Appendices

Appendix 1: More comprehensive description of methodology

This section gives a more detailed account of the methodological steps we took (cf. chapter 2). To answer the main research questions, we applied several qualitative approaches including qualitative content analysis (steps 1 - 3), semi-structured interviews (step 4), and expert workshops (step 5), thus practising method triangulation to increase the validity of our findings (Flick 2004).

Step 1: We analysed how transformative change (TC) is conceptualised in the current literature, starting with the IPBES global assessment and complementing it with the broader scholarly literature on the topic, including the seminal texts by Scoones et al. (2019), Loorbach et al. (2017), and Bulkeley et al. (2020). At the same time, we conducted a **qualitative content analysis** of selected international global assessment reports on biodiversity, forests, and marine and coastal ecosystems. Our framework emerged out of discussions based on this twofold review activity.

For the qualitative content analysis, we selected 18 global assessment reports (cf. Appendix 3) out of a list provided by GIZ. We screened all reports and then used the following selection criteria: to be included, a report had to be based on an international assessment; be written by scientists and address policy makers; be related to biodiversity, forests, or marine and coastal ecosystems; be recent (up to 5 years old); and be the latest available version when part of a series. Three of these assessment reports mainly focused on forest topics, three mainly on marine and coastal ecosystems, and 12 fall under the wider umbrella term “biodiversity”. Whenever one of these 12 general reports referred to forest or marine issues, this segment was coded accordingly and added to the analysis of the thematic reports.

In order to structure the content, we followed both a deductive and an inductive approach (Mayring 2014). We developed a coding scheme to code (i.e., manually assign one or several keywords to short text segments) the main challenges identified in each assessment report as well as the recommendations given in the reports. We also analysed the conclusions and recommendations according to their transformative potential coding with three tags derived from Scoones et al. 2019, ten tags derived from Loorbach et al. (2017) and seven tags derived from Bulkeley et al. (2020) (cf. Figure A). These codes for indications of transformative potential appear also in our conceptual framework (building blocks cf. Chapter 3); however, new codes were inductively added to the scheme as they emerged from the texts during the coding work.

The coding process was assisted by the MAXQDA software (versions 12 and 2020). The documents were coded in the “recommendations” or “conclusions” sections (where explicit) of the global assessment reports or throughout the main text (when reports lacked recommendations or concluding sections), distinguishing between “explicit” and “implicit” recommendations. For quality control of the coding process and in order to secure a common understanding in the working group, we applied a consensual coding method. Therefore, we reflected our understanding on the codes after having coded approximately 10% of the texts to enhance agreement on the coding content across coders. All authors then coded parts of the entire sample using the same coding scheme (Figure A). We proceeded to analyse 2128 coded segments from biodiversity-related assessments, 317 from forest-related assessments and 501 from the ocean assessments. All codes indicating transformative potential were double checked and when necessary re-coded by a small group that jointly discussed the content of these segments after coding was completed.

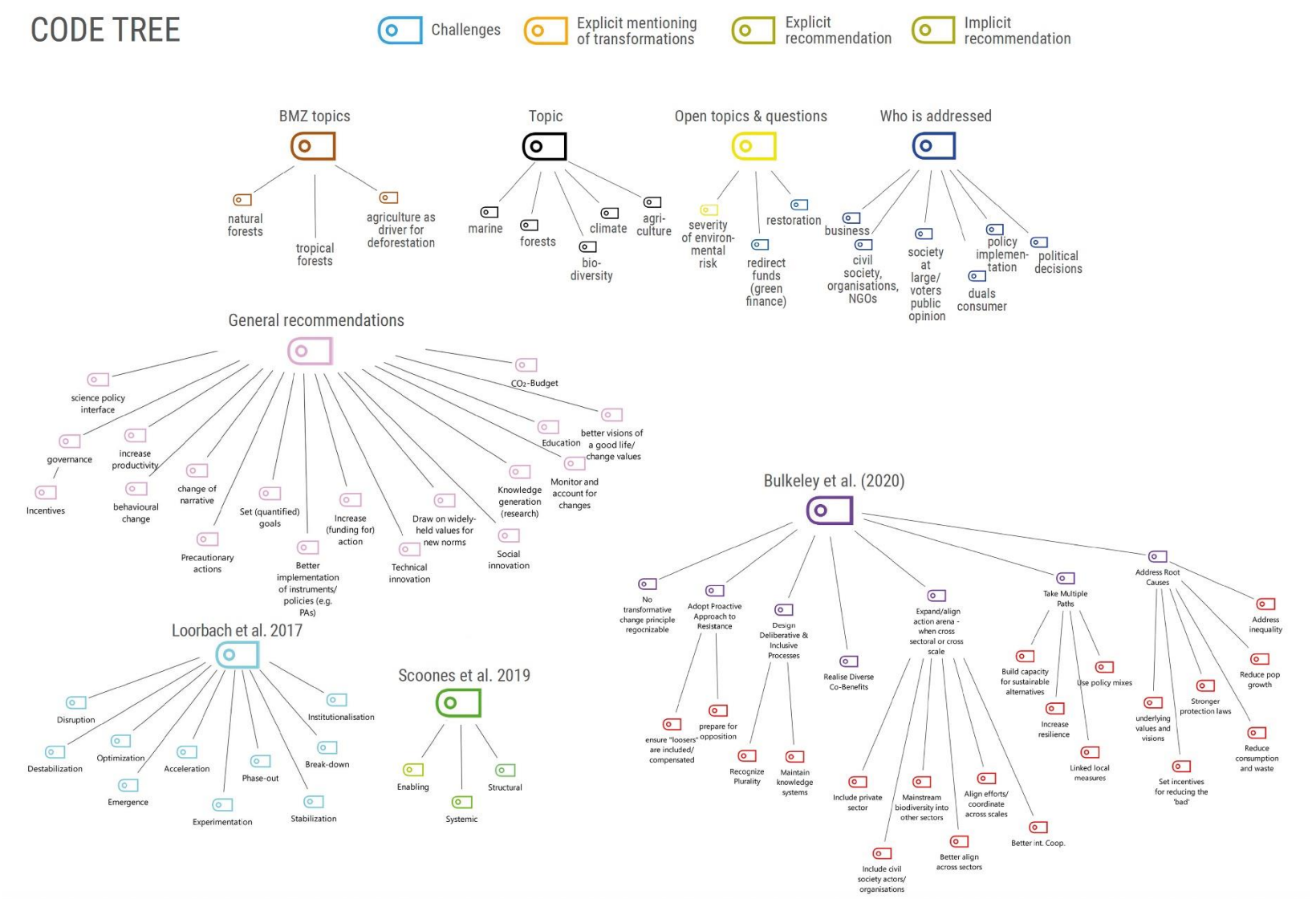

FIGURE A: Code tree

Step 2: For an initial stocktaking, we compiled all coded segments that describe challenges for biodiversity, forests, and marine and coastal ecosystems, and iteratively clustered and condensed them until we arrived at core challenges for each global common (presented in Chapter 4). Following the same inductive procedure, the central recommendations from the assessment reports were then clustered and summarised along newly defined head categories derived from the core challenges for each of the three topic areas (considering BMZ's main focus on forests and marine systems). These central recommendations, at this stage still regardless of their respective transformative potential, are summarised in Chapter 5.

Step 3: In the next step, again following a **qualitative content analysis** approach, we analysed to what extent these recommendations were transformative, either explicitly or implicitly by identifying requirements that can only be achieved via TC. All segments coded as bearing transformative potential – based on the criteria proposed by Scoones et al. (2019), Loorbach et al. (2017), and Bulkeley et al. (2020) – were now compiled according to our conceptual framework in order to determine whether and how they call for TC and what they suggest in order to encourage TC. We also probed how conclusive the recommendations were towards TC by analysing and appraising their internal consistency and identifying possible gaps when compared to the requirements specified in the conceptual framework.

FIGURE B: Qualitative content analysis (steps 1, 2 and 3), interviews (step 4) and workshops (step 5)

To fill the identified gaps, resolve inconsistencies, and enrich or specify the recommendations of the assessment reports, we compiled an analysis of more targeted reports and scientific literature on forest, marine and coastal ecosystems as well as on biodiversity and sustainability science. These were reports and publications presenting studies on global challenges which were not negotiated within intergovernmental platforms and are more targeted to specific topics, such as the Dasgupta Review on the economics of biodiversity, the IUFRO World Series on forest issues, or the Blue Paper series by the Ocean Panel on marine questions. A short description of the reports used for each of the three areas of concern can be found in Appendix 4.

Step 4: In step four we used the building blocks framework to analyse six UFZ and nine GIZ projects in terms of how they have contributed or could have contributed to TC and show how their transformative potential could have been or could still be increased. This adds a bottom-up perspective, rooted in practical experience, to the somewhat abstract conclusions of the global assessment reports. We reflected on a set of past and ongoing research and cooperation projects, in all of which UFZ or GIZ/KfW participated, in terms of how they have (or could have) contributed to TC. We selected projects working on the topics and with the approaches recommended by the assessment reports. We adapted the conceptual framework to a project context by formulating specific, open-ended questions about each building block (cf. Appendix 13). The analysis of the projects had two strands: for the IKI funded projects conducted by members of the UFZ-team the respective authors of each study answered the questions analysing their project resulting in an Excel file. For the BMZ-funded projects the lists of questions were first sent to and filled in by members of the project implementation teams. Then, based on their answers, the theory of change behind each project, and descriptions from project websites, our team prepared questions for a 90-120-minute video conference **semi-structured interview** for each of the BMZ-funded projects. The intention of both strands of this analysis was not to evaluate whether projects were successful, but to understand how future project design can better take transformative change into account. Our inquiry followed three main questions: What can be learned from practice? How do international collaboration projects take elements of transformative change into account? How could their transformative potential be enhanced? The interviews were documented in writing and analysed according to the building blocks. We summarised our interpretation by elaborating the answers to the questions and writing down key lessons learned, both of which were sent back to the interviewees for revision and approval. The lessons learned across projects are presented in chapter 7.

Step 5: Based on the first four steps and facilitated by our analytical framework, we formulated recommendations for international collaboration (international policy design and implementation) and development cooperation. These recommendations focus on how transformative change can be promoted in order to protect global environmental commons. The draft recommendations were discussed and further developed in two virtual **expert workshops** with development cooperation practitioners who had received a draft version of this report beforehand. The first workshop in January 2021 discussed the recommendations for forests and biodiversity, whereas the second workshop in March 2021 addressed the recommendations for marine and coastal ecosystems. The workshops proceeded in several discussion rounds, alternating between plenary and break-out sessions, and eventually provided a refined and peer-reviewed version of recommendations. These recommendations are elaborately described in chapter 8; chapter 9 wants to present the core of these complex and multifaceted recommendations as straightforward and applicable as possible.

Appendix 2: Block 5 of the conceptual framework: transformative governance

Will be added soon.

Appendix 3: List of assessments

Assessment	Cited as	Short descriptions
General and biodiversity assessments:		
IPBES (2019) Global Assessment Report on Biodiversity and Ecosystem Services. Summary for Policy Makers	IPBES GA SPM 2019	This is a critical assessment of the state of the natural world and its trends which have social implications. The reasons behind such trends and how the future could be better and more equitable are discussed here. The assessment takes diverse world views and knowledge systems into account, hoping to reach out to a wide spectrum of stakeholders.
IPBES (2018) Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia	IPBES ECA 2018	This assessment focuses on the issues that decision makers face when it comes to the threats to biodiversity and nature's contributions to humans. It aims to provide policymakers with information needed to better adapt to these challenges through technology, finance and behavioural changes. The importance of nature's contributions towards a good life is stressed upon in this report and it came to the conclusion that while some policies have been made to counter negative biodiversity trends, it's insufficient.
IPBES (2018) Assessment Report on Biodiversity and Ecosystem Services for the Americas	IPBES Am 2018	This report focuses on the Americas, their rich biodiversity and how that is threatened due to the rate at which resources are being used. Besides this, the report also analyses the food, water and energy security in the region, highlighting growing inequalities. It illuminates the threats biodiversity and nature face in this region due to indirect drivers such as demographic trends, economic growth, weak governance systems and inequity, while the dominant direct drivers include habitat conversion, fragmentation and overexploitation/overharvesting.
IPBES (2018) Assessment Report on Biodiversity and Ecosystem Services for Africa	IPBES Af 2018	This report focuses on Africa, finding that nature's contributions to people's lives not only ensures better quality of life but also is essential for a secure livelihood. While the continent's biodiversity can be a strategic asset, human activity and a rapidly growing population threaten it, thereby also affecting people's lives and livelihood. Land cover change due to overexploitation and habitat fragmentation has been identified as the primary cause for the same.
SCBD (2020) Global Biodiversity Outlook 5	SCBD 2020	This report is intended as a comprehensive account of the state of global biodiversity and looks back on the Aichi Targets of the CBD strategic plan concluded in 2020. It acknowledges that in order to conserve biodiversity different sectors/ policy areas need to transition. It develops this idea along 8 transitions necessary to halt the loss of biodiversity and possibly reverse this trend: (1) land and forest transition, (2) sustainable agriculture transition, (3) sustainable freshwater transition, (4) climate action transition, (5) one health transition, (6) sustainable food transition, (7) fisheries and ocean transition, (8) cities and infrastructure transition.

Assessment	Cited as	Short descriptions
IPCC (2019) Special Report Climate Change and Land Summary for Policymakers	IPCC SRCCL SPM 2019	This report primarily focuses on greenhouse gas fluxes in land-based ecosystems, land use and sustainable land management with regard to climate change adaptation, migration, desertification, land degradation and food security. This report succeeds the IPCC Special Report on Global Warming of 1.5°C (SR15), the thematic assessment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) on Land Degradation and Restoration, the IPBES Global Assessment Report on Biodiversity and Ecosystem Services, and the Global Land Outlook of the UN Convention to Combat Desertification (UNCCD), providing thereby, an updated assessment of the current state of knowledge of these issues.
FAO (2019) State of the World's Biodiversity for Food and Agriculture	FAO SWBFA 2019	This report illustrates the decline in biodiversity for food and agriculture and the ecosystem services they provide in several countries. Even the state of knowledge of several aspects of biodiversity is deemed inadequate in order to battle this decline. The report, however, does observe that practices with a focus on preserving biodiversity are gaining traction. Like most FAO assessments, this one too is country-driven, i.e., several countries participated in the reporting process, which also aided them in identifying some of the challenges and needs they have in terms of sustainable use and conservation of resources.
IPCC (2018) Special report 1,5 degree Summary for Policymakers	IPCC SR1.5 SPM 2018	This Summary for Policymakers (SPM) presents the key findings of the Special Report on the impacts of global warming of 1.5°C since pre-industrial levels which followed the UNFCCC CoP 21. The report based its analysis on available scientific, technical and socio-economic data relevant to such an increase in global temperatures, also comparing scenarios of global warming of 1.5°C and 2°C. The key findings are substantiated using IPCC calibrated language and knowledge gaps in the report are also acknowledged in this SPM.
Independent Group of Scientists appointed by the Secretary-General, Global Sustainable Development Report (2019) The Future is Now – Science for Achieving Sustainable Development (United Nations, New York, 2019).	GSDR 2019	This report, focusing on the 2030 Agenda for Sustainable Development, is written by an independent group of scientists, seeking to strengthen the science-policy interface with the implementation of the Agenda. It highlights salient knowledge for such transformations in sustainable development explicitly, addressing both government as well as various other stakeholders such as the private sector, civil society and actors in science.
Forest Assessments:		
FAO UNEP (2020) State of the World's Forests	FAO SWF 2020	This is a technical document written by the FAO and UNEP with the aim to inform about the current state of the forest resources globally and based on that, provide a comprehensive assessment regarding how these resources should be managed in the future. This report uses the concept of transformative change explicitly for a better future as well as global agreements such as the SDGs, the New York agreement and the UN restoration decade among others. Relevant topics highlighted

