. Scenarios show that meeting the Sustainable Development Goals and the 2050 Vision for Biodiversity depends on taking into account climate change impacts in the definition of future goals and objectives**. The future impacts of climate change are projected to become more pronounced in the next decades, with variable relative effects depending on scenario and geographic region. 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 profoundly. Changes in ranges can adversely affect the capacity of terrestrial protected areas to conserve species, greatly increase local species turnover and substantially increase the risk of global extinctions. For example, a synthesis of many studies estimates that the fraction of species at risk of climate-related extinction is 5 per cent at 2°C warming, rising to 16 per cent at 4.3°C warming. Coral reefs are particularly vulnerable to climate change and are projected to decline to 10-30

per cent of former cover at 1.5°C warming and to less than 1 per cent at 2°C warming. Therefore, scenarios show that limiting global warming to well below 2°C plays a critical role in reducing adverse impacts on nature and its contributions to people.

D. Nature can be conserved, restored and used sustainably while simultaneously meeting other global societal goals through urgent and concerted efforts fostering transformative change

Societal goals – including those for food, water, energy, health and the achievement of human well-being for all, mitigating and adapting to climate change and conserving and sustainably using nature – can be achieved in sustainable pathways through the rapid and improved deployment of existing policy instruments and new initiatives that more effectively enlist individual and collective action for transformative change. Since current structures often inhibit sustainable development and actually represent the indirect drivers of biodiversity loss, such fundamental, structural change is called for. 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. If obstacles are overcome, commitment to mutually supportive international goals and targets, supporting actions by indigenous peoples and local communities at the local level, new frameworks for private sector investment and innovation, inclusive and adaptive governance approaches and arrangements, multi-sectoral planning and strategic policy mixes can help to transform the public and private sectors to achieve sustainability at the local, national and global levels.

D1 The global environment can be safeguarded through enhanced international cooperation and linked locally relevant measures. The review and renewal of agreed environment-related international goals and targets based on the best available scientific knowledge and the widespread adoption and funding of conservation, ecological restoration and sustainable use actions by all actors, including individuals, are key to this safeguarding. Such widespread adoption implies advancing and aligning local, national and international sustainability efforts and mainstreaming biodiversity and sustainability across all extractive and productive sectors, including mining, fisheries, forestry and agriculture, so that individual and collective actions together result in the reversal of deterioration of ecosystem services at the global level. Yet these bold changes to the direct drivers of nature deterioration cannot be achieved without transformative change that simultaneously addresses the indirect drivers. {D29, 30}

D2 Five main interventions ("levers") can generate transformative change by tackling the underlying indirect drivers of nature deterioration: (1) incentives and capacity-building; (2) cross-sectoral cooperation; (3) pre-emptive action; (4) decision-making in the context of resilience and uncertainty; and (5) environmental law and implementation. Employing these levers involves the following, in turn: (1) developing incentives and widespread capacity for environmental responsibility and eliminating perverse incentives; (2) reforming sectoral and segmented decision-making to promote integration across sectors and jurisdictions; (3) 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; (4) 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; and (5) strengthening environmental laws and policies and their implementation, and the rule of law more generally. All five levers may require new resources, particularly in low-capacity contexts such as in many developing countries. {BG32}

D3 Transformations towards sustainability are more likely when efforts are directed at the following key leverage points, where efforts yield exceptionally large effects (Figure SPM.9): (1) visions of a good life; (2) total consumption and waste; (3) values and action; (4) inequalities; (5)

justice and inclusion in conservation; (6) externalities and telecouplings; (7) technology, innovation and investment; and (8) education and knowledge generation and sharing. Specifically, the following changes are mutually reinforcing: (1) enabling visions of a good quality of life that do not entail ever-increasing material consumption; (2) lowering total consumption and waste, including by addressing both population growth and per capita consumption differently in different contexts; (3) 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; (4) addressing inequalities, especially regarding income and gender, which undermine capacity for sustainability; (5) ensuring inclusive decision-making, fair and equitable sharing of benefits arising from the use of and adherence to human rights in conservation decisions; (6) accounting for nature deterioration from local economic activities and socioeconomic-environmental interactions over distances (telecouplings), including, for example, international trade; (7) ensuring environmentally friendly technological and social innovation, taking into account potential rebound effects and investment regimes; and (8) 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. {BG32}

