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SCENARIOS FOR THE 2050 VISION FOR BIODIVERSITY

Note by the Executive Secretary

I. INTRODUCTION

1. According to the multi-year programme of work of the Conference of the Parties adopted through decision XII/31, the Conference of the Parties will consider, at its fourteenth meeting, the long-term strategic directions to the 2050 Vision for biodiversity, as well as a related agenda item on approaches to Living in harmony with Nature. The Subsidiary Body may assist the Conference of the Parties in preparing for these items, which are envisaged to contribute to the preparation of the follow-up to the Strategic Plan for Biodiversity 2011-2020, which is due to be considered by the Conference of the Parties at its fifteenth meeting, in 2020.[1]

2. The present note has been prepared by the Executive Secretary, in collaboration with various partners,[2] to provide the Subsidiary Body with relevant information concerning biodiversity-related scenarios and related scientific and technical information on trends and projections towards 2050 and possible pathways to achieve the 2050 Vision. It draws largely from the work prepared for the second, third and fourth editions of the *Global Biodiversity Outlook*, and other ongoing scenario-related work including that designed to inform future assessments under both the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). The information in the present note highlights issues that may also be relevant to the process for preparing the follow-up to the Strategic Plan for Biodiversity 2011-2020 which, pursuant to decision XIII/1, will be considered by the Subsidiary Body on Implementation at its second meeting.[3]

3. Section II of the present note provides background information on the Strategic Plan for Biodiversity 2011-2020 and its 2050 Vision, on the 2030 Agenda for Sustainable Development and on other relevant global frameworks. Section III reviews the types of scenarios and their use for informing decision-making on biodiversity. Section IV provides an overview of the conclusions from scenarios with respect to the 2050 Vision. Section V addresses some further considerations in response to the findings of different scenarios and sections VI and VII provide overall conclusions and suggested recommendations for the Subsidiary Body.

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* CBD/SBSTTA/21/1.

[1] See UNEP/CBD/COP/12/26.

[2] UNEP-WCMC, the IPBES Scenario and Models s Expert Group, and Future Earth-BioDiscovery

[3] A background paper, "Approaches for the Preparation of the Post-2020 Biodiversity Framework" is available at https://www.cbd.int/post2020/

4. The present note is complemented by an addendum (CBD/SBSTTA/21/2/Add.1) providing an assessment of the links between biodiversity and the 2030 Agenda for Sustainable Development.[4] It has been prepared pursuant to paragraph 35 of decision XIII/1, by which the Conference of the Parties requested the Executive Secretary, building upon information that is already available, to prepare a further assessment, including a gap analysis, on the relationship between the Aichi Biodiversity Targets and the Sustainable Development Goals, for the consideration of the Subsidiary Body on Scientific, Technical, and Technological Advice. The note is also supplemented by a number of information documents, as referenced in various paragraphs below.

5. The Subsidiary Body is invited to consider these documents and to provide conclusions and recommendations for consideration by the Subsidiary Body on Implementation at its second meeting and the Conference of the Parties at its fourteenth meeting, as appropriate.

II. BACKGROUND

A. The Strategic Plan for Biodiversity 2011-2020 and its 2050 Vision

6. In adopting the Strategic Plan for Biodiversity 2011-2020, by decision X/2, the Conference of the Parties recognized that bringing about meaningful changes to the status of biodiversity was a long-term endeavour. Thus, a vision for 2050 was adopted as part of the Strategic Plan. The 2050 Vision is "Living in harmony with nature" where "by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people". The 2050 Vision of the Strategic Plan is supported by five overall Goals,[5] and the various elements of the 2050 Vision are further reflected in a number of the Aichi Biodiversity Targets. While not expressed in quantitative terms, the various elements of the 2050 Vision statement provide the essence of a long-term goal for biodiversity. Indeed, as further discussed below (para. 24), the 2050 Vision has been interpreted as a 2050 goal for biodiversity in various scenario-building efforts and efforts are under way to provide a more quantitative basis and plausible pathways for achieving such a vision, as discussed below (see paras. 29 and 30).

7. In adopting the Strategic Plan, the Conference of the Parties also recognized that urgent action was required to address pressing biodiversity challenges and to put the world on track to reach the 2050 Vision. This urgency is reflected in the mission statement of the Strategic Plan for Biodiversity 2011-2020[6] and the 20 Aichi Biodiversity Targets.[7] Thus, a key purpose of the Strategic Plan for Biodiversity 2011-2020 is to begin slowing the rate of biodiversity loss through a range of actions at the various levels reflected in the goals of the Strategic Plan. For this reason, actions to directly address the loss of biodiversity and the benefits it provides (Goals C and D of the Strategic Plan) are complemented by actions to address the drivers of loss (Goals A and B)..

8. The Aichi Biodiversity Targets were not intended as end points in and of themselves but rather as milestones in a longer process of ultimately halting the loss of biodiversity thereby contributing to human well-being. Therefore while the Aichi Biodiversity Targets are set to expire in 2020 (or, in a few cases,

[4] General Assembly resolution 70/1, annex.

[5] The strategic goals are: (a) Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society; (b) Reduce the direct pressures on biodiversity and promote sustainable use; (c) Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity; (d) Enhance the benefits to all from biodiversity and ecosystem services; and (e) Enhance implementation through participatory planning, knowledge management and capacity-building.

[6] The mission is to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication. To ensure this, pressures on biodiversity are reduced, ecosystems are restored, biological resources are sustainably used and benefits arising out of utilization of genetic resources are shared in a fair and equitable manner; adequate financial resources are provided, capacities are enhanced, biodiversity issues and values mainstreamed, appropriate policies are effectively implemented, and decision-making is based on sound science and the precautionary approach."

[7] The Aichi Biodiversity Targets are themselves a continuation of the sub-targets of the 2010 biodiversity target adopted in 2002 in which Parties committed to achieve by 2010 a significant reduction of the rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth.

2015), the 2050 Vision agreed by Parties will remain relevant beyond 2020. Thus, it may be envisaged that further interim targets will be considered as part of the follow-up to the current Strategic Plan (for example, for 2030, aligned with the 2030 Agenda for Sustainable Development).

9. The post-2020 global biodiversity framework, to be developed in follow-up to the current Strategic Plan, will need to be informed by trends in biodiversity and the drivers of its change as well as possible measures to achieve the 2050 Vision. It will also need to take into account the actual progress towards the Aichi Biodiversity Targets. As noted in the fourth edition of the *Global Biodiversity Outlook*, overall, current progress is not sufficient to achieve most of the targets by 2020. The IPBES global assessment and fifth edition of the *Global Biodiversity Outlook* will provide updated assessments of progress towards the targets.[8]

B. The 2030 Agenda for Sustainable Development and other relevant global frameworks

10. In considering long-term strategic directions to the 2050 Vision for biodiversity, it is important to take into account the relevant international processes which help to set the overall context. Perhaps the most relevant international process in this respect is the 2030 Agenda for Sustainable Development. The scientific context provided by the IPBES global and regional assessments will also be important.

11. The 2030 Agenda sets out an ambitious framework to address a range of global societal challenges with the purpose of promoting action on issues critical for human well-being and to promote policy coherence and foster integrated implementation across sectors and domains of society. These challenges are reflected in the 17 indivisible goals of the Agenda, under which there are 169 targets, many with a deadline of 2030 (though, as further noted below, many of the biodiversity-related targets have a 2020 end date).