Assessment	Cited as	Short descriptions
		in the report include the need for change in consumption to avoid deforestation and land degradation, landscape management and monitoring, including communities and diverse knowledge and governance
NYDF (2019) Protecting and Restoring Forests: A Story of Large Commitments yet Limited Progress Five Year Assessment Report	NYDF 2019	This report strives to give a comprehensive and holistic view on the state of forests globally, taking all existing research and data on deforestation, conservation and restoration into account. The focus on poverty-driven deforestation and forest governance points to the needs of populations living in and around forests and their vulnerabilities, which often results in resource depletion. The report aims to aid the transformation in forest preservation and restoration, also providing evidence for sound policymaking when it comes to forests. The report addresses not only experts, but is also written such as to be comprehensible to the general public.
EU (2019) Mitteilung zum Schutz und der Wiederherstellung der Wälder der Welt, we have coded the German version but this publication is available in English as well: EU 2019_Stepping Up EU Action to Protect and Restore the World's Forests	EU 2019	The European Commission adopted a communication on upscaling efforts from the EU to protect and help restore the world's forests. It lists five priorities in order to achieve the same, namely, reducing EU consumptions' footprint on land and supporting products coming from deforestation-free supply chains; working with producer countries to reduce such pressures on their forests; bolstering international cooperation to halt deforestation and promote restoration; funding sustainable land-use practices; and aiding access to quality information on forests and commodity supply chains affecting them.
FAO (2020): Global Forest Resources Assessment	FAO GFRA 2020	FRA 2020 examines the status of, and trends in, more than 60 forest-related variables in 236 countries and territories in the period 1990–2020. The information provided by FRA presents a comprehensive view of the world's forests and the ways in which the resource is changing. Such a clear global picture supports the development of sound policies, practices and investments affecting forests and forestry.
WEF 2020 The Future of Nature and Business	WEF 2020	The WEF Report is targeted at the business/ private sector community. It explicitly states how business-as-usual is no longer an option and transformation is urgently needed across 3 economic sectors, namely, food, land and ocean use; infrastructure and the built environment; and energy and extractives. It describes 15 transitions in these 3 economic sectors that contribute substantially to halt the loss of biodiversity and lead to nature-positive development.
The ocean:		
IPCC (2019) Special Report on the Ocean and Cryosphere in a Changing Climate	IPCC SROCC 2019	This special report analyses new data since the IPCC 5th Assessment Report and the Special Report on Global Warming of 1.5°C to see how the ocean and cryosphere are changing due to global warming, as well as the risks and opportunities these changes bring to people and ecosystems. It also suggests mitigation and adaptation options to reduce risks in the future. This report addresses governments and observer organisations who

Assessment	Cited as	Short descriptions
		were part of the IPCC Panel discussion in 2016 and gave proposals at the time.
UN (2016) World Ocean Assessment I	WOA 2016	This assessment is the result of the first cycle of the regular process for global reporting and assessment of the state of the marine environment, including socioeconomic aspects. It examines the knowledge humans have about the oceans and how our activity affects them. The analyses show that the world's oceans are in urgent need for protection from the various pressures they face. This assessment aims to provide a scientific basis for all governments, intergovernmental organisations and policy-makers in order to make informed decisions in ocean affairs.
FAO (2020) The State of World Fisheries and Aquaculture (SOFIA)	FAO SOFIA 2020	This report illustrates the salient role that fisheries and aquaculture play in providing both nutrition and employment while also pointing out the biggest challenges these industries face. Examples of the positive effects of appropriate management of fish stocks are shown, however, it is also observed that such successes are neither homogeneous globally, nor have helped to reverse the trend of overfishing. This report thereby calls upon replication of successful policies, adapting to the specific needs of fisheries and also new mechanisms to support successful implementation of the same.

Appendix 4: Further reports to take into consideration

Reports	cited as	Short descriptions
Dasgupta et al. (2020) The Dasgupta Review: Independent Review on the Economics of Biodiversity	Dasgupta Interim 2020	This independent Review primarily focuses on humans' engagement with Nature and the sustainability of such interactions – understanding what we take from nature, how we use it and return it, why we have disturbed Nature's processes and what urgent actions are required to protect and promote our collective health and wealth, as well as that of our future generations. This interim report provides the approach the Review is adopting and includes the significant economic and scientific concepts which support its work.
Dasgupta et al. (2021) The Economics of Biodiversity: The Dasgupta Review. Abridged Version	Dasgupta et al. 2021	This independent Review primarily focuses on humans' engagement with Nature and the sustainability of such interactions – understanding what we take from nature, how we use it and return it, why we have disturbed Nature's processes and what urgent actions are required to protect and promote our collective health and wealth, as well as that of our future generations. This Abridged Version aims to provide a shortened non-mathematical monograph of the Final Report and the target audience is identified as the "concerned citizen".
GFW (2020) We Lost a Football Pitch of Primary Rainforest Every 6 Seconds in 2019	GFW 2020	This report, supported by data from the University of Maryland, addresses the issue of rampant deforestation of the world's primary rainforests. The resulting loss of biodiversity and carbon storage is stressed upon in this report, which considers several global examples for the same. While there has been a reduction in forest loss in Colombia, West Africa and Indonesia observed recently, the deforestation in Bolivia, Brazil, Australia and Central Africa illustrates the urgency to protect such forests.
IUFRO (2005) World Series Vol. 15 – Meeting the Challenge: Silvicultural Research in a Changing World	IUFRO vol.15 2005	This IUFRO World Series volume stems from the conference in 2004, "Meeting the Challenge: Silvicultural Research in a Changing World". It contains extended abstracts of over 60 papers which were presented during this conference, which explored the changing role of silviculture, according to challenges it faced globally and the needs it aimed to meet. Through the presentation of their papers, participants illustrated how new research techniques could be used to tackle emerging forest management issues.
IUFRO (2005) World Series Vol. 17 - Forests in the Global Balance	IUFRO vol.17 2005	This book aims to contemplate on how changing paradigms are reflecting in the field of forestry and analyses concerns regarding the same. It looks at the role of forests and forestry, as well as the pressures they face both globally and regionally, and also examines various cross-cutting issues in sustainable forest management. It also provides suggestions for better governance of forest resources, for promoting forest-based livelihoods and diversifying the functions of planted forests among others.

Reports	cited as	Short descriptions
IUFRO (2008) World Series Vol. 21 – Sustainable Forest Management and Poverty Alleviation: Roles of Traditional Forest-related Knowledge	IUFRO vol.21 2008	This World Series presents extended abstracts from the 2007 conference on "Sustainable Forest Management and Poverty Alleviation: Roles of Traditional Forest-related Knowledge" by the IUFRO Task Force on Traditional Forest Knowledge. Traditional Forest-Related Knowledge (TFRK) has been acknowledged to have vital implications for biodiversity conservation and forest management and this conference highlighted the same. Recognising the potential of TFRK and protecting it within forest science was a central topic in the conference.
IUFRO (2009) World Series Vol. 22 - Adaptation of Forests and People to Climate Change. A Global Assessment Report	IUFRO vol.22 2009	This report is the first product of the Global Forest Expert Panels of the Collaborative Partnership on Forests (CPF), presenting knowledge on the impacts climate change has had on both forests and people, while also exploring possible adaptation options for the same. One of the most important findings was that the carbon-regulating services of forests are currently under threat of being lost entirely, if global carbon emissions aren't regulated soon. If this is not prevented, climate change would be accelerated due to the release of huge amounts of carbon dioxide into the atmosphere. The authors, co-authors and reviewers of this assessment were scientists and experts in forest-related disciplines from all around the world.
IUFRO (2010) World Series Vol. 25 - Forests and Society – Responding to Global Drivers of Change	IUFRO vol.25 2010	This 25th volume of the IUFRO World Series resulted from wanting to understand the challenges, threats and opportunities the forest sector is facing due to societal and climate change. The primary aim of this report was to identify the main drivers – both direct and indirect – of such change and propose ways to either reduce their repercussions on forests or take advantage of their benefits. Several case studies from around the globe illustrating the society's efforts to combat or adapt to such drivers of change have been included in this report.
IUFRO (2011) World Series Vol. 28 - "Embracing Complexity: Meeting the Challenges of International Forest Governance"	IUFRO vol.28 2010	This volume assessed the international efforts being made towards improving forestry governance, identifying that such global efforts have often neither taken specific local needs into account nor considered external economic pressures that lead to deforestation. The report thereby recommends options to deal with such complexity and ensure effective forest governance at not only the global, but also the regional, national and local levels.
IUFRO (2012) World Series Vol. 31 - Understanding Relationships between Biodiversity, Carbon, Forests and People	IUFRO vol.31 2012	This report evaluates the effects of forest and land management interventions contemplated under REDD+ summarising relevant scientific literature on the complex relationships between biodiversity and forest ecosystem services – such as carbon storage. It shows how these complex relationships are affected by the REDD+'s aims, the trade-offs and synergies among environmental and socio-economic objectives and their relationship to issues of governance. This report's findings also informed the policy brief "REDD+, Biodiversity and People: Opportunities and Risks", which is intended especially for policy- and decision-makers.

Reports	cited as	Short descriptions
IUFRO (2015) World Series Vol. 32 - Forests under pressure: Local responses to global issues	IUFRO vol.32 2014	This World Series emerged from the IUFRO-WFSE Steering Committee (SC) meetings in Vienna (2011) and Helsinki (2012). The SC found that the aspects which positively or negatively affect sustainable forest management (SFM) are still not well understood. Given that SFM is an integral part of sustainable management of natural resources in the endeavour to mitigate climate change, this report aims to improve the understanding of the conditions which nurture or hamper SFM. The focus here is on the conditions at the local level, alongside considering processes at the national and global scales.
IUFRO (2015) World Series Vol. 33 - Forests, Trees and Landscapes for Food Security and Nutrition. A Global Assessment Report	IUFRO vol.33 2015	The report primarily stresses upon the salience of policy coherence and integration, with the eradication of hunger, realisation of food security and the improvement of nutrition as focal points. These points of focus are a result of the post-2015 development agenda of the United Nations, which was around the time of this report being published. Extensive scientific data on the potential of forests, trees and landscapes in solving the impending problem of global food security is provided in this assessment.
IUFRO (2015) World Series Vol. 34 - Forest Landscape Restoration as a Key Component of Climate Change Mitigation and Adaptation	IUFRO vol.34 2015	In this report, by analysing restoration case studies and relevant literature, a framework was developed to illustrate how Forest Landscape Restoration (FLR) can aid in climate change adaptation and mitigation. This assessment showed the different ways where FLR significantly contributed to climate change mitigation, thereby reducing drastic effects on society. Additionally, a stoplight tool was developed to present complex restoration proposals better, showing how they may contribute to climate change adaptation in a specific local context.
IUFRO (2016) World Series Vol. 35 - Illegal Logging and Related Timber Trade – Dimensions, Drivers, Impacts and Responses. A Global Scientific Rapid Response Assessment Report	IUFRO vol.35 2016	In its aim to gain deeper understanding of illegal logging and timber trade, its causes and effects, this report provides a comprehensive overview of available scientific knowledge on the same. In addition, new perspectives such as a criminology one and new data about timber and its product trade flows are shared. Using this data, the report also considers future policy choices and resulting responses from the government.
IUFRO (2018) World Series Vol. 38 - Forest and Water on a Changing Planet: Vulnerability, Adaptation and Governance Opportunities	IUFRO vol.38 2018	This assessment, which is contextualised in the 17 Sustainable Development Goals (SDGs), explores the forests-water-climate-people link. All the 17 SDGs are dependent on water and forests also share an inseparable link with water. Hence, this report illustrates the importance of ensuring access to water for all and the integrated action required for the same, underlining the salient linkages between forests and water.
IUFRO (2020) World Series Vol. 39 - Forests, Trees and the Eradication of Poverty: Potential and Limitations	IUFRO vol.39 2020	This assessment provides comprehensive information on available scientific data about the linkages between forests and poverty. The 17 Sustainable Development Goals (SDGs) shape this report, with the links and interactions between SGD 1 on ending poverty and SDG 15 on life on land being the prime focus alongside other SDGs.

Reports	cited as	Short descriptions
OECD (2020) A Comprehensive Overview of Global Biodiversity Finance	OECD 2020	This report follows the OECD's 2019 report to the G7 Environment Ministers on "Biodiversity: Finance and the Business and Economic Case for Action", focusing on reaching governments and the private sector by addressing an information gap regarding global biodiversity finance flows. It provides a comprehensive summary of the same alongside an aggregate estimate of global biodiversity finance. The report also illustrates how government support could harm biodiversity and recommends methods to improve the analysis, tracking and reporting of biodiversity finance.
OECD (2019) Biodiversity Financing and Economic and Business Case for Action	OECD 2019	This report primarily aims at advising the G7 countries on economic and business efforts to tackle the challenge of protecting biodiversity. Alongside assessing existing biodiversity-related finance flows, it also pinpoints key indicator gaps which need to be addressed to aid monitoring of the causes of and actions to prevent biodiversity loss. Lastly, it gives recommendations in order to increase action to protect biodiversity.
WPN (2019): Forests as Global Commons International Governance and the role of Germany	WPN 2019	In this study, the primary aspects of International Forest Governance (IFG) – such as promoting sustainable forest management and protection, as well as its impacts on combating deforestation, degradation and biodiversity loss, amongst others – are analysed. Based on a comprehensive literature review, these elements of IFG are categorised into six types, which are then studied in terms of their effectiveness with regard to state and non-state actors. The need and opportunities for transformative changes to protect the forests' function as global commons is thereby stressed upon.
Walker et. al. (2020) The role of forest conversion, degradation, and disturbance in the carbon dynamics of Amazon indigenous territories and protected areas	Walker et. al. 2020	This report focuses on forest degradation in and around the Amazon's protected areas, given evidence showing how indigenous peoples and local communities (IPLCs) act as buffers against large carbon emissions in such areas. Data on changes in aboveground carbon density and forest cover are used to monitor gains and losses in carbon density from forest conversion as well as degradation. It was found that while indigenous territories (ITs) and protected natural areas (PNAs) stored a significant amount of carbon, nearly one billion tons of carbon was lost from those areas in 2016 due to degradation. This report therefore illustrates how acknowledging the IPLCs' services in the Amazon and protecting them is critical to the countries in the Amazon basin achieving their Paris Climate Agreement goals.
UNEP (2019) Frontiers 2018/2019. Emerging Issues of Environmental Concern	UNEP Frontiers 2019	This Environment Frontiers series from the UNEP strives to link latest science to action-oriented policies in the context of the health of the environment and its sustainability. This report covers five key current problems, namely, the latest developments in synthetic biology, the critical advantages of landscape connectivity, the complex interactions and vulnerability of permafrost peatlands, the challenges of widespread nitrogen pollution, and the hazards of maladaptation in a world of

Reports	cited as	Short descriptions
		climate change. The benefits and challenges of these issues are discussed in detail in this report.
Haddad et. al (2015) Habitat fragmentation and its lasting impact on Earth's ecosystems	Haddad et. al 2015	This report stemmed from an analysis of global forest cover which revealed that 70% of the world's remaining forests are within 1 km from the forest's edge, indicating the high risk of them suffering degradation due to fragmentation. After several experiments regarding fragmentation, it was found that habitat fragmentation reduces biodiversity largely and impairs key ecosystem functions due to biomass loss and changing nutrient cycles. Hence, it is stressed upon to focus on conservation and landscape connectivity in order to reduce extinction rates and help maintain ecosystem services.
EASAC (2020) Towards a sustainable future: transformative change and post-COVID-19 priorities	EASAC 2020	This report aims to aid policymakers in their understanding of the underlying scientific aspects of transformative change, so as to help better recognise the political choices facing Europe and the globe. In order to do so, the trends calling for such 'transformative/ transformational change' are summarised, focusing on failures at both the systemic and structural level which are driving the current unsustainable development. Following this, the practical aspects of redesigning and redirecting societies are described and ultimately, the implications for the European Union's post-COVID-19 policies are drawn out.
UNEP-Report (2020) COVID19, the Environment, and Food Systems: Contain, Cope, Restart and Build Back Better	UNEP Covid-19 2020	This report examines the impacts of COVID-19 on the food systems-environment nexus. It suggests options for governments and international agencies alike to mitigate said impacts and promote resilience and sustainability in food systems. It advises to employ policies and investments which take environmental trade-offs into account and promote food security alongside protecting rural livelihoods and acknowledging existing inequalities and injustices.
OHCHR (2019) Issue of human rights obligations related to environment	OHCHR 2019	This report reflects on how while the right to a healthy environment has been enshrined in the constitutions of several countries around the world, it has not been recognised on a global level as much. In this report, the Special Rapporteur focuses on air pollution and its negative impact on many human rights – such as the right to life and the right to health – particularly in the case of vulnerable populations. Various obligations of the state with regards to the same, examples of good practices and recommendations for states and businesses to reduce air pollution are summarised in this report.
FAO (2019) Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. *A Report by the High Level Panel of Experts on Food Security and*	FAO HLP 2019	The High Level Panel of Experts (HLPE) in this report explores the potential agroecological and innovative approaches can have in the context of strengthening sustainable food systems, thereby enhancing food security and nutrition (FSN). They employ a multiscale perspective, focusing on transition and transformation in FSN, finding that several transitions need to take place in both production systems and across the food value chain in order to achieve transformation on a system level. In