D4 **The character and trajectories of transformation will vary across contexts, with challenges and needs differing, among others, in developing and developed countries. Risks related to inevitable uncertainties and complexities in transformations towards sustainability can be reduced through governance approaches that are integrative, inclusive, informed and adaptive**. Such approaches typically take into account the synergies and trade-offs between societal goals and alternative pathways and recognize a plurality of values, diverse economic conditions, inequity, power imbalances and vested interests in society. Risk-reducing strategies typically include learning from experience that is based on a combination of precautionary measures and existing and emerging knowledge. These approaches involve stakeholders in the coordination of policies across sectors and the creation of strategic locally relevant mixes of successful policy instruments. The private sector can play roles in partnership with other actors, including national and subnational governments and civil society; for example, public-private partnerships in the water sector have been an important vehicle for financing investments to meet the Sustainable Development Goals. Some effective policy measures include the expansion and strengthening of ecologically representative and well-connected protected-area networks and other effective area-based conservation measures, the protection of watersheds and incentives and sanctions to reduce pollution {Table SPM1}. {BG31}

D5 **Recognizing the knowledge, innovations and practices, institutions and values of indigenous peoples and local communities and their inclusion and participation in environmental governance often enhances their quality of life, as well as nature conservation, restoration and sustainable use, which is relevant to broader society. Governance, including customary institutions and management systems, and co-management regimes involving indigenous peoples and local communities, can be an effective way to safeguard nature and its contributions to people, incorporating locally attuned management systems and indigenous and local knowledge**. The positive contributions of indigenous peoples and local communities to sustainability can be facilitated through national recognition of land tenure, access and resource rights in accordance with national legislation, the application of free, prior and informed consent, and improved collaboration, fair and equitable sharing of benefits arising from the use, and co-management arrangements with local communities. {BG31}

D6 **Feeding humanity and enhancing the conservation and sustainable use of nature are complementary and closely interdependent goals that can be advanced through sustainable agricultural, aquacultural and livestock systems, the safeguarding of native species, varieties,**

breeds and habitats, and ecological restoration. Specific actions include promoting sustainable agricultural practices, such as good agricultural and agroecological practices, among others, multifunctional landscape planning and cross-sectoral integrated management, that support the conservation of genetic diversity and associated agricultural biodiversity. Further actions to simultaneously achieve food security, biodiversity protection and sustainable use are context-appropriate climate change mitigation and adaptation, incorporating knowledge from various systems, including the sciences and sustainable indigenous and local practices, avoiding food waste, empowering producers and consumers to transform supply chains and facilitating sustainable and healthy dietary choices. As part of integrated landscape planning and management, prompt ecological restoration emphasizing the use of native species can offset current degradation and save many endangered species but is less effective if delayed. {BG 35, 36}

D7 **Sustaining and conserving fisheries and marine species and ecosystems can be achieved through a coordinated mix of interventions on land, in freshwater and in the oceans, including multilevel coordination across stakeholders on the use of open oceans**. Specific actions could include, for example, ecosystem-based approaches to fisheries management, spatial planning, effective quotas, marine protected areas, protecting and managing key marine biodiversity areas, reducing run-off pollution into oceans and working closely with producers and consumers {Table SPM.1}. It is important to enhance capacity-building for the adoption of best fisheries management practices; adopt measures to promote conservation financing and corporate social responsibility; develop new legal and binding instruments; implement and enforce global agreements for responsible fisheries; and urgently take all steps necessary to prevent, deter and eliminate illegal, unreported and unregulated fishing. {BG 34, 37, 38}

D8 **Land-based climate change mitigation activities can be effective and support conservation goals {Table SPM.1}. 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 climate change mitigation until 2030 needed to meet 2°C goals 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. {BG 25, 38}

D9 **Nature-based solutions can be cost-effective for meeting the Sustainable Development Goals in cities, which are crucial for global sustainability.** Increased use of green infrastructure and other ecosystem-based approaches can help to advance sustainable urban development while reinforcing climate mitigation and adaptation. Urban key biodiversity areas should be safeguarded. Solutions can include retrofitting green and blue infrastructure, such as creating and maintaining green spaces and biodiversity-friendly water bodies, urban agriculture, rooftop gardens and expanded and accessible vegetation cover in existing urban and peri-urban areas and new developments. Green infrastructure in urban and their surrounding rural areas can complement large-scale “grey infrastructure” in areas such as flood protection, temperature regulation, cleaning of air and water, treating wastewater and the provision of energy, locally sourced food and the health benefits of interaction with nature. {BG 39}

D10 **A key constituent of sustainable pathways is the evolution of global financial and economic systems to build a global sustainable economy, steering away from the current limited paradigm of economic growth.** That implies incorporating the reduction of inequalities into development pathways, reducing overconsumption and waste and addressing environmental impacts such as externalities of

economic activities, from the local to the global scales. Such an evolution could be enabled through a mix of policies and tools (such as incentive programmes, certification and performance standards) and more internationally consistent taxation, supported by multilateral agreements and enhanced environmental monitoring and evaluation. It would also entail a shift beyond standard economic indicators such as gross domestic product to include those able to capture more holistic, long-term views of economics and quality of life. {BG 33, 40}