12. The 2050 Vision of the Strategic Plan for Biodiversity 2011-2020 is complementary to, and consistent with, the overarching objective of the 2030 Agenda for Sustainable Development. Both seek to ensure health and prosperous societies for all people. Biodiversity is explicitly addressed in Sustainable Development Goals 14 and 15, which cover marine and terrestrial biodiversity and ecosystems respectively. Further, much of the wording of the targets under these goals mirrors that used in the Aichi Biodiversity Targets.[9] Similarly, all food systems depend on biodiversity and, therefore, biodiversity is an important consideration for the attainment of Sustainable Development Goal 2, related to food security. Biodiversity is also important for Goal 6 on sustainable water management. In addition, even in those Sustainable Development Goals where biodiversity is not explicitly addressed, it is often an important consideration, as further explored in the addendum to the present note. Conservation of biodiversity and ecosystem restoration could make major contributions to climate change mitigation and adaptation. Therefore, biodiversity is implicated in many of the Sustainable Development Goals, and it is imperative to appropriately consider biodiversity across all Goals to make it clear that, if biodiversity is not appropriately considered, it will be impossible to fulfil the 2030 Agenda.[10]

13. The Conference of the Parties has recognized that the implementation of the 2030 Agenda for Sustainable Development provides a major opportunity for the mainstreaming of biodiversity and for the achievement of the Aichi Biodiversity Targets. As further explored in the addendum to the present note, the 2030 Agenda may support the implementation of the Strategic Plan for Biodiversity 2011-2020, achievement of the Aichi Biodiversity Targets, and progress towards the 2050 Vision in a number of ways. Many of the Sustainable Development Goals and related targets address the drivers of biodiversity

[8] For proposals on the preparation of the fifth edition of the *Global Biodiversity Outlook*, see CBD/SBSTTA/21/6. Further interim assessments will also be considered by the Subsidiary Body on Scientific, Technical and Technological Advice at its twenty-second meeting, the Subsidiary Body on Implementation at its second meeting and the Conference of the Parties at its fourteenth meeting.

[9] See "Links between the Aichi Biodiversity Targets and the 2030 agenda for Sustainable Development" (UNEP/CBD/SBSTTA/19/INF/9), 22 October 2015.

[10] See "Biodiversity and sustainable development: Technical Note" (UNEP/CBD/COP/13/10/Add.1), 21 October 2016 (prepared in collaboration with FAO, UNDP, UNEP and the World Bank).

loss (for example climate change, pollution and overexploitation, as well as unsustainable production and consumption). Others relate to the building of institutions and human capital (for example through education), and the strengthening of equality and rights, thereby providing an enabling environment conducive to improved governance of factors affecting biodiversity. In addition, a number of Sustainable Development Goals recognize the role of biodiversity and ecosystems for their attainment, aiding the mainstreaming of biodiversity into the relevant sectors by providing incentives for its conservation and sustainable use. Where there are also potential trade-offs between biodiversity and the Sustainable Development Goals, these can be seen as constraining the choice of particular pathways for achieving a given Goal rather than representing a fundamental contradiction (for examples, see CBD/SBSTTA/21/2/Add.1).

14. Since the adoption of the Strategic Plan for Biodiversity 2011-2020 a number of additional frameworks have been established in other forums which could help to inform discussions on longer perspectives towards the 2050 Vision for biodiversity. Among these is the Paris Agreement on Climate Change[11] adopted under the United Nations Framework Convention on Climate Change. There are important potential synergies between the Nationally Determined Contributions towards the agreement and the 2050 Vision for biodiversity, and, potentially, the post-2020 global biodiversity framework.[12] Other relevant processes, acknowledged by the Conference of the Parties in decision XIII/3, include the Addis Ababa Action Agenda,[13] the SAMOA Pathway,[14] the Sendai Framework for Disaster Risk Reduction 2015-2030,[15] and relevant policy frameworks, guidance, and tools on agriculture, fisheries, and forestry developed by the Food and Agriculture Organization of the United Nations.

III. REVIEW OF SCENARIOS AND THEIR ROLE IN INFORMING DECISION-MAKING ON BIODIVERSITY

A. Types of scenarios

15. Scenarios and modelling are increasingly being used to help inform discussion on the policy implications of long-term trends on issues related to the environment, climate change and human well-being. Scenarios are representations of possible futures for one or more components of a system, for example of drivers of change in biodiversity and ecosystem services, including alternative policy or management options.

16. A methodological assessment of scenarios and models of biodiversity and ecosystem services was prepared by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and approved and accepted by the IPBES Plenary at its fourth meeting, in February 2016. The Conference of the Parties at its thirteenth meeting welcomed this assessment and recognized its high relevance for work under the Convention. The assessment provides guidance for the use of scenarios and models in the regional, global and thematic assessments conducted under IPBES, as well as more broadly. The focus of the assessment is on providing guidance on the use of scenarios and models to inform policymaking and decision-making in a variety of contexts.

17. The IPBES assessment described four different types of scenarios, each playing important roles in relation to the major phases of the policy cycle – (a) "exploratory scenarios" that can support agenda setting, (b) "target-seeking scenarios" that can support policy design, (c) "policy-screening scenarios" to

[11] United Nations Framework Convention on Climate Change, Conference of the Parties, twenty-first session, decision 1/CP.21 (see FCCC/CP/2015/10/Add.1).

[12] See UNEP/CBD/SBSTTA/20/INF/38. See also the intended nationally determined contributions process implemented under the United Nations Framework Convention on Climate Change. As part of this process countries were invited to establish emission reduction targets in the lead up to the 2015 Paris Conference as a way of informing the discussions that ultimately led to the Paris Agreement.

[13] General Assembly resolution 69/313, annex.

[14] See General Assembly resolution 69/15.

[15] General Assembly resolution 69/283, annex II.

support implementation, and (d) scenarios for "retrospective policy evaluation" (also known as "ex post evaluation") that can support policy review.

18. Scenarios may also include "trend" or "business-as-usual" scenarios. A trend scenario is a benchmark, not a forecast, and serves to understand the context and challenges relating to achieving the desired goals, such as biodiversity goals. Under a trend scenario, key variables continue more or less unchanged from recent history, assuming no major shocks with global impacts. Basic socioeconomic mechanisms continue to operate in the same fashion and no specific new policies are introduced ("dynamics-as-usual").

19. Exploratory scenarios have been widely used, for example in the *Millennium Ecosystem Assessment* (which provided inputs to the second edition of the *Global Biodiversity Outlook*), and the *Global Environment Outlook*, as well as the assessments of IPCC.[16] These storyline-based scenarios illustrate a range of plausible futures, and help to inform decision makers and the broader public of potential future trends and their consequences for human well-being. While they have played an important role in informing opinion and driving action on climate change, they have perhaps been less successful in influencing policy that is specifically related to biodiversity. Target-seeking scenarios that aim to identify plausible pathways to a given goal (or set of goals) have also been developed and used to inform decision-making on both climate change and biodiversity.

20. Scenarios are underpinned, to varying degrees, by quantitative models[17] that describe relationships between various components of the system being assessed (such as relationships between: indirect and direct drivers; drivers and biodiversity; and biodiversity, ecosystem services and human well-being). For example, integrated assessment models, have been widely used in climate modelling, and to explore the impacts of these drivers, in particular land use change, on biodiversity. However, to date, quantitative models that incorporate feedback regarding biodiversity change on ecosystem services and human well-being have not been incorporated into comprehensive scenarios.[18]

B. Use of scenarios under the Convention on Biological Diversity

21. The second edition of the *Global Biodiversity Outlook*, published in 2006, was largely informed by the reports of the *Millennium Ecosystem Assessment*, including the exploratory scenarios employed therein. These storyline-based scenarios illustrated a range of plausible futures under different socioeconomic assumptions. While they indicated varying impacts on biodiversity, none described pathways that might halt the loss of biodiversity.