Reports	cited as	Short descriptions
Nutrition of the Committee on World Food Security		order to achieve such transformation of the global food system, such transitions need to be coordinated and integrated at different scales, taking norms and institutions into consideration.
Oxfam (2020) Uneven Ground- Land Inequality at the heart of unequal societies	Oxfam 2020	Analysis of recent data has shown how land inequality is growing – jeopardising the livelihoods of several billion rural people who practice smallholder agriculture. It is this group and the work of the International Land Coalition that this report focuses on. Several groups such as indigenous people, women and youth are being marginalised and greater land is going to fewer more powerful actors, serving corporate and industrial interests and production patterns. This not only affects smallholder agriculture but also destabilises sustainable development of societies, affecting large populations.
Swiss Re Institute (2020) Biodiversity and Ecosystem services; A business case for re/insurance,	SRI 2020	This report strives to illuminate the impact biodiversity risks have on the economy. From their own data, the Swiss Re Institute observed that 55% of the global GDP is either moderately or highly dependent on Biodiversity and Ecosystem Services (BES). Hence any loss of BES will result in significant losses in the economy too. To help assess the various complex risks that BES face, this report encompasses a BES Index. This index, alongside illustrating the risks that BES face globally, also aids the process of integrating insurance relevant BES factors into business decision-making, thereby providing related benchmarks. Using this tool, companies have the possibility to manage and understand various risks related to BES decline on the one hand, while being able to develop strategies to protect businesses, society and the environment on the other.
IAASTD +10 Advisory Group (2020) Transformation of our food systems – the making of a paradigm shift	IAASTD +10 2020	This book comprises a collection of short essays which analyse selected landmark reports inspired by the IAASTD (International Assessment of Agricultural Knowledge, Science and Technology for Development), originating from the common concern for our food systems and changing how food is produced. It emphasises how a new food system narrative has been established since 2008, which is vastly different from the post-war narrative supporting chemicals, which dominates mainstream farming till now. The book also encompasses several articles on various subjects such as trade, corporate concentration and proprietary strategies, urbanization, innovation, and indigenous community-based research.
Global Alliance for the Future of Food (2016) Future of Food: Seeds of Resilience - A Compendium of Perspectives on Agricultural Biodiversity from around the World - Synthesis of Findings	GAFF 2016	This report summarises various perspectives, experiences and current research related to agricultural biodiversity and seed systems. The strong beliefs and philosophies attached to seed systems are both acknowledged and explored in this report. Various actors such as farmers, seed companies, academics and others' opinions have been included here.

Reports	cited as	Short descriptions
Global Alliance for the Future of Food (2017) The Future of Food in a Climate Changing World: 2nd International Dialogue Summary Report	GAFF 2017	The Global Alliance for the Future of Food hosted its second 2nd International Dialogue in May 2017 on 'The Future of Food in a Climate Changing World', which brought over 250 experts from local and global levels together. They shared their knowledge about the connections between climate change and food systems to understand the food systems that are required for current challenges as well as the ways to achieve the same. This report provides a comprehensive overview of this dialogue, the opportunities which were discussed and the potential actions required to transition into a more sustainable, equitable and secure future for food.
Global Alliance for the Future of Food (2019) Resilient Seed Systems - Shared Action Framework	GAFF 2019	The Global Alliance for the Future of Food acknowledges resilient seed systems as central to sustainable food systems as well as the urgent need to maintain and support agricultural biodiversity, given the critical and complex global challenges of climate change and food security. From discussions at a strategic convening on resilient seed systems held in Oaxaca, Mexico in 2018, salient issues were identified and guiding principles were developed. This led to the development of this Shared Action Framework, in order to accelerate actions which strengthen and protect agricultural biodiversity and support resilient seed systems. This framework, besides providing guidance for diverse stakeholders who are interested in employing a holistic and collaborative approach to enhance the resilience of seed systems, also highlights the benefits of such resilient systems in tackling such complex global challenges.
Cottrell, J., Meyer, E., & Koch, V. (2019). Financing Sustainable Development through green Fiscal Reform; Successful examples of GIZ support in partner countries.	Cottrell et al. (2019)	In its explanation of GFR (Green Fiscal Reform) the GIZ pictures the meaning, implementation and case studies of GRF. Which is defined as "a range of taxation and pricing measures which can raise fiscal revenues while furthering environmental goals" (IBRD – World Bank, 2005). It comprises a variety of policy instruments including taxes, fees and charges, emissions trading schemes and reform of environmentally harmful subsidies. GFR corrects market failures by including the costs of environmental damage – e.g. pollution, greenhouse gas emissions (GHG), health impacts – in the price of goods and services. This creates a price incentive for all economic actors to consume, behave and invest more sustainably.
UNEP (2021) Making Peace with Nature: a scientific blueprint to tackle the climate, biodiversity and pollution emergencies report	UNEP MPN 2021	This report, synthesising evidence based on global environmental assessments, presents a scientific blueprint for how climate change, biodiversity loss and pollution may be jointly tackled and mitigated within the framework of the Sustainable Developments Goals. The report was compiled by an eminent group of experts and advisors who shared their understanding of the science-policy interface in the context of dealing with environmental challenges.

Reports	cited as	Short descriptions
HLP for a Sustainable Ocean Economy (2019) The Future of Food from the Sea	HLP SOE FFS 2019	This report, also a part of the Blue Paper series, deals with the complex challenge of feeding the world's growing population in a nutritious, sustainable and economically viable manner. This Blue Paper confirms that ocean food production systems are vital in global food and nutrition security. It is found that through better management of wild fisheries and the sustainable development of marine aquaculture, the ocean could potentially supply over six times more food than it does presently, while also aiding the restoration of marine ecosystems. This finding is aimed to elicit responsive action from governments, financial institutions and businesses, who need to also understand the urgency of the situation, both for global food security and the health of marine ecosystems.
HLP for a Sustainable Ocean Economy (2019) The Expected Impacts of Climate Change on the Ocean Economy	HLP SOE ICCOE 2019	This report, drawing from the Intergovernmental Panel on Climate Change's Special Report on the Ocean and Cryosphere in a Changing Climate, focuses on the serious economic consequences of climate change for ocean industries, also assessing the adaptations which will be required across salient parts of the ocean economy to ensure continued benefits. The paper confirms the vital functions of the ocean economy to global health and wealth, highlighting how losing the same is unaffordable for society. Several flexible and responsive strategies as well as plans for better management of ocean ecosystems are provided in this paper.
HLP for a Sustainable Ocean Economy (2020) Ocean Finance: Financing the Transition to a Sustainable Ocean Economy	HLP SOE OF 2020	This paper examines how the new generation of financing mechanisms can support the transition to a sustainable ocean economy and how funds can be mobilised to finance this transition. The role insurance can play in accelerating such transition and how ocean-related subsidies can either boost or diminish the sustainable ocean economy are shown in this report. Lastly, this paper identifies approaches which need to be phased out as well as novel solutions encourage sustainable ocean management.
HLP for a Sustainable Ocean Economy (2020) The Ocean Transition: What to learn from System Transitions	HLP SOE OT 2020	As governance is recognised as one of the key catalysts for sustainable transformation, this paper focuses on understanding the changes required in governance systems to encourage sustainability transformations in the context of oceans. It is found that governance focusing on global commons, like the oceans, are not enough and further interlinkages are required among governance systems, scales and sectors. This paper addresses the challenge of governing the oceans as a global commons by examining emerging transition dynamics needed to achieve appropriate governance configurations for future. Hence, several relevant guidelines on transitioning to a sustainable ocean economy may be found in this paper.
HLP for a Sustainable Ocean Economy (2020) Towards Ocean Equity	HLP SOE OE 2020	This paper is published in the context of a time where unfair inequitable policies are being challenged in society and hence puts people at the centre as it strives to find equitable solutions. It examines the role such equity plays in achieving a sustainable ocean economy, which can provide for current and

Reports	cited as	Short descriptions
		future generations and fairly share the benefits of ocean industries. While it is acknowledged that attaining such equity will take time, some pathways to begin with the same are shared in this paper.
HLP for a Sustainable Ocean Economy (2020) Leveraging Multi-Target Strategies to Address Plastic Pollution in the Context of an Already Stressed Ocean	HLP SOE PP 2020	This paper examines the leakage of plastics and other pollutants into the ocean and the resulting impacts on marine ecosystems, human health and the economy. The paper comments on the kind of regenerative global industry that needs to be built, as well as integrated solutions to reduce all pollutants of the ocean. The role of science-based targets for measuring progress on ocean pollution is considered in a constellation of solutions to ocean pollution.
FAO (2019). The State of Food Security and Nutrition in the World. Safeguarding against economic slowdowns and downturns.	FAO (2019)	The State of Food Security and Nutrition in the World is an annual flagship report jointly prepared by FAO, IFAD, UNICEF, WFP and WHO to inform on progress towards ending hunger, achieving food security and improving nutrition and to provide in-depth analysis on key challenges for achieving this goal in the context of the 2030 Agenda for Sustainable Development. The report targets a wide audience, including policy-makers, international organizations, academic institutions and the general public.
World Bank. (2018). Piecing Together the Poverty Puzzle. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1330-6	World Bank 2018	The World Bank Group has two overarching goals: End extreme poverty by 2030 and promote shared prosperity by boosting the incomes of the bottom 40 percent of the population in each economy. As this year's Poverty and Shared Prosperity report documents, the world continues to make progress toward these goals.

Appendix 5: Actions and pathways for achieving sustainability (Table from: IPBES 2019: 44-47)

Table SPM 1 Approaches for sustainability and possible actions and pathways for achieving them. The appropriateness and relevance of different approaches varies according to place, system, decision-making process and scale. The list of actions and pathways in the following table is illustrative rather than exhaustive and uses examples from the assessment report.

Approaches for sustainability	Possible actions and pathways to achieve transformative change Key actors: (IG=intergovernmental organizations, G=Governments, NGOs =non-governmental organizations, CG=citizen and community groups, IPLC = indigenous peoples and local communities, D=donor agencies, SO=science and educational organizations, P=private sector)
Enabling integrative governance to ensure policy coherence and effectiveness	• Implementing **cross-sectoral approaches** that consider linkages and interconnections between sectoral policies and actions (e.g., IG, G, D, IPLC) {6.2} {D1}. • **Mainstreaming biodiversity** within and across different sectors (e.g., agriculture, forestry, fisheries, mining, tourism) (e.g., IG, G, NGO, IPLC, CG, P, D) {6.2, 6.3.5.2} {D5}. • **Encouraging integrated planning and management for sustainability at the landscape and seascape levels** (e.g., IG, G, D) {6.3.2} {D5}. • **Incorporating environmental and socioeconomic impacts**, including externalities, into public and private decision-making (e.g., IG, G, P) {5.4.1.6} {B5}. • **Improving existing policy instruments** and using them strategically and synergistically in smart policy mixes (e.g., IG, G) {6.2, 6.3.2, 6.3.3.3.1, 6.3.4.6, 6.3.5.1, 6.3.6.1} {D4}.
Promoting inclusive governance approaches through stakeholder engagement and the inclusion of indigenous peoples and local communities to ensure equity and participation	• **Recognizing and enabling the expression of different value systems and diverse interests** while formulating and implementing policies and actions (e.g., IG, G, IPLCs, CG, NGO, SO, D) {6.2} {B5, D5}. • **Enabling the inclusion and participation** of indigenous peoples and local communities, and women and girls in environmental governance and **recognizing and respecting the knowledge, innovations, and practices, institutions and values** of indigenous peoples and local communities, in accordance with national legislation (e.g., G, IPLC, P) {6.2, 6.2.4.4} {D5}. • **Facilitating national recognition for land tenure, access and resource rights** in accordance with national legislation, and the application of **free, prior and informed consent and fair and equitable benefit-sharing arising from their use** (e.g., G, IPLC, P) {D5}. • Improving **collaboration and participation among** indigenous peoples and local communities, other relevant stakeholders, policymakers and scientists to generate novel ways of conceptualizing and achieving transformative change towards sustainability (e.g., G, IG, D, IPLC, CG, SO) {D5}.
Practicing informed governance for nature and nature's contributions to people	• **Improving the documentation of nature** (e.g., biodiversity inventory and other inventories) **and the assessment of the multiple values of nature, including the valuation of natural capital** by both private and public entities (e.g., SO, D, G, IG, P) {6.2} {D2}. • **Improving the monitoring and enforcement** of existing laws and policies through **better documentation and information-sharing** and **regular, informed and adaptive readjustments** to ensure transparent and enhanced results as appropriate (e.g., IG, G, IPLC, P) {D2}. • Advancing knowledge co-production and **including and recognizing different types of knowledge**, including indigenous and local knowledge and education, that enhances the legitimacy and effectiveness of environmental policies (e.g., SO, IG, G, D) {B6, D3}.

Approaches for sustainability	Possible actions and pathways to achieve transformative change Key actors: (IG=intergovernmental organizations, G=Governments, NGOs =non-governmental organizations, CG=citizen and community groups, IPLC = indigenous peoples and local communities, D=donor agencies, SO=science and educational organizations, P=private sector)
Promoting adaptive governance and management	• **Enabling locally tailored choices** about conservation, restoration, sustainable use and development connectivity that account for uncertainty in environmental conditions and scenarios of climate change (e.g., G, IPLC, CG, P) {D3}. • **Promoting public access to relevant information as appropriate** in decision-making and responsiveness to assessments by improving monitoring, including setting goals and objectives with multiple relevant stakeholders, who often have competing interests (e.g., IG, G). • **Promoting awareness-raising activities** around the principles of adaptive management, including through using short, medium and long-term goals that are regularly reassessed towards international targets (e.g., IG, G, SO, CG, D) {D4}. • Piloting and testing **well-designed policy innovations** that experiment with scales and models (e.g., G, D, SO, CG, IPLC) {D4}. • Increasing the **effectiveness of current and future international biodiversity targets and goals** (such as those of the post-2020 global biodiversity framework and of the Sustainable Development Goals), (e.g., IG, G, D) {6.2, 6.4}.
Managing sustainable and multifunctional landscapes and seascapes and some of the actions they may entail	
Producing and consuming food sustainably	• **Promoting sustainable agricultural practices**, including good agricultural practices, agroecology, among others, multifunctional landscape planning and cross-sectoral integrated management {6.3.2}. • **Sustainable use of genetic resources in agriculture**, including by conserving gene diversity, varieties, cultivars, breeds, landraces and species (e.g., SO, IPLC, CG) {6.3.2.1} {A6}. • **Promoting the use of biodiversity-friendly management practices** in crop and livestock production, forestry, fisheries and aquaculture, including, where relevant, the use of traditional management practices associated with indigenous peoples and local communities {6.3.2.1} {D6}. • **Promoting areas of natural or semi-natural habitat** within and around production systems, including those that are intensively managed, and restoring or reconnecting damaged or fragmented habitats where necessary {6.3.2.1} {D6}. • Improving **food market transparency** (e.g., traceability of biodiversity impacts, transparency in supply chains) through tools such as labelling and sustainability certification. • **Improving equity in food distribution and in the localization of food systems**, where appropriate and where beneficial to nature or nature's contributions to people (NCP). • **Reducing food waste from production to consumption.** • Promoting **sustainable and healthy diets** {6.3.2.1} {D6}.
Integrating multiple uses for sustainable forests	• Promoting **multifunctional, multi-use and multi-stakeholder approaches and improving community-based approaches** to forest governance and management to achieve sustainable forest management (e.g., IG, G, CG, IPLC, D, SO, P) {6.3.2.2} {A4}. • Supporting the **reforestation and ecological restoration** of degraded forest habitats with appropriate species, giving priority to native species (e.g., G, IPLC, CG, D, SO) {6.3.2.2} {A4}. • **Promoting and strengthening community-based management and governance, including customary institutions and management systems, and co-management**

Approaches for sustainability	Possible actions and pathways to achieve transformative change Key actors: (IG=intergovernmental organizations, G=Governments, NGOs =non-governmental organizations, CG=citizen and community groups, IPLC = indigenous peoples and local communities, D=donor agencies, SO=science and educational organizations, P=private sector)
	regimes involving indigenous peoples and local communities (e.g., IG, G, CG, IPLC, D, SO, P) {6.3.2.2} {D5}. • **Reducing the negative impact of** unsustainable **logging** by improving and implementing sustainable forest management, and **addressing illegal logging** (e.g., IG, G, NGO, P) {6.3.2.2} {D1}. • **Increasing efficiency in forest product use**, including incentives for adding value to forest products (such as sustainability labelling or public procurement policies), as well as promoting intensive production in wellmanaged forests so as to reduce pressures elsewhere (e.g., P, D, NGO) {6.3.2.2} {B1}.
Conserving, effectively managing and sustainably using terrestrial landscapes	• **Supporting, expanding and promoting effectively managed and ecologically representative networks** of well-connected protected areas and other multifunctional conservation areas, such as other effective areabased conservation measures (e.g., IG, G, IPLC, CG, D) {3.2.1, 6.3.2.3} {C1, D7}. • **Using extensive, proactive and participatory landscape-scale spatial planning** to prioritize land uses that balance and further safeguard nature and **to protect and manage key biodiversity areas** and other important sites for present and future biodiversity (e.g., IG, G, D) {B1, D7}. • Managing and restoring biodiversity beyond protected areas, (e.g., IG, G, CG, IPLC, P, NGO, D) {B1}. • **Developing robust and inclusive decision-making processes** that facilitate the positive contributions of indigenous peoples and local communities to sustainability by incorporating locally-attuned management systems and indigenous and local knowledge {B6, D5}. • **Improving and expanding the levels of financial support** for conservation and sustainable use through a variety of innovative options, including through partnerships with the private sector {6.3.2.5} {D5, D7, D10}. • **Prioritizing land-based adaptation and mitigation measures that do not have negative impacts on biodiversity** (e.g., reducing deforestation, restoring land and ecosystems, improving the management of agricultural systems such as soil carbon, and preventing the degradation of wetlands and peatlands) {D8}. • **Monitoring the effectiveness and impacts of protected areas** and other effective area-based conservation measures.
Promoting sustainable governance and management of seascapes, oceans and marine systems	• Promoting shared and **integrated ocean governance, including for biodiversity, beyond national jurisdictions** (e.g., IG, G, NGO, P, SO, D) {6.3.3.2} {D7}. • **Expanding, connecting and effectively managing marine protected area networks** (e.g., IG, G, IPLC, CG {5.3.2.3} {D7}, including protecting and managing priority marine key biodiversity areas and other important sites for present and future biodiversity, and **increasing protection and connectivity.** • **Promoting the conservation and/or restoration of marine ecosystems** through rebuilding overfished stocks; preventing, deterring and eliminating illegal, unreported and unregulated fishing; encouraging ecosystem-based fisheries management; and controlling pollution through the removal of derelict gear and through addressing plastics pollution (e.g., IG, G, P, IPLC, CG, SO, D) {B1, D7}. • **Promoting ecological restoration, remediation and the multifunctionality of coastal structures**, including through marine spatial planning (e.g., IG, G, NGO, P, CG, IPLC, SO, D) {6.3.3.3.1} {B1, D7}. • Integrating **ecological functionality concerns into the planning phase of coastal construction** (e.g., IG, G, NGO, P, CG, IPLC, SO, D) {6.3.3.3.1} {B1, D7}.

Approaches for sustainability	Possible actions and pathways to achieve transformative change Key actors: (IG=intergovernmental organizations, G=Governments, NGOs =non-governmental organizations, CG=citizen and community groups, IPLC = indigenous peoples and local communities, D=donor agencies, SO=science and educational organizations, P=private sector)
	• **Expanding multi-sectoral cooperation** by increasing and improving corporate social responsibility measures and regulation in building and construction standards, and eco-labelling and best practices (e.g., IG, G, NGO, P, CG, IPLC, SO, D) {6.3.3.3.1} {B1, D7}.
Promoting sustainable governance and management of seascapes, oceans and marine systems	• **Encouraging effective fishery reform strategies** through incentives with positive impacts on biodiversity and through the removal of environmentally harmful subsidies (e.g., IG, G) {6.3.3.2} {D7}. • **Reducing the environmental impacts of aquaculture** by voluntary certification and by using best practices in fisheries and aquaculture production methods (e.g., G, IPLC, NGO, P) {6.3.3.3.2, 6.3.3.3.5} {B1, D7}. • **Reducing point and nonpoint source pollution**, including by managing marine microplastic and macroplastic pollution through effective waste management, incentives and innovation (e.g., G, P, NGO) {6.3.3.3.1} {B1, D7}. • **Increasing ocean conservation funding** (e.g., G, D, P) {6.3.3.1.3} {D7}.
Improving freshwater management, protection and connectivity	• **Integrating water resource management and landscape planning**, including through increased protection and connectivity of freshwater ecosystems, improving transboundary water cooperation and management, addressing the impacts of fragmentation caused by dams and diversions, and incorporating regional analyses of the water cycle (e.g., IG, G, IPLC, CG, NGO, D, SO, P) {6.3.4.6, 6.3.4.7} {B1}. • **Supporting inclusive water governance,** e.g., through developing and implementing invasive alien species management with relevant stakeholders (e.g., IG, G, IPLC, CG, NGO, D, SO, P) {6.3.4.3} {D4}. • **Supporting co-management regimes for collaborative water management** and **to foster equity** between water users (while maintaining a minimum ecological flow for the aquatic ecosystems), and engaging stakeholders and using transparency to minimize environmental, economic and social conflicts {D4}. • Mainstreaming practices that **reduce soil erosion, sedimentation and pollution run-off** (e.g., G, CG, P) {6.3.4.1}. • **Reducing the fragmentation of freshwater policies** by coordinating international, national and local regulatory frameworks (e.g., G, SO) {6.3.4.7, 6.3.4.2}. • **Increasing water storage** by facilitating groundwater recharge, wetlands protection and restoration, alternative storage techniques and restrictions on groundwater abstraction. (e.g., G, CG, IPLC, P, D) {6.3.4.2} {B1, B3}. • **Promoting investment in water projects** with clear sustainability criteria (e.g., G, P, D, SO) {6.3.4.5} {B1, B3}.
Building sustainable cities that address critical needs while conserving nature, restoring biodiversity, maintaining and enhancing ecosystem services	• Engaging **sustainable urban planning** (e.g., G, CG, IPLC, NGO, P) {6.3.5.1} {D9}. • **Encouraging densification for compact communities**, including through brownfield development and other strategies {6.3.5.3}. • **Including biodiversity protection, biodiversity offsetting, river basin protection, and ecological restoration in regional planning** {6.3.5.1}. • **Safeguarding urban key biodiversity areas** and ensuring that they do not become isolated through incompatible uses of surrounding land {6.3.5.2, SM 6.4.2}. • **Promoting biodiversity mainstreaming through stakeholder engagement and integrative planning** (e.g., G, NGO, CG, IPLC) {6.3.5.3}. • **Encouraging alternative business models and incentives for urban conservation** {6.3.2.1}. • **Promoting sustainable production and consumption** {6.3.6.4}.

Approaches for sustainability	Possible actions and pathways to achieve transformative change Key actors: (IG=intergovernmental organizations, G=Governments, NGOs =non-governmental organizations, CG=citizen and community groups, IPLC = indigenous peoples and local communities, D=donor agencies, SO=science and educational organizations, P=private sector)
	• **Promoting nature-based solutions** (e.g., G, NGO, SO, P) {6.3.5.2} {D8, D9}. • **Promoting, developing, safeguarding or retrofitting green and blue infrastructure** (for water management) while improving grey (hard) infrastructure to address biodiversity outcomes, {6.3.5.2}. • **Promoting ecosystem-based adaptation within communities** {3.7, 5.4.2.2}. • Maintaining and designing for **ecological connectivity within urban spaces**, particularly with native species {6.3.5.2, SM 6.4.1}. • **Increasing urban green spaces and improving access to them** {6.3.2}. • **Increasing access to urban services for low-income communities**, with priorities for sustainable water management, integrated sustainable solid waste management and sewage systems, and safe and secure shelter and transport (e.g., G, NGO) {6.3.5.4} {D9}.
Promoting sustainable energy and infrastructure projects and production	• Developing **sustainable strategies, voluntary standards and guidelines** for sustainable renewable energy and bioenergy projects (e.g., G, SO, P) {6.3.6} {D8}. • Strengthening and promoting **biodiversity-inclusive environmental impact assessments**, laws and guidelines {6.3.6.2} {B1}. • **Mitigating environmental and social impacts** where possible and **promoting innovative financing and restoration** when necessary (e.g., G, P, NGO, D) {6.3.6.3} {B1}, including by redesigning **incentive programmes and policies** to promote bioenergy systems that optimize trade-offs between biodiversity loss and benefits (e.g., through life cycle analysis) {D8}. • **Supporting community-based management and decentralized** sustainable energy production (e.g., G, CG, IPLC, D) {6.3.6.4, 6.3.6.5} {D9}. • **Reducing energy demands** so as to reduce the demand for biodiversity-impacting infrastructure (e.g., through energy efficiency, new clean energy and reducing unsustainable consumption) (e.g., G, P) {B1}.
Improving the sustainability of economic and financial systems	• **Developing and promoting incentive structures** to protect biodiversity (e.g., removing harmful incentives) (e.g., IG, G) {6.4} {D10}. • Promoting **sustainable production and consumption**, such as through: sustainable sourcing, resource efficiency and reduced production **impacts**, circular and other economic models, corporate social responsibility, life-cycle assessments that include biodiversity, trade agreements and public procurement policies (e.g., G, CA, NGO, SO) {6.4.3, 6.3.2.1} {D10}. • **Exploring alternative methods of economic accounting** such as natural capital accounting and Material and Energy Flow Accounting, among others (e.g., IG, G, SO) {6.4.5} {D10}. • **Encouraging policies that combine poverty reduction** with measures to increase the provision of nature's contributions and the conservation and sustainable use of nature (e.g., IG, G, D) {3.2.1} {C2}. • **Improving market-based instruments**, such as payment for ecosystem services, voluntary certification and biodiversity offsetting, to address challenges such as equity and effectiveness (e.g., G, P, NGO, IPLC, CG, SO) {B1}. • **Reducing consumption** (e.g., encouraging consumer information to reduce overconsumption and waste, using public policies and regulations and internalizing environmental impacts) (e.g., G, P, NGO) {B4, C2}. • **Creating and improving supply-chain models** that reduce the impact on nature {D3}.

Appendix 6: Biodiversity: How transformative are the recommendations in the assessment reports?

Compilation according to building blocks for transformative change

"The need is critical, and action must be bold and decisive, not just for change but for systemic transformation." (GDSR 2019: 172)

Several assessment reports agree with this sentiment: transformative change is essential. The IPBES global assessment, for instance, is optimistic that "[n]ature can be conserved, restored and used sustainably while simultaneously meeting other global societal goals through urgent and concerted efforts fostering transformative change" (IPBES 2019: 42).

The Fifth Global Biodiversity Outlook (SCBD 2020) breaks this vision down further and proposes a set of eight necessary 'sustainability transitions': for land and forests, freshwater, fisheries and oceans, agriculture, food systems, cities and infrastructure transition, climate action, and the biodiversity-inclusive One Health transition.

Block 1: Transformative vision

A transformative vision includes a far-reaching analysis and critique of the structural or systemic issues that need to be addressed and a narrative combining the 'big picture' of what goes wrong, with 'big answers' that orient and inspire for change.

Concerning core challenge 1 (Prevailing socio-economic models lead to resource overuse), current production and consumption patterns are seen as one of the main causes of biodiversity loss – in particular in the entire food system. Other sectors such as infrastructure, energy, and mining are also found in need of "fundamental transformation" (WEF 2020: 9). There are unambiguous calls to limit "the consumption of [...] goods and services affecting biodiversity, for example in forestry, energy and provision of fresh water" (SCBD 2020: 145). **Indirect drivers** such as population growth should be addressed at the same time (IPBES 2019: 16).

Assessments question ***what***, ***how*** and ***how much*** **food is produced and consumed**. "Reducing food waste from production to consumption" (IPBES 2019: 48) is a central demand, accompanied by "significant dietary shifts […] especially by the wealthiest consumers" (WEF 2020: 13, also IPBES 2019: 44). Food production processes must be radically transformed "to achieve ecosystem restoration and avoid land and ocean use expansion" (WEF 2020: 12) as a precondition for reducing biodiversity loss. Beyond food, "wasteful fast fashion" is identified as a consumer trend that should be abandoned (WEF 2020: 13).

There is thus wide agreement on the causes of biodiversity decline and a far-reaching critique of the current paradigm of resource-intensive globalised food production and wasteful consumption, in particular of wealthier consumers.

In terms of a compelling new narrative, we find a broad array of elements related to all three core challenges: e.g. the idea to **enhance productivity without harming biodiversity** while ensuring that ecosystem services also increase (SCBD 2020: 145/163, WEF 2020: 12). WEF advocates for "**transparent and sustainable supply chains** [...] to ensure that consumers, regulators and investors are able to

make informed decisions that, in turn, reinforce responsible production" (WEF 2020: 13). More generally, IPBES sees the need for **"internalizing the external costs of production, extraction and consumption"** and "a shift **beyond standard economic indicators** such as gross domestic product to include those [indicators] able to capture more holistic, long-term views of economics and quality of life" (IPBES 2019: 22). It highlights that transformation towards a sustainable world is supported by **replacing "existing, widely-held values of responsibility**" with "**new social norms for sustainability,** especially by extending notions of responsibility to include the impacts associated with consumption, and emphasises that there need to be **visions "of a good quality of life** that do not entail ever increasing material consumption" (IPBES 2019: 20).

Further elements for a new narrative can be added from the recommendations for core challenge 2 (Biodiversity loss reinforces global inequalities). **Inequalities,** particularly between genders, "**undermine the capacity for sustainability"** (IPBES 2019: 20). The IPBES global assessment (2019) consequently identifies **current inequality as one of the leverage points for transformative change,** and most assessments point to the need of addressing inequalities and the importance of including indigenous peoples and local communities in decision making. The IPBES Europe and Central Asia Assessment emphasises that transformations looking for "**a balanced supply of nature's contributions to people**, coupled with **participatory decision-making processes**, are likely to be t**he most effective pathways** for moving towards a sustainable future" (IPBES 2018: 8). Further, "just and equitable solutions that **address the land rights of indigenous peoples and local communities"** are needed (WEF 2020: 12). Transitions should make sure that "**currently informal activities** that support millions of rural and indigenous livelihoods" are integrated into sustainable supply chains (WEF 2020: 15).

Recommendations to core challenge 3 (Lack of integrated and multilateral responses) emphasise that biodiversity loss can only be addressed effectively through **better coordination and alignment across sectors and scales.** A case in point is sustainable landscape management, which "can be better achieved through multifunctional, multi-use, multi-stakeholder and community-based approaches", including a more "effective implementation of multilateral environmental agreements" (IPBES SPM 2019: 43). The global IPBES assessment report regards "**internationally agreed environment-related goals and targets**" as key to safeguarding the environment (IPBES 2019: 19). It further explicates that "a commitment to **mutually supportive international goals and targets** [...], 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" on the trajectory towards greater sustainability (IPBES 2019: 18, see also IPCC 2018: 23).

This vision entails fundamental long-term shifts, including "the evolution of global financial and economic systems to build **a global sustainable economy, steering away from the current, limited paradigm of economic growth**" (IPBES 2019: 20). This recommendation challenges a core tenet of the current global economic system; yet, it is hard to imagine or distil a compelling alternative narrative from the assessment texts. The quote goes on to outline that this implies "incorporating the reduction of inequalities into development pathways" (IPBES 2019: 20), which could be achieved by "a mix of policies and tools (such as incentive programmes, certification and performance standards)" (IPBES 2019: 20). Specifically, a combination of "existing policy instruments and new initiatives" seems most useful (IPBES 2019: 18).