22. The third edition of the *Global Biodiversity Outlook*, published in 2010, set out possible future trends for biodiversity during the rest of the twenty-first century based on a combination of observed trends, models and experiments drawing upon the previous relevant scenario exercises conducted for the *Millennium Ecosystem Assessment*, the *Global Environment Outlook* and earlier editions of the *Global Biodiversity Outlook*, as well as scenarios developed under IPCC. This work identified a broader range of plausible futures than previous assessments. In addition to the analysis of existing models and scenarios, a new assessment was carried out for the third edition of the *Global Biodiversity Outlook* on potential

[16] For example, the "SRES scenarios" (i.e. scenarios contained in the Special Report on Emissions Scenarios (SRES), a 2000 IPCC report), were used in the third and fourth assessment reports of IPCC, published in 2001 and 2007 respectively. "Representative concentration pathways" (RCPs) were used in the fifth assessment report. A new generation of exploratory scenarios – the shared socioeconomic pathways (SSPs) – have recently been developed as further described in paragraph 28 of the present note.

[17] "Models" are qualitative or quantitative descriptions of key components of a system and of relationships between those components. The assessment focuses mainly on models describing relationships between: (a) indirect and direct drivers; (b) direct drivers and nature; and (c) nature and nature's benefits to people. "Scenarios" are representations of possible futures for one or more components of a system, particularly, in the assessment, for drivers of change in nature and nature's benefits, including alternative policy or management options.

[18] Henrique M. Pereira, et al. (2010). Scenarios for Global Biodiversity in the 21st Century, Science 330, 1496.

"tipping points" that could lead to large, rapid and potentially irreversible changes.[19] These analyses provided the rationale for the structure of the Strategic Plan for Biodiversity 2011-2020, and informed the development of some of the Aichi Biodiversity Targets.

23. In addition, a new exercise in biodiversity scenario development ("Rethinking biodiversity scenarios") was undertaken by the Netherlands Agency for Environmental Assessment for the tenth meeting of the Conference of the Parties, complementing the analysis in the third editions of the *Global Biodiversity Outlook*. Target-seeking approaches were used, explicitly focused on reducing biodiversity loss. The analysis showed that a number of mechanisms could contribute to reducing biodiversity loss,[20] but could not halt it by 2020. The scenarios highlighted time lags and the importance of early action to achieve longer-term benefits for biodiversity.

24. This target-seeking approach was further developed and extended in the "Roads from Rio+20: Pathways to achieve global sustainability goals by 2050" published on the occasion of the UN Conference on Sustainable Development in 2012. These scenarios explicitly focussed on the target of halting biodiversity loss by 2050, consistent with the 2050 Vision, and simultaneously addressing a broader set of agreed climate change and development goals. As further explored in the next section, these scenarios demonstrated that it is possible, though challenging, to simultaneously achieve these various goals.

25. The fourth edition of the *Global Biodiversity Outlook* brought together multiple lines of evidence to assess progress towards the Aichi Biodiversity Targets and prospects for achieving the 2050 Vision. It made use of longer-term model based scenarios, including an extension of the "Roads from Rio+20" scenarios. These scenarios include a "trend" or "business-as-usual" scenario,[21] and three alternative target-seeking scenarios that aim to achieve the 2050 Vision and other globally agreed goals. They also included an assessment related to a range of economic sectors.[22]

26. The Conference of the Parties has also encouraged the use of scenarios at the regional and national levels.[23] The use of such scenarios will be explored in an information note (see also para. 45 below). Lessons and conclusions drawn from these scenarios are explored in section IV of the present note.

C. Ongoing work to develop scenarios on biodiversity, land use, climate change and sustainable development

27. A new set of exploratory scenarios has recently been developed, primarily to provide socioeconomic storylines to inform work under IPCC.[24] The shared socioeconomic pathways (SSPs),

[19] The in-depth study underlying the third edition was published as Leadley, P., Pereira, H.M., Alkemade, R., etal (2010) Biodiversity Scenarios: Projections of 21st century change in biodiversity and associated ecosystem services. Secretariat of the Convention on Biological Diversity, Montreal. Technical Series no. 50 available at https://www.cbd.int/doc/publications/cbd-ts-50-en.pdf. An extension of the work on tipping points was published as: Paul Leadley et al., (2014) "Interacting regional-scale regime shifts for biodiversity and ecosystem services". BioScience 64 (8) 665–679, available at http://bioscience.oxfordjournals.org/content/early/2014/06/25/biosci.biu093.full

[20] The main indicator used in this assessment and the subsequent Roads from Rio and GBO-4 assessments, is Mean Species Abundance (MSA). This is in essence an indicator of "naturalness" of ecosystems as the compound result of human-induced pressure factors. It considers the composition of species in numbers and abundance compared with the original state and provides a common framework to assess the major causes of biodiversity loss. While MSA loss closely relates to direct biodiversity parameters, it cannot be considered one-on-one as "biodiversity", and thus the indicator is complemented by others.

[21] The trend scenario is adapted from and closely resembles the OECD 2012 environmental scenarios.

[22] PBL Netherlands Environmental Assessment Agency (2014). How Sectors Can Contribute to Sustainable Use and Conservation of Biodiversity. Secretariat of the Convention on Biological Diversity, Montreal. CBD Technical Series No. 79 available at https://www.cbd.int/doc/publications/cbd-ts-79-en.pdf

[23] Decision XIII/29 (para. 6): The Conference of the Parties encourages Parties, and invites other Governments, relevant organizations, the scientific community, stakeholders and indigenous peoples and local communities to further develop and use scenarios and models to support decision-making and the evaluation of policies, and to contribute to the further development of scenarios and models as described by the Summary for Policymakers of the IPBES methodological assessment of scenarios and models of biodiversity and ecosystem services.

[24] Previously, the IPCC has used scenarios for emissions and concentrations of greenhouse gases to make projections of possible future climate change in a number of its assessment reports. The "SRES scenarios" (i.e. scenarios contained in the Special Report

being catalysed by IPCC, focus on exploring a wide range of plausible human development pathways, including different rates of population growth, economic growth, and technological development, and varying approaches to trade and environmental policy. The SSPs can be used in combination with the representative concentration pathways (RCPs), which describe pathways of greenhouse gas emissions resulting in different climate change scenarios. Models can then translate relevant combinations of SSPs/RCPs into land-use change and climate change projections.[25] The results can be useful in illustrating plausible storylines for socioeconomic development and their consequences for many drivers of changes in the status of biodiversity. Further information on the SSPs will be provided in an information note, and some of the results are illustrated in section IV of the present note. Scenarios for the *Global Land Outlook*, recently published by the Secretariat of the United Nations Convention to Combat Desertification (UNCCD), were developed using the SSPs as a starting point.[26]

28. In line with recommendations of the IPBES methodological assessment, work is currently under way by the IPBES Scenarios and Models and Expert Group to extend the SSPs to inform the ongoing IPBES Global Assessment of Biodiversity and Ecosystem Services. A range of existing biodiversity and ecosystem-service models will be used alongside additional approaches and tools to translate projections from selected SSP/RCP combinations into outcomes for biodiversity, ecosystem services and human well-being. This will allow an assessment of impacts expected from projected changes in land use and climate at the global scale across several dimensions of biodiversity (e.g. species richness, abundance, composition) and ecosystem services (provisioning, regulating, and cultural services).[27] This work responds to the invitation from the Conference of the Parties for IPCC and IPBES to foster collaboration between their respective scientific communities working on scenarios and models.[28]