IPBES also addresses the important point of resistance:

*"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**" (IPBES 2019: 18).*

Summary and appraisal: The assessments outline the need for fundamental changes in production and consumption patterns, particularly but not limited to the agri-food system, as essential to address biodiversity loss. This includes clear calls to consumers, only recently emerging as consensus in the scientific and policy documents, such as the need for changes in diets particularly of the wealthiest consumers, and more transparent and sustainable supply chains. Other elements such as the internalisation of costs (of production, extraction and consumption) and the reduction of harmful subsidies have been regularly voiced for decades now.

Similarly, most reports emphasise the need for addressing inequality and for participatory decision-making to help address biodiversity loss and achieve a sustainable future. Reducing inequalities and finding just and equitable solutions are considered objectives as well as measures on the pathways to sustainability.

The analysed assessments see international cooperation as an effective lever for transformation and list numerous demands and ideas in what areas international collaboration should be enhanced. The IPBES global assessment goes as far as calling for 'steering away from the limited paradigm of economic growth'; while the wording is vague, it does fundamentally challenge the current system.

Assessments provide a far-reaching critique of current practices, outline elements that need to change, and fundamentally challenge the current economic paradigm. A new narrative is much less clear: the reports provide a broad array of elements including the need for a change of values and visions of a good quality of life, an evolution of the global economic and financial system, inclusive decision making and increasing international collaboration. However, they do not provide a new narrative in terms of a compelling alternative to the current system and paradigms beyond the need for transformative change and the belief that it can be brought about by an intelligent combination of existing policies and new initiatives as well as international cooperation in multiple fora.

Block 2: Transformative knowledge

This second building block for driving transformation refers to **better understanding what kind of knowledge is relevant for transformation**, amidst the rapidly growing supply of data and information. Beyond seeking to understand complex systems, it is about the specific knowledge for supporting this process: What type of knowledge is needed for **identifying those interventions that are strategically placed to stimulate and accelerate comprehensive system change**?

To meet transformative knowledge needs for tackling the three core challenges (1: prevailing unsustainable socio-economic models, 2: vicious circle between inequality and biodiversity loss, and 3: insufficient multilateral responses), we expect assessment **recommendations to refer to knowledge** (production/exchange/identification) **on issues such as**:

- how to enable or facilitate transformative change for slowing biodiversity loss,
- which actors are in a position to take initiative and contribute substantially,
- how to halt and reverse the continuously growing inequality, at global and national scales,
- effective options in changing direction in high impact sectors (e.g. agriculture, energy),
- addressing root causes: e.g. poor environmental accountability in global finance, both corporate and intergovernmental

- how to obtain transformative knowledge and make it accessible
- the decoupling of economies from resource consumption and their functioning within planetary boundaries, or
- the links between degrowth and societal well-being.

The basic understanding of the IPBES Global Assessment on how transformative change could be brought about is summarised in the following:

> *"Collaborative implementation of priority governance interventions (levers) targeting key points of intervention (leverage points) could enable transformative change from current trends towards more sustainable ones. Most levers can be applied at multiple leverage points by a* ***range of actors****, such as* ***intergovernmental organizations, governments, non-governmental organizations, citizen and community groups, indigenous peoples and local communities, donor agencies, science and educational organizations, and the private sector****, depending on the context. Implementing existing and new instruments through place-based* ***governance interventions that are integrative, informed, inclusive and adaptive, using strategic policy mixes and learning from feedback****, could enable global transformation." (IPBES SPM 2019: 42)*

A broad range of actors is listed who could contribute by applying a set of "levers" at multiple "leverage points". The leverage points identified are: (1) Visions of a good life, (2) Total consumption and waste, (3) Latent values of responsibility, (4) Inequalities, (5) Justice and inclusion in conservation, (6) Externalities from trade and other telecouplings, (7) Responsible technology, innovation and investment, and (8) Education and knowledge generation and sharing. They also define a set of five policy levers for bringing about such change: (A) Incentives and capacity building, (B) Coordination across sectors and jurisdictions, (C) Pre-emptive action, (D) Adaptive decision-making and (E) Environmental law and implementation.

Concerning how transformative change will evolve and how risks can be handled, the IPBES Global Assessment provides the following outlook:

> *"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 the inevitable uncertainties and complexities in transformations towards sustainability can be reduced through governance approaches that [...]* ***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." (IPBES SPM 2019: 19)*

The last sentence offers general advice at a highly aggregated level, highlighted in bold in our quotation above. "Alternative pathways" are mentioned but not spelled out in the argument. In terms of the requirements of transformative change, we could interpret this as emphasising the importance of considering alternative pathways and different options at each step. The implications for the governance approach are summarised and further developed in block five of our conceptual framework.

Beyond this rather general outline, the recommendations do not offer many specific answers to the questions raised. They merely point out that **we are confronted with difficult questions**, "including questions about what and how we consume, how we manage our waste, and the role family planning and reproductive health can play" (Dasgupta 2020: 12).

The Independent Group of Scientists' report (GDSR) is most explicit about transformative knowledge. It outlines knowledge needs for transformation towards achieving the SDGs and offers several specific recommendations on how to address the fundamental changes in the agri-food system identified as crucial for effectively addressing biodiversity loss; these are outlined under Block 5. Finally, this report points to the need for generating more transformative knowledge. The outlined options range from increased public funding for "**mission-oriented research** – guided by the 2030 Agenda" (GDSR 2019: 170) to the commissioning of a "**major scientific assessment of existing transformation knowledge**" by the UN which would include "**lay, practical and indigenous knowledge**" (GDSR 2019: 170), to collaborative "**experimental spaces**" set up by donors where "co-creation, testing and extension of transformational ideas" (GDSR 2019: 170) can be pursued. **Technology transfer** within and between the global North and South should be accelerated (GDSR 2019: 171), and the authors point out that, strategically, "the **2030 Agenda can serve as a shared compass to rapidly mobilize and harness the extensive knowledge available**" (GDSR 2019: 169).

The IPBES assessment, similar to the GSD Report (2019), insists on **special consideration and integration of traditional and indigenous knowledge** to enhance the legitimacy and effectiveness of environmental policies (IPBES 2019: 21). Appreciation of indigenous knowledge can be interpreted as having transformative potential because it implies the recognition not only of sustainable traditional practices, but also of alternative views on development and plural values of nature. Thus, synergies between sustainable development, alternative cosmovisions (e.g. 'buen vivir'), and degrowth concepts may help to face and tackle the caveats of each discourse and "open pathways towards a global new Great Transformation" (IPBES Am 2018: 606). While many countries should "design and pursue development that breaks the path of Western-style path dependence of economic growth at environmental costs" (GDSR 2019: 170), the respective knowledge needs for changing paths generally, and for breaking with western-style economic paradigms in particular, are not spelled out.

In most other assessment reports, knowledge needs are mentioned for various areas, e.g. agriculture; yet, their specific transformative character remains unspecified. These knowledge gaps concern fundamental mechanisms like the human-induced acceleration of ecosystem change, as this is considered to enhance uncertainty about socio-ecological system stability (IPBES 2019: 14); an observation that is echoed in calls for a knowledge focus on climate-related risks (IPCC SR1.5 2019: 41). Generally, research-related information infrastructures on the links between biodiversity and agri-food systems are prevalently considered to be of high widespread priority, as well as the means and capacities to access and use their data and outputs (FAO SWBFA 2019: 494). This is in particular called for to identify socio-economic dependencies on biodiversity and to remove harmful subsidies (IPBES 2018: 23). At the practical end of the spectrum, one report states that "greater understanding and adoption of the appropriate agronomic solutions" would be needed (WEF 2020: 12).

Some assessment reports merely point towards innovation, naming innovation policies, incentives for technology diffusion, "enhanced technological innovation capabilities", and the need for "new and possibly disruptive technologies and practices" (IPCC SR1.5 SPM 2018: 23). While technical innovation holds vast potential, it does not by itself and on its own deliver sustainability improvements and is somewhat reminiscent of outdated 'progress' fantasies.

Assessments (in particular the IPCC and IPBES assessments) point toward areas of intervention for addressing core challenges that can enable transformative change. Thus in general, knowledge on how to address single challenges does exist; however, knowledge is often fragmented, and assessments identify the need for **integration of knowledge across land use systems, scales and actors** for ad-

dressing the complexity of the challenges. Knowledge integration is required **e.g. for promoting sustainable agriculture and agroforestry systems** (GDSR 2019: 166 -167), **and to reduce land degradation – which would have multiple benefits for the SDGs** (IPCC SR1.5 2019: 29). This recommendation, to integrate existing knowledge in different regards, depending on the specific issue, in order to tackle the three biodiversity challenges thus promises to be a transformative one.

Various recommended responses that do not rely on existing knowledge, have high knowledge demands. For example, the call for more interdisciplinary, cross-sector integrated policy and planning, as well as the suggestion to apply policy mixes (i.e., synergistic combinations of policy instruments which together pursue and cater to a range of social and environmental goals), not only require shifted mindsets (building block 1), but also need substantial knowledge and information inputs. Yet, such recommendations (as in IPCC Land 2020: 35) do not come along with calls for targeting knowledge production.

Instead, assessments mention diverse aspects of how knowledge should be applied and integrated, such as taking a longer-term perspective in planning (FAO SWBFA 2019: 496), using collaboration platforms to co-create shared transition roadmaps (WEF 2020: 15), pursuing holistic and multidisciplinary approaches both at policy level and at the level of practical implementation (FAO SWBFA 2019: 492).

Ultimately, transformative knowledge should make it possible for decision makers to aim for the strategic entry points for system change: The main thrust of the recommendations lies in combining a set of measures jointly, with the intention that they reinforce each other. Transformation is possible only when novel combinations of transformative levers are deployed (GDSR 2019: 173). The assessments do not spell out how the knowledge on how measures interact can be achieved. Thus for these measure-combination recommendations to be transformative, we must constitute a lack of knowledge (a knowledge gap) like for several of the above.

Summary and appraisal: Knowledge needs for transformation are spelled out in general terms by the GSDR (2019) and oriented towards achieving the Sustainable Development Goals in general. This report also contains some specific recommendations on how to address the fundamental changes in the agri-food system. The GSDR (2019) explicitly discusses the need for anticipating resistance. There are starting points as to how this could be addressed, especially at the international level. For other issues, some specific transformative knowledge needs are outlined and there are elaborate recommendations for funding transformative knowledge generation.

The other assessment reports are much less explicit on knowledge for transformation. Nonetheless, they highlight the usefulness of policies, instruments, technical solutions and innovations – some of them in complex packages requiring joint implementation – that require an advanced technological and integrative understanding within and across disciplines and sectors, as well as a set of skills that enables leaders to think holistically. Assessments remain vague or silent on the specification of required knowledge and how it can be gained where needed. Knowledge needs for transformation are only very rarely mentioned and mostly make general claims such as “more training” and “improved access to information”. Thus, these assessment reports do not stress specific transformative knowledge needs.

Block 3: Transformative dynamics

In this block, the question is examined what role transformation dynamics play in the various recommendations – or how the recommendations can be interpreted in this regard. Consideration of transformation dynamics includes understanding what changes are considered desirable and which practices, technologies or even structures are to be replaced by these. To achieve this, sequences of actions are necessary and their timing, acceleration and up-scaling matter, as each phase of a transformation requires different triggers or responses.

Core Challenge 1: Prevailing socio-economic models and incentive structures lead to land and resource use that exceeds bio-physical capacities.

Regarding this core challenge, we would expect assessments to make recommendations on how to initiate and navigate transformation processes aimed at changing unsustainable production systems, consumption patterns, and their underlying economic structures and financial drivers. We do not find many text passages in this regard, but a few entry points exist:

Scaling up agroecology can be a means to sustainably intensify food production and to accelerate the **transition towards a synthetic-pesticide free agriculture**. This requires a reassessment of production practices aiming at "the least possible pesticide use and no critical residues in plants and foodstuffs" (GSDR 2019: 166). This outlines a small part of what systemic changes are needed in the agri-food system and reflects an understanding of dynamics.

Assessments explicitly recommend a stronger **focus on balancing priority development needs** with progressive and proactive conservation and cultural heritage (IPBES SPM 2019). Such 'balancing' is a highly ambitious task - it involves questioning what constitutes such 'priority development needs'.

This resonates with calls for **alternative models and measures of economic welfare.** Metrics of 'welfare' should include nature and plural values of nature (IPBES GA 2018: 46).

Also, nature-based solutions are widely called for (IPBES 2019: 46).

These are potent elements for changing development strategies: In a balancing perspective, economic growth is no longer accepted as a universal remedy to poverty or as the principal development indicator. In turn, nature-based solutions challenge development paradigms in which engineered solutions represent 'modernity'. This stimulates broader debate on development pathways and on the importance of natural systems and their integrity for human needs. It can also stimulate steps towards a novel formulation of biodiversity conservation objectives in the light of human development needs (IPBES Af 2018: 19).

Another route to transformation includes awareness and efforts targeted at consumer behaviour – which by itself may have impacts on transformation dynamics (IPBES 2018: 52).

The need for phasing out harmful subsidies and other regulations or instruments which incentivise activities that lead to biodiversity loss is explicitly stated (IPBES 2019: 20).

Core Challenge 2: Biodiversity loss reinforces global inequalities which at the same time reinforce biodiversity loss.

There are not many words to be found refering the dynamics of transformation with regard to tackling inequality. Recommendations refer principally to rethinking established instruments and developing new instruments to account for long-distance impacts. Entry points for change are the reform of trade

agreements and derivatives markets to promote equity while preventing further deterioration of nature. Yet, how such reforms should be initiated is not further specified (IPBES 2019: 46).

Another entry point refers to the strengthening and facilitation of positive contributions of indigenous peoples and local communities to sustainability. This could be initiated 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 (IPBES 2019: 21).

Again, while these are obvious first actions and well-established recommendations for enhanced equity in biodiversity, it is not further described how this influences transformation dynamics. It can be assumed that the strengthening of indigenous and local community voices and rights will change national debates and resulting policy efforts towards sustainability. The idea has appeared in several agreements; international debates consider indigenous knowledge, resource use practices and 'traditional lifestyles' to be more biodiversity protective in comparison to 'modern development paradigms' and therefore relevant for biodiversity protection, especially under the new Global Biodiversity Framework.

Core Challenge 3: The protection of biodiversity as a global public good lacks more determined, integrative, and multilateral responses.

Institutional fragmentation and lack of engagement between stakeholders at different scales stymie many biodiversity efforts (FAO SWBFA 2019: 492).

Most of the assessment reports recommend better coordination and alignment across sectors and across scales. A priority area is the agri-food system. By means of e.g. integrated land-use planning, the maximisation of co-benefits can be pursued. Does this have implications for transformation dynamics? While integrated planning can by itself produce positive biodiversity outcomes, it can also **generate momentum for larger societal change by bringing together people from different sectors** (GDSR 2019: 169) and different scales (IPCC SR1.5 SPM 2018: 20).

Enhanced collaboration across a range of sectors such as agriculture, public health, transportation, environment, water, energy and infrastructure will increase the opportunities for broader socio-economic change (IPCC Land 2020: 36, FAO 2019: 496). The assessment recommendations do not go into more detail. Yet, it can be assumed that such collaboration breeds willingness and interest to come up with policy designs and sectoral objectives which are less narrowly focused, seek to maximise co-benefits, and minimise trade-offs across sectors (IPCC Land 2020: 36).

Various recommendations also suggest the **pursuit of multiple interventions in diverse arenas**, in particular the **enabling of local-level and bottom-up efforts** reaching towards higher policy levels. Civil society articulation and local and bottom-up initiatives which achieve mobilising either critical masses or key stakeholder groups can generate public pressure and stimulate substantial political change (IPBES 2019: 46, SCBD 2020: 145).

Other recommendations appear more top-down, elite-focused, or trite: "Actors from governance, economy and finance, civil society, and science and technology must thus rethink their partnership and establish novel collaborations" (GDSR 2019: 173). At times, a technocratic understanding of policy processes is observable which largely neglects political dynamics or oversimplifies politics: "Mainstreaming could be harnessed in a three-step process by: first, raising awareness of the dependence of good quality of life on biodiversity; second, defining policy objectives concerning the ecological,

economic and sociocultural needs for achieving sustainable development; and, third, designing instruments and policy mixes to support the implementation of effective, efficient and equitable policy and decision-making for nature and a good quality of life" (IPBES 2018: 23). Frequently, the assessment reports list multiple general ingredients which are supposed to improve sustainability outcomes. At the abstract level, such ingredients (e.g. 'landscape approaches' or 'strengthened policy instruments') hide the complexity of issues, neglect controversies and ignore dynamics involved in their implementation (IPBES 2019: 42).

A suitable **entry point for accelerating change is the joint pursuit of climate and land policies** (IPCC Land 2020: 35), and of agriculture and environmental policies (FAO SWBFA 2019: 495), in combination with economic and sustainable development efforts (IPCC SR1.5 SPM 2018: 20). However, it is unclear whether this catalyses socio-economic transformation – or merely 'change'.

A special role is given to **international cooperation,** as it can **provide an enabling environment.** It is called a critical enabler for developing countries and vulnerable regions, thus seen in a position to lay certain groundwork or **overcome initial hesitation, e.g. by enhancing access to finance and technology and expanding domestic capacities** (IPCC SR1.5 SPM 2018: 24).

Assessments also see the **private sector in a position to insert dynamic into a change process,** leading to more biodiversity protection. Businesses might bear a certain responsibility due to the resources they have and use. **They can move ahead of policy and regulation, stimulating change.** They are also seen as potential advocates for policy reforms. Their ability to build alliances and collaboration platforms can be used to co-create shared transition roadmaps for specific value chains or regions. All this can have an accelerating effect (WEF 2020: 15). On the other hand, governments should work with companies that depend on or affect natural capital to ensure they properly manage the related risks – including operational, reputational, regulatory, human rights and health risks (GDSR 2019: 170).

Summary and appraisal: Across the assessment reports, ideas for what should be phased in or out can be found, but an overarching dynamic conceptualisation of transformative change is not presented. Important proposals for breaking with the prevailing socio-economic models are the phasing out of pesticide use in agriculture and of harmful subsidies more broadly. Instead, agroecological approaches and nature-based solutions should be scaled up; an avenue that would deserve further elaboration is the establishment of alternative economic measures and theories. Regarding the inequality challenge, the reports find that market mechanisms must be reformed, but do not offer many details. Similarly, the call for better involvement of indigenous peoples and local communities is loud and clear, but does not spell out any dynamic considerations. On the third core challenge, the expectation is that increased cooperation will create new opportunities for transformative change. While falling short of a full dynamic view, two important arguments are put forward in the reports: bottom-up initiatives should be encouraged, and private businesses can potentially become a motor of more vivid change dynamics.

Block 4: Emancipation and agency for transformation

The Independent Group of Scientists expresses a clearly emancipatory ambition and places the responsibility for achieving this on governments, who "should ensure equal access to opportunities, end legal and social discrimination and invest in building human capabilities so that **all people are empowered and equipped to shape their lives and bring about collective change**" (GDSR 2019: 164).

Regarding **core challenge 1** (Prevailing unsustainable socio-economic models), there are calls for securing land tenure so that indigenous peoples and local communities can manage their lands, and the acknowledgement that their management practices are usually more biodiversity-friendly than than more centralised management practices, e.g. large food companies. Moreover, there is frequent mention of the importance of including local and indigenous communities, their knowledge and sometimes their institutions in all sorts of land use decisions and practices. Yet, most of these recommendations do not make reference to the potential of local collective agency for initiating change, or providing more sustainable alternatives than industrial style agriculture. Nor do they formulate visions or approaches rooted in indigenous and local knowledge which could serve as alternatives or starting points for thinking towards different socio-economic systems.

The main audiences of the assessment reports work at national (policy) levels. It seems that the potentially disruptive nature of strong local participatory structures and emancipatory agency is often downplayed by connecting participation with instrumental benefits such as more effective implementation: combined with other instruments, the use of "**local and indigenous knowledge and collective action [...] can achieve positive adaptation and mitigation outcomes**" (IPCC Land 2020: 35; see also IPBES SPM 2019: 48).

Local economies are rarely explicitly mentioned. They are appreciated, for example, under the umbrella of local food security: "Options that **address and engage other actors** in food systems (including the public sector, civil society, consumers and grassroots movements) include participatory on-farm research, the promotion of low-impact and healthy diets and the **localization of food systems**" (IPBES SPM 2019: 45). Recommendations for strengthening local food systems can be interpreted as a call for empowering local economies, which are potentially more in line with local cultural and social characteristics. *"Promoting and strengthening **community-based management and governance, including customary institutions and management systems,** and co-management regimes involving indigenous peoples and local communities" (IPBES SPM 2019: 48)* or *"Thus, it is advisable to supplement the current policy framework with a **bottom-up process**, including **broad participation and conflict management processes** at the different governance levels" (IPBES ECA 2018: 785).*

Regarding core challenge 2 (Vicious circle between inequality and biodiversity loss), local agency may not be able to address global inequality, but it can tackle economic injustice and poverty at the local and regional scale.

Assessment recommendations raise key issues in this regard: access, land tenure and land rights. However, these issues are often viewed in an instrumental perspective, as this quote illustrates: "**Insecure land tenure affects the ability of people, communities and organisations to make changes to land that can advance adaptation and mitigation**. Limited recognition of customary access to land and ownership of land can result in increased vulnerability and decreased adaptive capacity. **Land policies** (including recognition of customary tenure, community mapping, redistribution, decentralisation, co-management, regulation of rental markets) can provide both security and flexibility in response to climate change" (IPCC SR1.5 2019: 35). In this line of argument, insecure land tenure is primarily a technical problem hindering adaptation and mitigation, rather than a social issue of inequality, justice or poverty.

Address inequalities for transformative change

> *"[A]ddressing inequalities, especially regarding income and gender, **which undermine the capacity for sustainability**" (IPBES SPM 2019: 20)*

The following quote emphasises this same line of thought. Land and resource justice is presented as preconditional for indigenous and local contributions to sustainability:

> *"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." (IPBES SPM 2019: 21).*

Securing the rights of indigenous and local populations to land and the preservation of traditional management practices is recommended both for enhanced social justice *and* as a lower cost option for biodiversity conservation (IPBES SPM 2018: 584).

Some assessments do frame equity concerns as a goal in itself: "Governance options are [necessary] to deliver multiple benefits which can help to balance patterns of access and allocation of ecosystem services in Africa. Policy coherence may also contribute towards poverty reduction and help to build resilience." (IPBES Af 2018: 20).

Regarding core challenge 3 (Lack of determined, integrative and multilateral responses), four observations can be made.

First, the assessment reports **emphasise the importance of 'social values' for sustainability**: "Actions that help to voluntarily unleash existing social values of responsibility in the form of individual, collective and organizational actions towards sustainability can have a powerful and lasting effect in shifting behaviour and cultivating stewardship as a normal social practice" (IPBES SPM 2019: 44). Such social values can be interpreted as conducive to emancipatory agency.

Second, many assessments focus on citing a range of instruments for community management and **collective action at lower scales** (locally, regionally) which are considered highly useful, without much further explanation. For example: "Successful management of trade-offs often includes maximising stakeholder input with structured feedback processes, particularly in community-based models, use of innovative fora like facilitated dialogues or spatially explicit mapping, and iterative adaptive management that allows for continuous readjustments in policy as new evidence comes to light" (IPCC SR1.5 2019: 36).

Third, some assessments seem to see community support not in the aim of opening new political spaces or strengthening civic articulation, but primarily as a means to enhance 'social acceptability' (e.g. of new rules): "**Education, information, and community approaches,** including those that are informed by indigenous knowledge and local knowledge, can accelerate the wide-scale behaviour changes consistent with adapting to and limiting global warming to 1.5°C." (IPCC SR1.5 2019: 23)

Fourth, other assessments do indeed see strategic potential in local emancipatory agency: "Developing pathways and corresponding experiments in a participatory manner, including all relevant stakeholder groups and indigenous peoples and local communities, enables the **inclusion of a diversity of perspectives and promotes the necessary deliberation** of strategic planning and agenda-setting" (IPBES ECA 2018: 53).

Summary and appraisal: The extent to which the global assessment reports satisfy the requirements of building block 4, emancipation and agency, is mixed. On the one hand, there is unanimous agreement that indigenous and local communities need to be better involved in political processes; on the

other hand, their role is not seen as stimulators of transformative change or the elaboration of different visions for the world. There is some recognition that locally specific, customary governance and management modes are valid alternatives, but land rights are often presented in a purely instrumental way. Participation is sometimes seen in an equally functional way, serving to increase the acceptability of necessary measures; on the other end of the spectrum, the IPBES reports strongly emphasise the benefits of diverse perspectives, democratic decision-making about transformative change trajectories, and the positive mutual reinforcement of poverty-reduction and biodiversity-conservation efforts.

Block 5: Transformative actions and solutions

Our framework argues that the context of the four previous blocks sets the frame for whether or not specific interventions unfold transformative potential. In addition, it matters who applies them and whether all relevant actors have been considered. Given that transformation involves fundamental and non-predictable changes, requirements for adequate governance are high. We have screened recommendations in terms of how well they specify actors (who?), actions (what?), and governance modes (how?). The synthesised results are presented here; a full version of the table is in Appendices 7-9. Here we present and briefly discuss an aggregated overview of the most prominent interventions recommended with regard to the three core challenges.

Core Challenge 1: Prevailing socio-economic models and incentive structures lead to land and resource use that exceeds bio-physical capacities.

Recommended actions for addressing this challenge have in common the emphasis of taking a socio-ecological perspective when addressing agricultural production and consumption patterns, when designing policies that promote the “good” and reduce the “bad”, when improving resource management, as well as in finance and international development cooperation. Such an integrative socio-ecological perspective is regarded to be necessary in order to account for the complexity of human-environment interactions and the resulting impacts on biodiversity and ecosystem services from local to global scales (teleconnections).

The IPBES global assessment provides an overview about possible actions and pathways which can be found in Appendix 5.

	Specific intervention
Fundamental changes in agri-food production and consumption	Promoting **substantial changes to existing infrastructure, policies, regulations, norms, and preferences** to change food and nutrition systems that foster universal good health and eliminate malnutrition while minimising environmental impact. **Reduce food loss and waste** from production to consumption. **Transform supply chains** by • improving **food market transparency** (through e.g. labelling and sustainability certification) • regulation, promotion of sustainable advertising and marketing practices • **empowering producers and consumers to transform them** • consumer education • balanced diets and increased diversification in the food system • influencing dietary choices to feature plant-based foods, such as those based on coarse grains, legumes, fruits and vegetables, nuts and seeds, and animal-sourced food produced in resilient, sustainable and low-greenhouse emission systems.

	Improve equity in food distribution and localisation of food systems **Strengthen the agri-food value chains and pro-poor markets for nutritious foods,** including through naturally nutrient-dense foods and through biofortified and fortified staple foods Establish stronger **social-protection floors** to enhance food security Development of low- and middle-income countries that **breaks the path dependence of economic growth** at environmental costs.
Agricultural practices to increase productivity while enhancing biodiversity and ecosystem services	Promote usage of **biodiversity-friendly management practices** and include **traditional management and farming practices** Advanced precision technologies and bio-based inputs Introduce agroecological and other innovative approaches Reduce and reverse land degradation, at scales from individual farms to entire watershed Provide technical assistance – especially for small-holders
Supportive governance framework	Account for nature deterioration from local economic activities and telecouplings Implement multi-level, hybrid and cross-sectoral governance and policies developed and adopted in an iterative, coherent, adaptive and flexible manner Improve access to markets, secure land tenure, internalise environmental costs, payment for ecosystem services and enhance local and community collective action
Governmental policies for setting incentives	**Remove environmentally harmful policies, subsidies and taxes** across sectors (eg. agriculture, energy, fisheries). As a first step: identify, assess and **track public expenditure harmful** to biodiversity **Develop incentives and capacity for environmental responsibility** • Payments linked to social and environmental metrics • Payments for ecosystem services • Compensation payments to reward conservation-friendly behaviour • Biodiversity offsets and habitat banking • Tax reliefs • Ecological fiscal transfers • Integrated funding for biodiversity and climate-change adaptation Reduce costs of ecosystem restoration Transformative potential lies in a **mix of policies** rather than single policy approaches due to complexity of challenges and diversity of actors
Environmental law and regulation	Develop and improve instruments, such as voluntary certification, blue-carbon sequestration, cap-and-trade programmes, green bonds and trust funds and new legal instruments Strengthening environmental impact assessments, laws, policies and standards Improve standards, systems and regulations to **internalise the external costs** of production, extraction and consumption.

Finance	Scale up and align finance for biodiversity Strengthen and adapt financial reporting frameworks, Develop a common framework to assess and track private finance for biodiversity Risk management: **treat natural capital as an integrated whole**; analyse links between climate change, water, biodiversity and public health
International and Development Cooperation	Support sustainable agriculture in developing countries, promotion and transfer of existing sustainable technologies Sectoral coordination and investments in integrated land-use planning to support land degradation neutrality Ensure global cooperation on tax policy to eliminate diversion and tax avoidance Harmonise standards, labels and trade policy in materials use, recovery and disposal Harmonise finance internationally Establish clear product labelling standards to encourage transparency for consumers

Most of the recommended interventions are well-established and long-known. What is comparatively new are the interventions in the uppermost first row, with a strong agreement across reports that diets, supply chains and agricultural production practices need to change towards more diversified plant-based diets, less synthetic pesticide use, and more equitable access to supply infrastructure. Eliminating or at least reducing subsidies for harmful and increasing them for beneficial activities has been a prime objective for decades as well.

Core Challenge 2: Biodiversity loss reinforces global inequalities which at the same time reinforce biodiversity loss.

The recommended actions for addressing this challenge focus on accounting for distributional impacts on and mitigating inequalities (in particular for indigenous peoples and local communities) when it comes to issues related to securing land rights, poverty, employment, income, gender, health and energy. Building capacity for more accountable governance, cross-sectoral approaches and mutual learning as well as enhancing resilience through better risk management such as diversification of management practices.

	Specific interventions (all relevant for international collaboration and development cooperation)
Address inequalities	Pay special attention to interlinkages between energy, biodiversity, climate change and inequalities Assuring the rights of indigenous peoples and local communities to land and their management practices as a conservation strategy for biodiv and ecosystem services conservation Returns to work should be strengthened to achieve a more equitable balance with returns to capital and ensure full gender parity Explore equitable employment opportunities for workers displaced by low-carbon transition

Build capacity for sustainable alternatives	Strengthened accountable multilevel governance including gender-sensitive policies, finance including innovative financing, and cooperation on technology development and transfer Improve access to information and create opportunities for stakeholder to interact and exchange knowledge and ideas
Increase resilience	Promote risk sharing and transfer mechanisms to enhance resilience Promote agricultural diversification, expand market access and prepare for increasing supply chain, disruption to scale up adaptation in food system

Core Challenge 3: The protection of biodiversity as a global public good lacks more determined, integrative and multilateral responses.

> *"Solutions in terms of innovations are thought to come from new combinations of well-known and established levers for change - rather than from new levers beyond those already identified." (GDSR 2019: 173)*

The recommended actions to address this challenge focus on cross-sectoral approaches, in particular to combine climate action and biodiversity, mainstreaming biodiversity and ecosystem services and including a wide range of actors.