29. In a second component of work, the IPBES Scenarios and Models Expert Group are developing a new set of multi-scale biodiversity scenarios. In contrast to existing scenarios in which impacts on biodiversity are the endpoint in a linear cascade of models, the new work will place biodiversity at the centre of scenario development, and address the full range of social-ecological feedbacks, including those between biodiversity change, ecosystem services and human well-being and consideration of individual and institutional responses to biodiversity changes. An iterative, participatory and creative process will be used to identify multiple "Visions for Nature", bringing together key stakeholders from different sectors, at multiple spatial scales. Once these alternative futures have been identified, a range of qualitative and quantitative approaches (e.g. modelling, empirical studies and expert knowledge) will be used to identify potential pathways for reaching these outcomes, including specific policy alternatives. This work will underpin future assessments under IPBES and has the potential to inform the development of the post-2020 global biodiversity framework.[27] Conversely, discussions on the post-2020 global biodiversity framework can help to shape the new scenarios. Further information on this initiative is provided in an information note.[29]

30. Other scenario initiatives are focused on broader issues of sustainable development. For example, The World in 2050 (TWI2050) initiative aims to develop sustainable pathways that reach all 17 Sustainable Development Goals and achieve transformation towards sustainability within "planetary boundaries" beyond 2050. It will build on existing global assessments (including the *Global Biodiversity*

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on Emissions Scenarios (SRES), a 2000 IPCC report), were used in the third and fourth assessment reports of IPCC, published in 2001 and 2007, respectively. "Representative Concentration Pathways" (RCPs) were used in the fifth assessment report.

[25] A corresponding set of Oceanic System Pathways is being developed to explore future scenarios focusing on open ocean fisheries. See Maury et al (2017) from shared socio-economic pathways to oceanic system pathways: building policy-relevant scenarios for global oceanic ecosystems and fisheries. *Global Environmental Change* 45, 203-216.

[26] van der Esch et al (2017). Exploring future changes in land use and land condition and the impacts on food, water, climate change and biodiversity. Scenarios for the UNCCD Global Land Outlook. PBL Netherlands Environmental Assessment Agency.

[27] Rosa, Pereira, Ferrier, Alkemade et al. (2017) Multi-scale Scenarios for Nature Futures, *Nature Ecology and Evolution*.1, 1416–1419.

[28] Decision XIII/29, paragraph 10.

[29] This builds upon the outcomes of an expert workshop entitled "New visions for nature and nature's contributions to people for the 21st century" hosted by IPBES Scenarios and Models Expert Group, Auckland, New Zealand, 4-8 September 2017.

Outlook), and on more recent advances in scenario building and modelling.[30] These and other relevant initiatives along with their implications for the Convention on Biological Diversity are further elaborated in an information document.

IV. CONCLUSIONS FROM SCENARIOS RELEVANT TO THE 2050 VISION

A. Future projections for biodiversity under business as usual scenarios

31. Current trends or "business-as-usual" scenarios show continued loss of biodiversity. According to the third edition of the *Global Biodiversity Outlook*, projections of global change impacts on biodiversity show continuing and, in many cases, accelerating species extinctions, loss of natural habitat, and changes in the distribution and abundance of species and the boundaries of biomes over the twenty-first century. Habitat loss, pollution, invasive alien species and unsustainable use are currently the most important drivers of biodiversity change and are projected to remain so over the coming century. However, climate change and ocean acidification are also already impacting biodiversity and will become increasingly important drivers during the twenty-first century.

32. The fourth edition of the *Global Biodiversity Outlook* reinforced these findings. Future projections for 2050 based on current trends ("business as usual") show unsustainable outcomes: increased demand for fertile land from agriculture and bioenergy, resulting in increased pressure on natural terrestrial habitats and large declines in biodiversity; collapse of many wild fisheries, and their replacement by aquaculture, with potential consequent increased pollution, demand for high protein feed and further competition for land; climate change leading to biodiversity loss, ecosystem change and disruption of food production systems; and increased water scarcity in many regions, resulting in reduced water flow for vulnerable freshwater ecosystems. At local levels, declines in biodiversity could undermine agricultural productivity. At regional scales, combinations of drivers could push some ecosystems beyond tipping points, with serious implications for human well-being.

33. A more detailed compilation of projected biodiversity trends derived from the recent literature is provided in an information note.

B. Demographic and economic projections under various socioeconomic pathways and consequences for land use change and climate change

34. Current trends notwithstanding, scenarios demonstrate that there is a wide range of plausible futures, with regard to demographic, economic, technological and cultural changes, that would have consequences for biodiversity (Figure 1). For example, the different shared socioeconomic pathways (SSP) scenarios developed by IPCC show that while world population is projected to increase to 2050, among the scenarios the rate of increase varies substantially, and, they sharply diverge in the second half of the century. Population projections range from a peak of about 8.5 billion in 2050 declining to 7 billion in 2100 for the low scenario (SSP 1), to 10 billion in 2050 rising further to12.6 billion in 2100 for the high scenario (SSP 3), compared to 6.8 billion in 2017.[31] The greatest proportionate increase is projected for Africa, where the range among the scenarios is particularly high: 1.7 billion in 2050 and 1.8 billion in 2100 under SSP 1; 2.3 billion in 2050 and 4.0 billion in 2100 under SSP 3, compared to 1.2 billion in 2017. The differences are explained by various factors in the scenario storylines, with female education playing a particularly important role. Urbanization is also projected to continue under all scenarios, reaching up to 75 per cent by 2050 and 90 per cent in 2100 under some scenarios, while in others showing only small increases from the present 52 per cent and reaching only 60 per cent in 2100.

[30] TWI2050 was launched in 2015 by the International Institute for Applied Systems Analysis (IIASA), the Sustainable Development Solutions Network , the Stockholm Resilience Center and the Earth Institute at Columbia University. More information on The World in 2050 (TWI2050) is contained in a 2017 concept note available at: http://www.iiasa.ac.at/web/home/research/researchPrograms/TransitionstoNewTechnologies/Concept-note-TWI2050-3page-Apr2017.pdf

[31] These population projections which represent modelled outputs from the SSP scenarios differ from the United Nations projections, which are statistical extrapolations. The United Nations mid projection is 9.8 billion by 2050 and 11.2 billion by 2100.

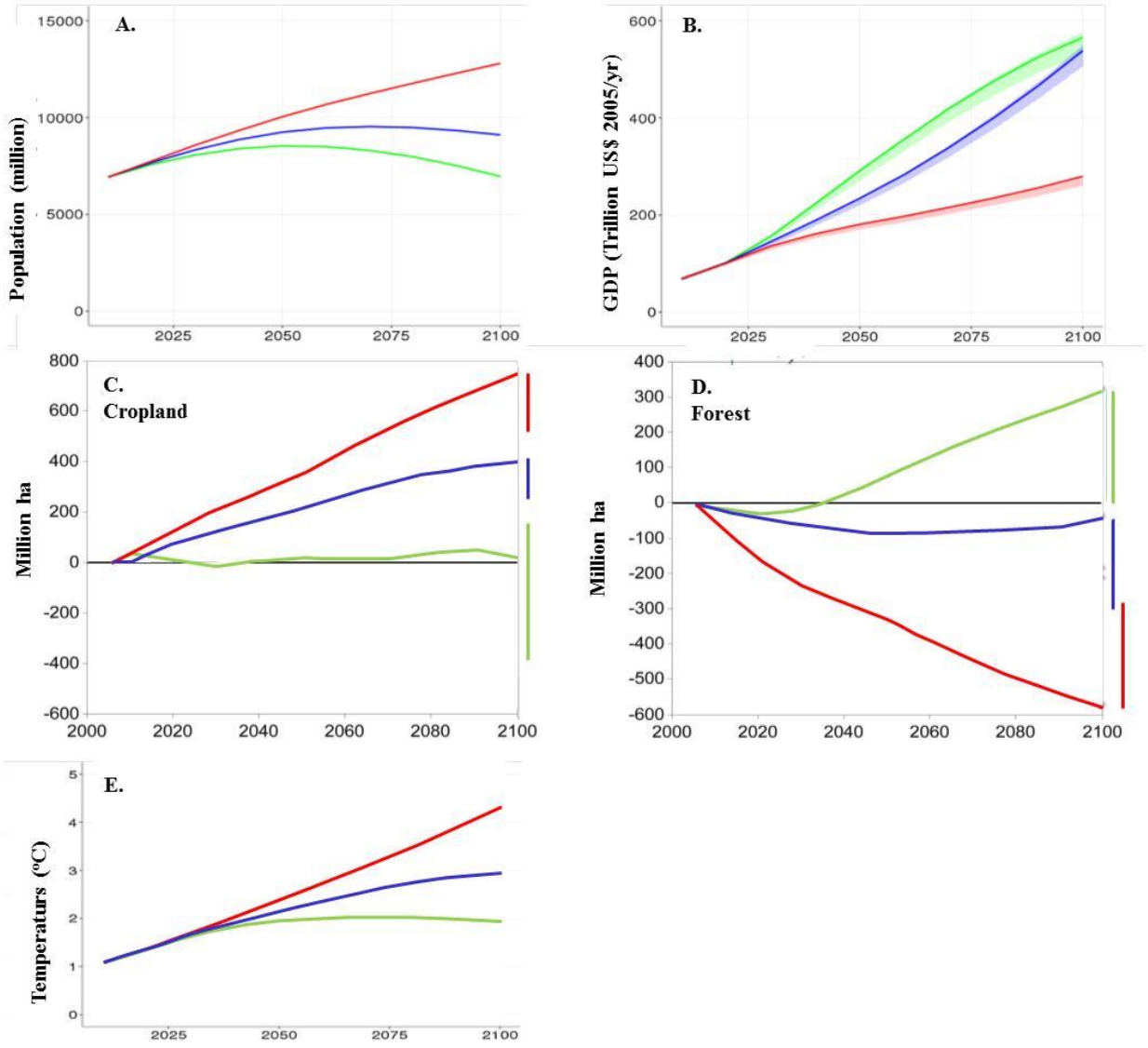

Figure 1.Projections for population, economic growth, land-use change and climate change under the shared socio-economic pathways. Projected change in population (A.), gross domestic products (B.), cropland (C.), forest (D.) and temperature (E.) under three of the shared socioeconomic pathways (SSP). SSP1 (green line) is "Sustainability – Taking the Green Road". SSP2 (blue line) is "Middle of the road". SSP3 (red line) is "Regional rivalry – A rocky road". In the case of temperature (E.) the projections for SSP 1 and SSP 2 include climate mitigation measures (thus SSP1 is combined with RCP 2.6; SSP2 is combined with RCP 4.5).[32]

35. Economic growth is projected to continue, albeit with a slow-down in growth rates in the second half of the century. Again, there are very large differences among the scenarios, and these are reflected also in gross domestic product per capita figures as well as levels of inequality within and among countries.

[32] Riahi et al (2017). The shared socioeconomic pathways and their energy, land use, and greenhouse gas emissions implications: An overview. *Global Environmental Change*, 42 (2017) 153–168, and van Vuren et al (2017). Energy, land-use and greenhouse gas emissions trajectories under a green growth paradigm. Global Environmental Change 42 (2017) 237–250.

36. The various SSP scenarios show that in the future, total cultivated cropland could expand or contract by millions of hectares over this century. In SSP 3, massive growth of population, relatively low agricultural productivity, and little emphasis on environmental protection leads to an expansion of cropland and pasture land and large-scale losses of forests and other natural lands. In comparison, the SSP1 scenario features a gradual, global-scale expansion of forests and other natural lands resulting from low population projections, healthy diets with limited food waste, and high agricultural productivity. Other SSP scenarios feature modest changes in land use with some expansion of overall cultivated lands.

37. Under the various SSP scenarios, average global temperature would range between 1.5°C and a little over 2°C above pre-industrial levels by 2050 and between 1.5°C and 4°C by 2100. A recently published statistically based probabilistic forecast of CO_2 emissions and temperature change to 2100, based on data which already shows the effect of existing climate policies, suggests that the world is currently on track for a temperature rise of about 3.2°C by the end of the century (likely range: 2.0 – 4.9°C).[33]

C. Potential pathways towards the 2050 Vision for biodiversity

38. The wide range of plausible futures provide space for policy measures to achieve the 2050 Vision alongside other global goals. The third edition of the *Global Biodiversity Outlook* concluded that despite the negative trends for biodiversity identified in that assessment, well-targeted policies focusing on critical areas, species and ecosystem services could help to avoid the most dangerous impacts on people and societies from biodiversity loss in the near-term future. It found that, in the longer term, biodiversity loss (expressed through some indicators) may even be halted and then reversed, if urgent, concerted and effective action is applied in support of an agreed long-term vision.

39. The scenario assessments underpinning the fourth edition of the *Global Biodiversity Outlook* suggest that the biodiversity goals reflected in the 2050 Vision could be attained while also reaching broader socioeconomic objectives that include strong climate mitigation, improved diets and the eradication of hunger (figure 2). In comparison with business-as-usual trends, several indicators of biodiversity are improved in the alternative scenarios: population abundance, status of threatened species and mean species abundance, as well as the status of marine fish stocks. Three pathways to the 2050 Vision were explored in the scenario analysis (see para. 42 below), representing various mixes of policy measures to deliver these outcomes.

40. The elements of a policy mix include:

(a) *Measures to increase the productivity and sustainability of agriculture.* Sustainable increases in agricultural productivity are needed in order to provide for the increased food production necessary to meet food security goals while avoiding large-scale expansion of crop area. Measures are also needed to improve the efficiency of use of water and nutrients and reduce or avoid the use of pesticides. Thus negative impacts on biodiversity within and beyond agricultural systems are reduced. Greater use of biodiversity within agricultural ecosystems can contribute to sustainable production increases through, for example, increasing pollination, employing biological pest-control, enhancing soil biodiversity and fertility, and enhancing the use of crop and livestock genetic resources as well as those of currently under-utilized species;

(b) *Measures to reduce ecosystem degradation and fragmentation and maintain biodiversity and the provision of key ecosystem services.* Proactive spatial planning, supported by incentives and monitoring is needed to protect key areas for biodiversity and the provision of ecosystem services and improve ecological connectivity in the landscape. This would include the restoration of degraded lands and the strategic expansion of protected areas. Efforts are also needed to reduce infrastructure expansion and its impacts on key ecosystems;

(c) *Measures to reduce overexploitation of biological resources,* including fisheries, forest products and wild meat. These need to recognize local needs and traditional practices while promoting

[33] Raftery el (2017). Less than 2°C warming by 2100 unlikely. *Nature Climate Change*, 7 637-641.

transitions to enforce sustainable practices in fisheries, forest management and hunting and the non-detrimental trade in products derived from these;

(d) *Measures to mitigate climate change*. Efforts are needed to improve energy efficiency and replace fossil fuels by renewable energy, while mitigating any negative impacts of the latter on biodiversity and ecosystems. In particular, the large-scale use of biofuels from crops needs to be limited;

(e) *Measures to reduce waste and excessive consumption*. Efforts are needed to reduce waste of food, both on-farm (especially in developing countries) and by consumers (especially in developed countries). Reducing overconsumption of meat would reduce impacts on biodiversity and climate while also providing health benefits. Moderating average per capita consumption should be achieved in tandem with reducing inequality and would not therefore involve reductions in consumption for poorer segments of society.