	Specific intervention
Better align across sectors	Promote horizontal coordination and vertical coherence Promote cross-sectoral approaches to reconcile multiple interests, values and forms of resource use Develop policies and programmes that promote sustainability-minded collective action, protect watersheds beyond city jurisdictions and ensure the connectivity of ecosystems and habitats Promote coherent policies on agriculture, forestry, and on rural, urban and infrastructure development, and comprehensive spatial planning
Specifically to combine climate action and biodiversity	Promote ecosystem-based approaches combining biodiversity conservation with climate change mitigation and improvement of livelihood Promote nature-based solutions and rapid phase-out of fossil fuel use
Mainstreaming biodiversity	(Intensify) mainstreaming biodiversity and ecosystem services into policies, plans, programmes, strategies and practices of public and private actors could be achieved with **more proactive, focused and goal-oriented environmental action,** including quantitative goals
Include private sector and civil society	Increase and improve corporate social responsibility Financial support (including partnerships with private sector) for conservation and sustainable use

Appendix 7: Transformative actions for biodiversity, core challenge 1

Call for Action	Who?	What?	How?
FUNDAMENTAL CHANGES IN (FOOD) PRODUCTION AND CONSUMPTION			
"Many low- and middle-income countries need to design and pursue development that breaks the path of Western-style path dependence of economic growth at environmental costs." (GSDR 2019: 170)	Low- and middle income countries	Development of low- and middle-income countries that breaks the path dependence of economic growth at environmental costs	/
"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**." (IPBES 2019: 21) "**Reducing food losses** and waste would bring substantial benefits with few negative trade-offs." (SCBD 2020: 168)	/	combining science with local or indigeneous sustainable practises avoid / reduce food losses and waste empowering producers and consumers to transform supply chains, more sustainable land-use	informed and inclusive governance
"Improving food market transparency (e.g., traceability of biodiversity impacts, transparency in supply chains) through tools such as labelling and sustainability certification." (IPBES 2019: 47)		improve food market transparency e.g. by labelling and sustainability certification	
"Improving equity in food distribution and in the localization of food systems, where appropriate and where beneficial to nature or nature's contributions to people (NCP)." (IPBES 2019: 47)		improve equity in food distribution and localization of food systems	
"Policies that operate across the food system, **influence dietary choices**, enable more sustainable land-use management, enhanced food security and low emissions trajectories (high confidence)." (IPCC SRCCL SPM 2019: 29) "Further, a number of response options such as increased food productivity, dietary choices and food losses, and waste reduction, can reduce demand for land conversion, thereby potentially freeing land and		Influence dietary choices Diversification in the food system **Balanced diets**, featuring plant-based foods, such as those	

Call for Action	Who?	What?	How?
creating opportunities for enhanced implementation of other response options (high confidence)." (IPCC SRCCL SPM 2019: 20) "Response options throughout the food system, from production to consumption, including food loss and waste, can be deployed and scaled up to advance adaptation and mitigation (high confidence). … The total technical mitigation potential of dietary changes is estimated as 0.7 – 8 Gt CO_2 eq yr-1 by 2050 (medium confidence)." (IPCC SRCCL SPM 2019: 23) "Promoting sustainable and healthy diets" (IPBES 2019: 47) "Diversification in the food system (e.g., implementation of integrated production systems, broad-based genetic resources, and diets) can reduce risks from climate change (medium confidence). **Balanced diets**, featuring plant-based foods, such as those based on coarse grains, legumes, fruits and vegetables, nuts and seeds, and animal-sourced food produced in resilient, sustainable and low-GHG emission systems, present major opportunities for adaptation and mitigation while generating significant co-benefits in terms of human health (high confidence). By 2050, dietary changes could free several million km^2 (medium confidence) of land and provide a technical mitigation potential of 0.7 to 8.0 Gt CO_2 eq yr-1, relative to business as usual projections (high confidence). **Transitions towards low-GHG emission diets may be influenced by local production practices, technical and financial barriers and associated livelihoods and cultural habits (high confidence).**" (IPCC SRCCL SPM 2019: 24) "Strengthen the agri-food value chains and pro-poor markets for nutritious foods, including through naturally nutrient-dense foods (e.g., fruits, vegetables, pulses, animal source foods and nuts) and through biofortified and fortified staple foods." (GSDR 2019: 166) "Governments should establish stronger **social-protection floors** to enhance food security and ensure adequate caloric intake and the quality of diets, with special attention to the needs of women and girls. Innovative insurance mechanisms can be part of such floors. Special attention and support are needed in least developed countries." (GSDR 2019: 165)		based on coarse grains, legumes, fruits and vegetables, nuts and seeds, and animal-sourced food produced in resilient, sustainable and low-GHG emission systems, to significantly reduce area for food production and increase CO_2 mitigation Strengthen the agri-food value chains and pro-poor markets for nutritious foods, including through naturally nutrient-dense foods and through biofortified and fortified staple foods Establish stronger social-protection floors to enhance food security	
"International cooperation is necessary to harmonize standards, labels and trade policy in materials use, recovery and disposal, and to establish clear	/	International co-operation to:	

Call for Action	Who?	What?	How?
product labelling standards to encourage transparency for consumers. These efforts, when carried out in major trade blocs, can have significant spillover effects." (WEF 2020: 76)		harmonize standards, labels and trade policy in materials use, recovery and disposal establish clear product labelling standards to encourage transparency for consumers	
"Encourage changes in patterns of demand and consumption, including through regulation, promotion of sustainable advertising and marketing practices, and consumer education, to reduce environmental impact." (GSDR 2019: 165)		regulation, promotion of sustainable advertising and marketing practices, and consumer education to encourage changes in patterns of demand and consumption and thus reduce environmental impact	
"All stakeholders should work to make substantial changes to existing infrastructure, policies, regulations, norms, and preferences so as to transition towards food and nutrition systems that foster universal good health and eliminate malnutrition while minimizing environmental impact." (GSDR 2019: 165)		substantial changes to existing infrastructure, policies, regulations, norms, and preferences to change food and nutrition systems that foster universal good health and eliminate malnutrition while minimizing environmental impact	
"Trading systems and trade agreements should facilitate the realization of the objectives of universal access to nutritious food at sustainable environmental costs." (GDSR 2019: 165)			
AGRICULTURAL PRACTISES TO INCREASE PRODUCTIVITY WHILE ENHANCING BIODIVERSITY AND ECOSYSTEM SERVICES			

Call for Action	Who?	What?	How?
"Redesigning agricultural systems through **agroecological and other innovative approaches** to enhance productivity while minimizing negative impacts on biodiversity" (SCBD 2020: 163)	/	introduce agroecological and other innovative approaches	/
"Transforming agricultural landscapes and farming practices for both food and non-food **agriculture through a combination of traditional farming techniques, advanced precision technologies, and bio-based inputs** can increase biodiversity, enrich soils, improve water management and enhance ecosystem services while improving yields." (WEF 2020: 12)	/	usage of traditional farming techniques, advanced precision technologies, and bio-based inputs	/
"**Sustainable land management, including sustainable forest management, can prevent and reduce land degradation, maintain land productivity,** and sometimes reverse the adverse impacts of climate change on land degradation (very high confidence). It can also contribute to mitigation and adaptation (high confidence). **Reducing and reversing land degradation, at scales from individual farms to entire watersheds, can provide cost effective, immediate, and long-term benefits to communities and support several Sustainable Development Goals (SDGs)** with co-benefits for adaptation (very high confidence) and mitigation (high confidence)." (IPCC SRCCL SPM 2019: 23)		Sustainable land management Reducing and reversing land degradation, at scales from individual farms to entire watershed	
"The adoption of sustainable land management and poverty eradication can be enabled by **improving access to markets, securing land tenure, factoring environmental costs into food, making payments for ecosystem services, and enhancing local and community collective action** (high confidence)." (IPCC SRCCL SPM 2019: 29)	/	improve access to markets, secure land tenure, internalize environmental costs, payment for ecosystem services and enhance local and community collective action	enhance local and community collective action = inclusive governance?
"Promoting the use of biodiversity-friendly management practices in crop and livestock production, forestry, fisheries and aquaculture, including, where relevant, the use of traditional management practices associated with indigenous peoples and local communities" (IPBES 2019: 48)	/	promote usage of biodiversity-friendly management practices and include traditional management practices	Inclusive governance
"Discourage excess usage of fertilizers in agricultural production, especially those releasing nitrogen and phosphorus into environment, which can be done through regulation and through deployment of new technologies. Reuse of nutrients and energy on farms should also be encouraged." (GSDR 2019: 165)			

Call for Action	Who?	What?	How?
"Scale up reliance on agroecology as a means to sustainably intensify food production and to accelerate the transition towards a synthetic pesticide–free agriculture. This requires a reassessment of production practices, with the least possible pesticide use and no critical residues in plants and foodstuffs." (GSDR 2019: 166)			
"Strengthened **multi-level, hybrid and cross-sectoral governance**, as well as **policies developed and adopted in an iterative, coherent, adaptive and flexible manner can maximise co-benefits and minimise trade-offs**, given that land management decisions are made from farm level to national scales, and both climate and land policies often range across multiple sectors, departments and agencies (high confidence)." (IPCC SRCCL SPM 2019: 30)	/	multi-level, hybrid and cross-sectoral governance and policies developed and adopted in an iterative, coherent, adaptive and flexible manner	integrated and adaptive governance
"The international community should support sustainable development of agriculture in developing countries, including through **inclusive business models in agriculture** and promotion and transfer of existing sustainable technologies." (GSDR 2019: 167)	international community	support sustainable agriculture in developing countries, promotion and transfer of existing sustainable technologies	inclusive and accountable governance
"Governments should take immediate action to support **land degradation neutrality** so as to benefit food security, biodiversity and farmers' livelihoods and mitigate climate change. The **transition to sustainable land-management practices, requires sectoral coordination and investments in integrated land-use planning**." (GSDR 2019: 169)	Governments	sectoral coordination and investments in integrated land-use planning to support land degradation neutrality	integrated governance
ENHANCE ECOSYSTEM RESTORATION			
"For example, scenarios that involve bold conservation and **restoration efforts** enable a future pathway in which the essential components of the 2050 Vision for Biodiversity may be realized, but only if coupled with simultaneous measures to **transform the current food system**, thus addressing the underlying drivers of further conversion of habitats to meet food demand." (SCBD 2020: 145) "As part of integrated landscape planning and management, prompt **ecological restoration**, emphasizing the use of native species, can offset the current degradation and save many endangered species, but is less effective if delayed." (IPBES 2019: 21)	/	restoration efforts, with native species addressing underlying drivers **ecological restoration**, can offset current degradation and save many endangered species, but is less effective if delayed.	/

Call for Action	Who?	What?	How?
"Given the inherent high costs of ecosystem restoration, it can be promoted by economic incentives such as PES (Bullock et al. 2011) and/or by biodiversity-offset policies (Maron et al. 2012)" (IPBES Am 2018: 586)	/	economic incentives to reduce costs of ecosystem restoration	/
POLICY MIX FOR BIODIVERSITY			
"Due to the complexity of challenges and the diversity of actors involved in addressing land challenges, **a mix of policies, rather than single policy approaches**, can deliver improved results in addressing the complex challenges of sustainable land management and climate change (high confidence). **Policy mixes** can strongly reduce the vulnerability and exposure of human and natural systems to climate change (high confidence). Elements of such policy mixes may include weather and health insurance, social protection and adaptive safety nets, contingent finance and reserve funds, universal access to early warning systems combined with effective contingency plans (high confidence)." (IPCC SRCCL SPM 2019: 29) "Using existing entry points and mechanisms that draw on a **mixture of policy instruments** can help to leverage synergies, by facilitating the implementation of policy at regional and national levels." (IPBES Af 2018: 20) "Improving existing policy instruments and using them strategically and synergistically in smart policy mixes" (IPBES 2019: 47)	/	Transformative potential lies in a mix of policies rather than single policy approaches due to complexity of challenges and diversity of actors	/
Sustainable management of biodiversity for food and agriculture (BFA): "Although incentive programmes supporting the sustainable management of BFA are becoming more widespread, such schemes are often isolated measures targeting the particular concerns of individual public programmes, private-sector operations or civil-society initiatives, and in many cases are very localized. Evidence suggests that a coordinated package of measures can create more impact in terms of improving outcomes for BFA. Other priorities include better documenting and mapping existing schemes, taking a longer-term perspective in planning, and improving cross-sectoral cooperation and institutional collaboration so as to improve the coordination of multiple incentives." (FAO 2019: 496)	/	Improving outcomes for BFA by coordinate packages of measures, better documenting and mapping existing schemes	Long-term perspective, cross-sectoral cooperation and institutional collaboration Integrated governance
DEVELOP INCENTIVES FOR ENVIRONMENTAL RESPONSIBILITY AND REMOVE PERVERSE INCENTIVES			

Call for Action	Who?	What?	How?
"Governments could **reform subsidies and taxes** to support nature and its contributions to people, removing perverse incentives and instead promoting diverse instruments such as payments linked to social and environmental metrics, as appropriate." (IPBES 2019: 46) "Remove or revise policies" (FAO 2019: 490) "The removal of harmful subsidies in various sectoral policies, such as agriculture, fisheries and energy, in Europe and Central Asia, reduces negative impacts on biodiversity and allows for a more cost- effective use of public funds." (IPBES 2018: 23) "Developing incentives and widespread capacity for environmental responsibility and eliminating perverse incentives" (IPBES 2019: 20) "Environmental taxes, charges and fees make environmental pollution and habitat degradation more expensive, thereby making the polluter pay, whereas payments for ecosystem services or compensation payments reward conservation-friendly behaviour that is otherwise not profitable or affordable {6.4.1, 6.4.2, 6.6.5.2}. **Reforming environmentally harmful subsidies** in sectors that negatively affect ecosystems (e.g., agriculture, fisheries, energy) would support more cost-effective use of public funds in reaching conservation objectives. Innovative economic and financial instruments include biodiversity offsets and habitat banking, tax reliefs, ecological fiscal transfers and integrated funding for biodiversity and climate-change adaptation." (IPBES 2018: 51)	Government	Remove environmentally harmful policies, subsidies and taxes across sectors (agriculture, energy, fisheries) Developing incentives and capacity for environmental responsibility Payments linked to social and environmental metrics payments for ecosystem services compensation payments to reward conservation-friendly behaviour biodiversity offsets and habitat banking tax reliefs ecological fiscal transfers integrated funding for biodiversity and climate-change adaptation.	integrated
FINANCING CONSERVATION			
"Improving market-based instruments, such as **payment for ecosystem services, voluntary certification and biodiversity offsetting**, to address challenges such as equity and effectiveness." (IPBES 2019: 50) "Additional tools could include both non-market and market-based economic instruments for financing conservation, including for example **payment for ecosystem services, biodiversity offset schemes,**	/	payment for ecosystem services, voluntary certification biodiversity offset schemes, blue-carbon sequestration, cap-and-trade	/

Call for Action	Who?	What?	How?
blue-carbon sequestration, cap-and-trade programmes, green bonds and trust funds and new legal instruments, such as the proposed international, legally binding instrument on the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction under the United Nations Convention on the Law of the Sea" (IPBES 2019: 45)		programmes, green bonds and trust funds and new legal instruments	
FINANCE			
"Financial institutions should ensure that, at the very least, they do no harm and do not support companies that deplete natural capital. Financial risk management should treat natural capital as an integrated whole, not as a series of stand-alone components. Climate change, water, biodiversity and public health are interrelated, and those links should be analysed to ensure no risks are missed." (GDSR 2019: 170)	financial institutions	risk management: treat natural capital as an integrated whole; analyse links between climate change, water, biodiversity and public health	accountable governance
ENVIRONMENTAL LAW AND REGULATORY STANDARDS			
"Strengthening environmental laws and policies and their implementation, and the rule of law more generally" (IPBES 2019: 20) "Strengthening and promoting biodiversity-inclusive environmental impact assessments, laws and guidelines" (IPBES 2019: 49) "Set up, adjust and enforce legal and regulatory standards to sustain biodiversity and nature's contributions to people" (IPBES ECA 2018: 49)	Government	Strengthening environmental impact assessments, laws, policies and standards	/
INTERNALIZING THE EXTERNAL COSTS			
"Introducing and improving **standards, systems and relevant regulations aimed at internalizing the external costs of production, extraction and consumption** (such as pricing wasteful or polluting practices, including through penalties)" (IPBES 2019: 44)	government	improve standards, systems and regulations to internalize the external costs production, extraction and consumption	/
"**Reflecting the environmental costs of land-degrading agricultural practices** can incentivise more sustainable land management (high confidence). Barriers to the reflection of environmental costs arise from technical difficulties in estimating these costs and those embodied in foods." (IPCC SRCCL SPM 2019: 30)	/	Reflection of environmental costs of agricultural practices	/
ACCOUNTING FOR NATURE DETERIORATION			