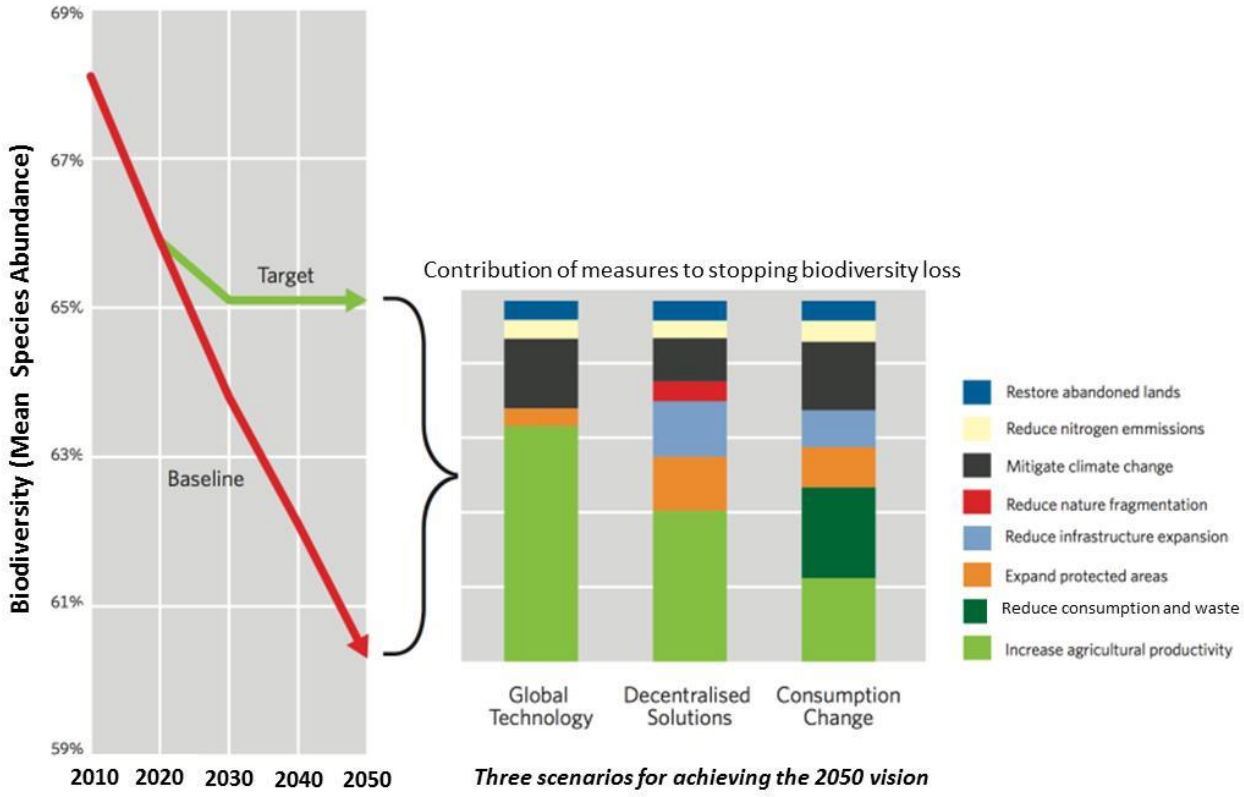

Figure 2. Pathways towards the 2050 Vision for Biodiversity **c**ontrasting pathways to sustainability using the Rio+20 socioeconomic scenarios. The scenarios illustrated here would each reach, by 2050, the goals of slowing and eventually halting biodiversity loss while also keeping global average temperature increases within two degrees Celsius, and achieving a range of socioeconomic development goals including ending hunger, providing universal access to safe drinking water, basic sanitation and modern energy sources. The goals can be reached by three different pathways.[34]

[34] Secretariat of the Convention on Biological Diversity (2014) Fourth edition of the Global Biodiversity Outlook. Montréal, https://www.cbd.int/gbo/gbo4/publication/gbo4-en.pdf

41. These various policies can be combined in various ways to deliver the desired outcomes. The scenarios underpinning the fourth edition of the *Global Biodiversity Outlook* explore three such potential pathways:

(a) A "global technology*"* pathway with a focus on large-scale technologically optimal solutions and a high degree of international coordination, including through trade liberalization. This "top-down" pathway emphasizes agricultural productivity, with limited expansion of protected areas. It is conceptually similar to the Millennium Assessment's "Technogarden" scenario;

(b) A "decentralized solutions" pathway with a focus on an adaptive management approach in response to regional priorities. This "bottom-up" pathway emphasizes biodiversity-friendly farming practices. It is conceptually similar to the Millennium Assessment's "Adaptive mosaic" scenario;

(c) A "lifestyle change*"* (or "reduced consumption") pathway with a focus on changes in consumption patterns, and biodiversity-positive behavioural change in institutions and individuals, for example through the choice of a less energy- and material-intensive lifestyle coupled with ambitious efforts to reduce pre- and post-market waste in the food sector. This type of scenario has been under-represented in earlier assessments.

42. Both of the first two pathways focus on changes in production patterns and both require a strong focus on spatial planning, albeit at different levels of management. The third pathway emphasizes changes in consumer demand which in turn would also result in changes in production patterns. Protected areas expansion is important in all three pathways, but leads to higher levels of eco-regional representation in the decentralized solutions pathway. Restoration of degraded lands is also a key response in all three. In practice, a mixed approach drawing on all three pathways will likely be needed for a feasible and robust approach to be developed.[35] Ultimately, the choice among these (or further alternative) pathways, or the balance among these alternatives, may be a result of differences in culture and worldview underlying the importance of broad and meaningful stakeholder engagement in the design of policy measures that may be informed by such scenarios.

43. In conclusion, the fourth edition of the *Global Biodiversity Outlook* concluded that plausible pathways exist for achieving the 2050 Vision in conjunction with key human development goals. These pathways are coherent with known constraints on economics, resource use and human development goals. They are also very much in line with similar strategies developed through other forums, for example the green growth strategy for agriculture of the Organization for Economic Cooperation and Development or current approach of the Food and Agriculture Organization of the United Nations.[36] However, they require fundamental changes in development paradigms. This will entail changes in society, including much more efficient use of land, water, energy and materials, rethinking our consumption habits and in particular major transformations of food systems. They will also require strong, coordinated and comprehensive action at the international, national and local levels. Ultimately, there is no individual, simple policy or other tool available to bring about the realization of the 2050 Vision. It will require the implementation of a coherent package of actions, including: legal or policy frameworks; socioeconomic incentives aligned to such frameworks; public and stakeholder engagement and action; monitoring; and enforcement. Issues related to transformational change and policy coherence are further explored below.

44. Various regional-level scenario analyses also suggest similar pathways to reduce biodiversity loss. For example, the Cerrado is a global biodiversity hotspot of high species richness and endemism where 46 per cent of native vegetation has already been lost, threatening 450 plant species with extinction. Business-as-usual projections show that 31–34 per cent of the remaining Cerrado is likely to be cleared by 2050, driven by expansion of soybean and beef production, raising the number of species committed to extinction to 1,140. In turn, this could have damaging repercussions in world markets for the agribusiness sector in Brazil. However, alternative scenarios show that a combination of measures – including monitoring, spatial planning, incentives, restoration, and strategic establishment of protected areas – could

[35] Note that the "sustainability" scenario of the shared socioeconomic pathways includes all of the above elements.

[36] Reviewed Strategic Framework 2010-19 of the Food and Agriculture Organization of the United Nations.

lower the number of species committed to extinction by 83 per cent while still allowing for the projected increases in crop and livestock production. Many similar policy measures have been deployed with success in the Amazon region and others are in development.[37] Other examples of the use of regional- and national-level scenarios to inform biodiversity policy are provided in an information document.

V. FURTHER CONSIDERATIONS AND IMPLICATIONS FOR THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK

45. Just as scenario analysis contributed to the development of the Strategic Plan for Biodiversity 2011-2020, the conclusions set out in the previous sub-sections resulting from scenarios, as well as new work being undertaken, could inform the development of the post-2020 global biodiversity framework. A number of lessons that will need to be taken into account and areas where further work will be required are set out in the following paragraphs.

46. As noted in the previous section, plausible pathways to the 2050 Vision exist, but they will require fundamental and transformational changes in many aspects of economies and societies. The need for transformational change for achievement of the Sustainable Development Goals is recognized in the 2030 Agenda for Sustainable Development, and, indeed, the implementation of the 2030 Agenda will help to enable such change (see CBD/SBSTTA/21/2/Add.1). The ongoing energy transition provides an example of how policy changes, informed by societal concerns and priorities, can shift trends (including, for example, from coal to other fossil fuels, and from fossil fuels to renewables). This transition has resulted from concerns about climate change, as well as health effects of air pollution, combined with a growing understanding of the economic and social benefits of shifting from a fossil-fuel based economy. Another example is the changes brought about in many societies with respect to smoking where a consistent and coherent combination of regulatory and incentive measures has shifted social norms. Future work under the Convention could benefit from lessons learned in these and other fields.[38]

47. There are a number of obstacles to achieving transformational change related to political economy, human behaviour and institutional issues. These include: lack of transparency; vested interests; unequal distribution of costs and benefits from actions; tendencies for short-term decision-making; the logic of market-driven processes; the lack of policy coherence; and inertia. Addressing these obstacles requires, among other things, understanding of the psychology of losses and gains and of the need for collective action. This is especially the case when there are trade-offs between different objectives or winners and losers among stakeholder groups. This is frequently the case in practice: even if integration of biodiversity into broader policies is a win-win for society at large, such an approach may not prevail in practice because some groups lose out or perceive that they risk doing so.

48. It is therefore critical to pursue the discussions and continue to elaborate decisions and guidance related to the mainstreaming of biodiversity into sectoral and cross-sectoral plans and strategies (decision XIII/3; see also CBD/SBSTTA/21/5) and to critically analyse the extent to which targets and outcomes defined in national biodiversity strategies and action plans are being achieved, understand the obstacles and to make use of appropriate tools to assess the effectiveness of measures taken with a view to achieving the best outcomes for biodiversity and society at large.

49. The ecosystem approach, adopted under the Convention as its primary framework for action, recognizes that ecosystems are complex systems and that humans are an integral component of many of them. At its fifth meeting, in 2000, the Conference of the Parties noted that:

> "The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding

[37] Strassburg et al. (2017). Moment of Truth for the Cerrado. *Nature Ecology Evolution*. 2017.

[38] The term "sustainability transitions" is increasingly used to refer to large-scale societal changes, deemed necessary to solve "grand societal challenges." In the present note, the term is used as shorthand for transitions to sustainability — large-scale disruptive changes in societal systems that emerge over a long period of decades. A recent review is provided by Loorbach et al (2017) Sustainability Transitions Research: Transforming Science and Practice for Societal Change. Annu. Rev. Environ. Resour. 2017. 42:4.1–4.28.

> of their functioning. Ecosystem processes are often non-linear, and the outcome of such processes often shows time lags. The result is discontinuities, leading to surprise and uncertainty. Management must be adaptive in order to be able to respond to such uncertainties and contain elements of "learning-by-doing" or research feedback. Measures may need to be taken even when some cause-and-effect relationships are not yet fully established scientifically."[39]

It is further noted that ecosystem management is a matter of societal choice. Ecological limits are recognized, as is the inevitability of change.[40]

50. Notwithstanding the endorsement of the ecosystem approach under the Convention and advances in the understanding of socioecological systems and their management, there exist gaps in the tools available and their implementation. The Subsidiary Body on Scientific, Technical and Technological Advice at is seventeenth meeting identified some key scientific and technical needs related to the implementation of the Strategic Plan for Biodiversity 2011-2020, including the need for better ways to draw on social sciences to motivate choices consistent with the objectives of the Strategic Plan for Biodiversity 2011-2020 and to develop new approaches through, among other things, better understanding of behavioural change, production and consumption patterns, policy development, and the use of non-market tools as well as the need for more effective communication, education and public awareness to be spread more widely through school systems and other channels and to devise communication and awareness strategies on biodiversity, complementing communication, education and public awareness efforts with other perspectives including research on intercultural and intracultural communication experiences.

51. Coherence with climate policy is important. On the one hand, climate-change mitigation is critically important for the protection of biodiversity and ecosystems. Keeping global warming within 2° C or less is essential for avoiding high risks of degradation of biodiversity and ecosystem services, especially in vulnerable systems such as coral reefs and mountains; even within these limits, significant negative impacts are inevitable. On the other hand, land-use change is currently the largest driver of biodiversity loss in terrestrial ecosystems and is projected to remain so for most of this century under most scenarios, as more land is required for the production of food, agricultural commodities, wood and bioenergy as well as for urban and infrastructure development. Land-based approaches to climate-change mitigation may increase or decrease land-use change, and its impact on biodiversity, depending on the strategy pursued. In fact, the most stringent climate mitigation scenarios presented in the IPCC fifth assessment report (RCP 2.6) leads to substantial biodiversity loss this century due to land-use change associated with biofuel crops. Other IPCC scenarios (e.g. RCP 4.5) rely on halting deforestation, reducing forest degradation, afforestation and ecosystem restoration and lead to improvements in biodiversity.[41]

[39] Decision V/6.

[40] Ibid.

[41] Newbold et al (2015). Global effects of land use on local terrestrial biodiversity. *Nature. 520, 45–50.* See also "Relationships between the Aichi targets and land-based climate mitigation" (UNEP/CBD/SBSTTA/20/INF/29) and the "Update on climate geoengineering in relation to the Convention on Biological Diversity" (UNEP/CBD/SBSTTA/19/INF/2), summarized in UNEP/CBD/SBSTTA/19/7.

Thus, it is important that biodiversity is fully integrated into climate policy and related assessments,[42] in particular in relation to land-based mitigation.[43]

52. There are other potential drivers of change that are currently not adequately addressed in most biodiversity scenarios. These include: the "tele-coupling" of ecosystems at distance through trade leading to separation of causes and consequences, and the development of new, potentially disruptive technologies, including synthetic biology, geoengineering and artificial intelligence.

53. With respect to the 2050 Vision, various actors in the conservation community have been advocating new targets and approaches for the conservation and sustainable use of biodiversity. For example, three independent scientific analyses produced for the World Parks Congress in 2014 tended to converge on the need to protect about 30 per cent (28-32 per cent) of land to ensure the conservation of the world's vertebrate species.[44] Similar percentages of protection have been proposed for marine and coastal regions. These studies provide an empirical basis for a long term target of about this magnitude. However they do not consider ecosystem services, evolutionary process, migrations, and all species of plants and invertebrates. Furthermore, the feasibility of such targets has not been fully examined.

54. A more ambitious approach focuses on the idea of setting aside half of the earth for nature conservation, including both terrestrial and marine realms, by expanding habitat protection, or as a series of interconnected protected and conserved areas. However, some earlier studies[45] suggest that such an approach may not be consistent with some of the other Sustainable Development Goals. In contrast to this so-called, "Half-Earth" approach, "Whole-Earth" is a concept that challenges attempts to polarize people and nature and suggests an approach that sees humans and nature as interlinked, and aims to ensure healthy ecosystems across the "Whole-Earth". Based on the argument that human inequality is a major cause of biodiversity loss, this approach would require a system of de-growth economics and large-scale redistribution of wealth.

VI. OVERALL CONCLUSIONS

55. The following conclusions can be drawn from the foregoing:

(a) *The 2050 Vision of the Strategic Plan remains relevant and should be considered in any follow up to the Strategic Plan for Biodiversity 2011-2020*. The 2050 Vision contains elements that could be translated into a long-term goal for biodiversity and provide context for discussions on possible biodiversity targets for 2030 as part of the post-2020 global biodiversity framework;

(b) *Current trends, or "business-as-usual" scenarios, show continued loss of biodiversity*, with major negative consequences for human well-being, including changes that may be irreversible. Urgent action on biodiversity therefore remains a pressing global societal issue;

[42] This includes the IPCC sixth assessment report (to be completed in 2022) and three special reports : The special report 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 (to be finalized in October 2018); The Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (to be finalized in September 2019); and the Special Report on the Ocean and Cryosphere in a Changing Climate (to be finalized in September 2019). The Subsidiary Body on Scientific, Technical and Technological Advice under the Convention on Biological Diversity has invited IPCC, when elaborating its special report on the impacts of global warming of 1.5 degrees Celsius above pre-industrial levels, to include consideration of the impacts on biodiversity and ecosystem functions and services, and of the contribution of the conservation and sustainable use of biodiversity, and of ecosystem restoration, to efforts to keep global warming within a limit of 1.5 degrees Celsius (recommendation XX/10).

[43] For further analysis, "Relationships between the Aichi Targets and land-based climate mitigation (UNEP/CBD/SBSTTA/20/INF/29).

[44] Butchart SHM, Clarke M, Smith RJ, Sykes RE, Scharlemann JPW, Harfoot M, et al. (2015). Shortfalls and Solutions for Meeting National and Global Conservation Area Targets. Conserv Lett . 8: 329–337. Pouzols FM, Toivonen T, Di Minin E, Kukkala AS, Kullberg P, Kuusterä J, et al. (2014). Global protected area expansion is compromised by projected land-use and parochialism. Nature 516: 383–6. Venter O, Fuller R.A., Segan D.B., Carwardine J., Brooks T., Butchart S.H.M., et al. (2014). Targeting Global Protected Area Expansion for Imperiled Biodiversity. PLoS Biol.12.

[45] Including PBL-Netherlands Agency for Environmental Assessment (2010). "Rethinking biodiversity scenarios".

(c) *Scenarios of future socioeconomic development demonstrate that there is a wide range of plausible futures* with respect to population growth, education, urbanization, economic growth, technological development and approaches to international trade, among other factors, leading to varying levels of climate change, land-use change and other drivers of biodiversity change. This range of plausible futures provide space for developing policy measures to achieve the 2050 Vision and other global goals;

(d) *The biodiversity goals reflected in the 2050 Vision could be attained while also reaching broader socioeconomic objectives, by deploying a combination of measures*, including measures: to increase the productivity and sustainability of agriculture, making greater use of biodiversity within agricultural ecosystems to contribute to sustainable production increases; to reduce ecosystem degradation and fragmentation and maintain biodiversity and the provision of key ecosystem services, through proactive spatial planning, the restoration of degraded lands and the strategic expansion of protected areas; to reduce overexploitation of fisheries and other biological resources; to control invasive alien species; to mitigate climate change, and to reduce waste and excessive consumption;

(e) *These measures could be developed in various "policy mixes" depending on the needs and preferences of countries and stakeholders*. For example, these could vary with respect to the emphasis on changes in production and consumption, the degree of reliance on new technologies and international trade and global versus local coordination. Further visioning exercises, at multiple scales and with strong stakeholder engagement, are needed to further elucidate options and promote action;

(f) *The pathways towards a sustainable future, while plausible, require transformational change*, including changes in behaviour at the levels of producers and consumers, Governments and businesses. Further efforts will be needed to understand motivations and facilitate change. Disruptive societal and technological developments can lead to transitions that may contribute to, or counter, sustainability. Governments and international institutions play can a critical role in establishing an enabling environment to foster positive change. Further work is required to identify ways and means by which the Convention, and the post-2020 global biodiversity framework, can leverage such change;

(g) *A coherent approach is needed on biodiversity and climate change* to ensure that impacts on biodiversity of climate change are reduced, that biodiversity and ecosystems can contribute solutions to climate adaptions and mitigation, and that climate mitigation measures do not negatively impact biodiversity through land-use change;

(h) *The 2050 Vision is consistent with the 2030 Agenda for Sustainable Development and other international goals*. Progress towards the 2030 Agenda for Sustainable Development would help to address many drivers of biodiversity loss and also support biodiversity objectives by creating a favourable enabling environment. The indivisible nature of the Agenda implies that achievement of all goals is necessary and also that there are constraints on the choice of pathways towards the achievement of each goal, highlighting the need for policy coherence;

(i) *Scenarios and models may be useful in informing the development and implementation of the post-2020 global biodiversity framework*. The development of the current Strategic Plan for Biodiversity 2011-2020 was informed by biodiversity scenarios including those developed for the third edition of the *Global Biodiversity Outlook*. There is also a potential for scenarios, developed at appropriate scales, to inform policymaking and implementation at national levels.

VII. SUGGESTED RECOMMENDATION

56. The Subsidiary Body on Scientific, Technical and Technological Advice may wish to adopt a recommendation along the following lines:

The Subsidiary Body on Scientific, Technical and Technological Advice

1. *Takes note* of the information provided in the note by the Executive Secretary on scenarios for the 2050 Vision for biodiversity,[46] in particular the conclusions set out in paragraph 55 thereof, and *recommends* that the Conference of the Parties at its fourteenth meeting make use of this information to inform discussions on "the long-term strategic directions to the 2050 Vision for biodiversity, and "approaches to Living in harmony with Nature";

2. *Recommends* that the Subsidiary Body on Implementation at its second meeting take this information into account in preparing proposals for the process of developing a post-2020 global biodiversity framework;

3. *Welcomes* the ongoing work of the Expert Group on Models and Scenarios of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services to develop a new set of multi-scale biodiversity scenarios through a stakeholder-driven process, noting its relevance to the process of developing a post-2020 global biodiversity framework, and *encourages* Parties, other Governments, indigenous peoples and local communities and all stakeholders to engage in this process;

4. *Requests* the Executive Secretary, when preparing proposals for the process of developing a post-2020 global biodiversity framework, to make provisions for analytical work, building on previous work and taking into account ongoing work under the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services that, among other things, addresses the following issues:

(a) The links between biodiversity and other sustainability goals and the role of the 2030 Agenda for Sustainable Development[47] in providing an enabling environment;

(b) Lessons learned from the implementation of Convention and the Strategic Plan for Biodiversity 2011-2020;[48]

(c) The possible reasons for the varying levels of progress towards the Aichi Biodiversity Targets;

(d) The possible ways in which action under the Convention could leverage the transformational change required to achieve the 2050 Vision for Biodiversity and thereby also contribute to the implementation of the 2030 Agenda for Sustainable Development.

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[46] CBD/SBSTTA/21/2.

[47] General Assembly resolution 70/1, annex.

[48] Decision X/2, annex.