Call for Action	Who?	What?	How?
"**Accounting for nature deterioration** from local economic activities and socioeconomic and environmental interactions over distances (telecouplings), including, for example, international trade" (IPBES 2019: 20)	/	Accounting for nature deterioration from local economic activities and telecouplings	
TAKING AN ECOSYSTEM APPROACH TO (WATER) RESOURCE MANAGEMENT			
"Integrating water resource management and landscape planning, including through increased protection and connectivity of freshwater ecosystems, improving transboundary water cooperation and management, addressing the impacts of fragmentation caused by dams and diversions, and incorporating regional analyses of the water cycle" (IPBES 2019: 49)	/	Integrating water resource management and landscape planning; improve transboundary water cooperation and management; address the impacts of fragmentation caused by dams and diversions	Integrated governance
IMPLEMENT INCENTIVES AND REGULATIONS THAT PROMOTE THE "GOOD" AND REDUCE THE "BAD"			
"Some incentives and regulations may contribute to positive changes at both the production and consumption ends of supply chains, such as the creation, improvement and implementation of voluntary standards, certification and supply-chain agreements (e.g., the Soy Moratorium) and the reduction of harmful subsidies. Regulatory mechanisms could also address the risks of co-option and lobbying, where commercial or sectoral interests may work to maintain high levels of demand, monopolies and continued use of pesticides and chemical inputs {5.3.2.1}. Non-regulatory alternatives are also important, and potentially include technical assistance – especially for small-holders – and appropriate economic incentive programs, for example, some payment for ecosystem services programmes and other non-monetary instruments" (IPBES 2019: 45)			

Appendix 8: Transformative actions for biodiversity, core challenge 2

Call for Action	Who?	What?	How?
ADDRESS INEQUALITIES			
"The Impact Inequality points to the levers we have at our disposal to steer the global economy towards sustainable development. But the Inequality has had to be expressed at the global level." (Dasgupta et al. 2020: 43)	/	Express inequality at the global level	/
"Secondly, the distributional impacts must be considered, and indigenous peoples and local communities must be fully involved in the development and implementation of land-based approaches." (SCBD 2020: 175)	/	Consideration of distributional impacts and involvement of IPLCs	inclusive governance
"Essential principles of a biodiversity-inclusive approach to One Health are that it should: consider all dimensions of health and human well-being; enhance resilience of socio-ecological systems to prioritize prevention; apply the ecosystem approach; be participatory and inclusive; be cross-sectoral, multinational, and transdisciplinary; operate across spatial and temporal scales; and promote social justice and gender equality." (SCBD 2020: 179)	/	Essential principles of a biodiversity-inclusive approach to One Health	participatory and inclusive governance integrated governance
"All stakeholders should pay special attention to the interlinkages between energy and poverty eradication, reduction of inequalities, gender equality, jobs, biodiversity and climate change." (GSDR 2019: 168)	all stakeholders	Interlinkages between energy, biodiversity, climate change and inequalities	accountable governance
"Addressing inequalities, especially regarding income and gender, which undermine the capacity for sustainability" (IPBES 2019: 20)	/	Address inequalities to increase capacity for sustainability	/
Rights of IPLCs: "Consequently, assuring the rights of indigenous and local populations to land and to keeping traditional management practices - inside or outside protected areas - is not only a matter of social justice; it is intimately related to a conservation strategy for biodiversity and ecosystem services conservation at a relatively low cost. This seems especially relevant for food security in the current global context of climate change, increasing population and an eroding genetic diversity of plant cultivars." (IPBES Am 2018: 584)		Assuring the rights of IPLC to land and their management practices as a conservation strategy for biodiv and ecosystem services conservation	inclusive governance
"Governments, supported by civil society and the private sector, should promote an upward convergence in living standards and opportunities, accompanied by reduced inequalities in wealth and income, within and across countries." (GDSR 2019: 165)			

Call for Action	Who?	What?	How?
"Strengthen the returns to work to achieve a more equitable balance with the returns to capital and ensure full parity across genders." (GDSR 2019: 165)		Returns to work should be strengthened to achieve a more equitable balance with returns to capital and ensure full gender parity.	
"Apply redistributive strategies appropriate to context to reduce inequality, with additional targets for the most severe inequality dimensions in each country. Report on those targets in voluntary national reviews." (GDSR 2019: 165)			
"Encourage governments, with the support of the private sector and civil society, to explore equitable employment opportunities for workers displaced in the shift to the low-carbon economy." (GDSR 2019: 165)		explore equitable employment opportunities for workers displaced by low-carbon transition	anticipate resistance
BUILD CAPACITY FOR SUSTAINABLE ALTERNATIVES			
"Cooperation on strengthened accountable multilevel governance that includes non-state actors such as industry, civil society and scientific institutions, coordinated sectoral and cross-sectoral policies at various governance levels, gender-sensitive policies, finance including innovative financing, and cooperation on technology development and transfer can ensure participation, transparency, capacity building and learning among different players (high confidence)." (IPCC 2018: 24)	/	strengthened accountable multilevel governance including gender-sensitive policies, finance including innovative financing, and cooperation on technology development and transfer	accountable, inclusive, integrated, informed and adaptive governance
"As well as organizing training activities, there is a need to improve access to information (e.g. via publications and information systems) and create opportunities for stakeholders to interact and exchange knowledge and ideas." (FAO 2019: 495)	/	improve access to information and create opportunities for stakeholder to interact and exchange knowledge and ideas	increase informed and inclusive governance
INCREASE RESILIENCE			
"Adaptation and enhanced resilience to extreme events impacting food systems can be facilitated by comprehensive risk management, including risk sharing and transfer mechanisms (high confidence). Agricultural diversification, expansion of market access, and preparation for increasing supply chain disruption can support the scaling up of adaptation in food systems (high confidence)." (IPCC SRCCL SPM 2019: 30)	/	to enhance resilience: risk sharing and transfer mechanisms Agricultural diversification, expansion of market access, preparation for increasing supply chain disruption	/

Call for Action	Who?	What?	How?
"Governance options that harness synergies and deliver multiple benefits, supported by an enabling environment, can help to balance patterns of access and allocation of ecosystem services in Africa. Policy coherence may also contribute towards poverty reduction and help to build resilience." (IPBES Af 2018: 20)	/	Governance options to balance patterns of access and allocation of ecc in Africa Policy coherence	/
"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" (IPBES 2019: 20)	/	managing for resilient social and ecological systems	adaptive governance

Appendix 9: Transformative actions for biodiversity, core challenge 3

Call for Action	Who?	What?	How?
BETTER ALIGN ACROSS SECTORS			
"To utilize this potential and to overcome the current **fragmented policy framework, horizontal coordination between the different sectors** (i.e. forestry, conservation, energy) is required as well as **vertical coherence of policy targets and institutions at the different governance levels** (international, European Union, national, regional)." (IPBES 2018: 785)	/	horizontal coordination, vertical coherence	
"**Cross-sectoral approaches**, including landscape approaches, integrated watershed and coastal zone management, marine spatial planning, bioregional scale planning for energy, and new urban planning paradigms offer opportunities to reconcile multiple interests, values and forms of resource use, provided that these cross-sectoral approaches recognize trade-offs and uneven power relations between stakeholders" (IPBES 2019: 42)	/	cross-sectoral approaches to reconcile multiple interests, values and forms of resource use	integrated governance
"integrative approaches, such as mainstreaming across government sectors, are focused on the relationships between sectors and policies and help to ensure policy coherence and effectiveness" (IPBES 2018: 43)	government	integrative approaches, such as mainstreaming across government sectors	
"Actions in one area will remove barriers impeding change in another, so that **multiple interventions across the whole** range of activity actually become more feasible than attempting to focus interventions in isolated parts of the action portfolio." (SCBD 2020: 145)	/		Integrated governance
"Transformation is possible only when the levers are deployed together in an integrated and intentional manner. The key innovation needed to advance the implementation of the 2030 Agenda must come from novel combinations of levers. Actors from governance, economy and finance, civil society, and science and technology must thus rethink their partnership and establish novel collaborations." (GSDR 2019: 173)	/	Integrated thinking and cooperation between actors is key to implement the 2030 Agenda	integrated and intentional manner
"Reforming sectoral and segmented decision-making to promote integration across sectors and jurisdictions" (IPBES 2019: 20)	/	Reform sectoral and segmented decision-making to promote integration across sectors	Integrated governance
"Particularly important **at the regional scale are policies and programmes that promote sustainability-minded collective action** {5.4.1.3}, **protect watersheds**	regional scale	policies and programmes that	use cross-sectoral approaches

Call for Action	Who?	What?	How?
beyond city jurisdictions and ensure the connectivity of ecosystems and habitats (e.g., through green belts). At the regional scale, **cross-sectoral approaches** to mitigating the impact of infrastructure and energy projects entail support for comprehensive environmental impact assessments and strategic environmental assessments of local and regional cumulative impacts" (IPBES 2019: 46)		promote sustainability-minded collective action, protect watersheds beyond city jurisdictions and ensure the connectivity of ecosystems and habitats	integrated governance
SPECIFICALLY COMBINE ACTION FOR CLIMATE CHANGE AND BIODIVERSITY			
"To the urgent and often integrated issues related to climate and land-use change, biodiversity and ecosystem loss, and persistence of poverty and inequality, this Chapter uncovers some emerging solutions. For instance, … **ecosystem-based approaches** to climate change adaptation and disaster risk reduction are a great opportunity for the region. Such **policies combine biodiversity conservation with climate change mitigation and improvement of livelihoods**." (IPBES Am 2018: 606)	/	Ecosystem-based approaches / policies combining biodiversity conservation with climate change mitigation and improvement of livelihoods	/
Nature-based solutions: "Employing nature-based solutions, alongside a **rapid phase-out of fossil fuel use**, to reduce the scale and impacts of climate change, while providing positive benefits for biodiversity and other sustainable development goals. This transition recognizes the role of biodiversity in sustaining the capacity of the biosphere to mitigate climate change through carbon storage and sequestration and in enabling adaptation through resilient ecosystems, as well as the need to promote renewable energy while avoiding negative impacts on biodiversity" (SCBD 2020: 175)	/	Nature-based solutions and rapid phase-out of fossil fuel use	/
"Mutually supportive climate and land policies have the potential to save resources, amplify social resilience, support ecological restoration, and foster engagement and collaboration between multiple stakeholders (high confidence)." (IPCC SRCCL SPM 2019: 29)	/		Mutually supportive climate and land policies
COHERENT POLICIES AND COMPREHENSIVE SPATIAL PLANNING			
"Coherent policies on agriculture, forestry, and on rural, urban and infrastructure development, and comprehensive spatial planning, applying the ecosystem approach or landscape approach" (SCBD 2020: 151)	/	coherent policies on agriculture, forestry, and on rural, urban and infrastructure development, and comprehensive spatial planning	integrated governance

Call for Action	Who?	What?	How?
MAINSTREAMING BIODIVERSITY			
"Mainstreaming biodiversity within and across different sectors (e.g., agriculture, forestry, fisheries, mining, tourism) " (IPBES 2019: 47, see also IPBES 2019: 20) "Promoting biodiversity mainstreaming through stakeholder engagement and integrative planning" (IPBES 2019: 19) "Most important is to include the conservation and sustainable use of biodiversity, and the provision of nature's contributions to people, into all sectoral policies (e.g. agriculture, energy, health, industry, transportation), plans, programmes, strategies and practices - an objective known as "mainstreaming biodiversity"." (IPBES 2018: 8) "Greater mainstreaming of biodiversity and ecosystem services considerations into important development sectors such as energy and agriculture is occurring in many governments, but scope for substantially more progress has been identified (CBD 2016a)." (IPBES Am 2018: 575) "Mainstreaming the conservation and sustainable use of biodiversity and the sustained provision of nature's contributions to people into policies, plans, programmes, strategies and practices of public and private actors could be achieved with **more proactive, focused and goal-oriented environmental action**, including quantitative goals (well established)" (IPBES 2018: 48)	government	(intensify) mainstreaming biodiversity and ecosystem services into policies, plans, programmes, strategies and practices of public and private actors could be achieved with **more proactive, focused and goal-oriented environmental action**, including quantitative goals	stakeholder engagement and integrative planning proactive, focused and goal-oriented environmental action
"Thus, compensation and offset logic ought to be applied to energy projects (see 6.4.2.2) and biodiversity and ecosystem services policy instruments should also be used in energy policy design." (IPBES Am 2018: 575)	/	Apply biodiv and ecosystem services logics and policies in the energy field	/
INCLUDE PRIVATE SECTOR AND CIVIL SOCIETY			
"Yet the speed of change required, the future budget constraints facing governments that are now preparing to spend heavily in the recovery from the pandemic, and the reality of a fracturing of international cooperation and coordination **all point to the limits of relying on governments as the sole leaders on this agenda**." (WEF 2020: 15)			
"Expanding **multi-sectoral cooperation** by **increasing and improving corporate social responsibility** measures and regulation in building and construction standards, and eco-labelling and best practices" (IPBES 2019: 48)	/	increase and improve corporate social responsibility	accountable governance

Call for Action	Who?	What?	How?
"Improving and **expanding the levels of financial support for conservation** and sustainable use through a variety of innovative options, including **through partnerships with the private sector**" (IPBES 2019: 48)	/	Financial support (including partnerships with private sector) for conservation and sustainable use	integrative governance
"Actors should include civil society, communities (including indigenous peoples) and governments." (GDSR 2019: 169) "Bringing together stakeholders (both public and private) with different perspectives and supported by enhanced international cooperation and multilevel partnerships, and through the provision and mobilization of sustainable, predictable and adequate means of implementation." (IPBES Af 2018: 20)	/	include a wide range of actors / stakeholders	international cooperation and multi-level partnerships
INTERNATIONAL BIODIVERSITY GOALS			
"Increasing the effectiveness of current and future international biodiversity targets and goals (such as those of the post-2020 global biodiversity framework and of the Sustainable Development Goals)" (IPBES 2019: 47)	/	Increase effectiveness of international biodiversity targets and goals	/

Appendix 10: Forests: How transformative are the recommendations in the assessment reports?

Looking at the four reports dealing chiefly with forests (FAO SWF 2020, EU 2019, NYDF 2019, FAO GFRA 2020) and at other documents that give some specifically forest-related recommendations, a first step is to analyse what kind of transformative elements these recommendations include. We follow the framework developed in chapter 3.

Two out of the four reports explicitly mention "transformational change" (FAO SWF 2020: 22, NYDF 2019: 74) and "transformative progress" (NYDF 2019: 9) as goals; all reports recommend at least some elements of transformative change. Notably, the most central recommendations can hardly be considered transformative by themselves: reforestation, increased conservation efforts, forest restoration, and an improved enforcement of existing laws and regulations would undoubtedly improve the state of the world's forests without transforming or even questioning the existing system(s). Yet, a successful sustainability transition without these elements is hardly conceivable.

Block 1: Transformative vision

Elements of a transformative vision can be found across the reports recommending action for forests, embedding them in a broader system view that reaches well beyond the forest sector itself.

Agriculture is identified as a major cause for deforestation, as well as other production systems that lead to deforestation. Consequently, a call for a fundamental restructuring of production and consumption patterns is widely echoed across various reports (cf. FAO SWF 2020: 22; EU 2019: 9; NYDF 2019: 83), but generally remains vague. One recommendation specifies that "environmental degradation and unsustainable resource use" must be decoupled from economic growth (FAO SWF 2020: 22). The reduction of pressures on woodland, according to the NYDF report, "requires more productive systems among smallholders and basic-needs populations, improved land management and practices across sectors, and, to a larger extent, a move to sustainable, plant-based diets among the wealthy, and a reduction in overall food waste and losses" (NYDF 2019: 18). The report thus explicitly addresses the contribution wealthy people and countries must make regarding the profound transformation of global consumption patterns. At the same time, the economic viability of local smallholders needs to be safeguarded. Even more sweepingly, FAO and UNEP emphasise the role of consumer awareness along the entire food chain in combination with more sustainable production techniques, pointing out the nexus between technology, health, and consumer behaviour and thus the need to overcome sectoral boundaries in the protection and sustainable use of forests: "Adopting agroforestry and sustainable production practices, restoring the productivity of degraded agricultural lands, embracing healthier diets and reducing food loss and waste are all actions that urgently need to be scaled up" (FAO SWF 2020: 22). Other reports accordingly recommend developing "a societal vision for the protection of forests" (GDSR 2019: 169) and more sustainable lifestyles (EU 2019: 9).

The recommendations in the reports we analysed often target the finance and business sectors as effective leverage points for transformation, in addition to the fiscal policies of governments. This is at least potentially connected to visions of a completely transformed world economic system. For instance, UNEP recommends a "review of agricultural subsidies, given that agriculture is the biggest driver of deforestation" (FAO SWF 2020: 167). More broadly speaking, governments should "phase out countervailing fiscal and other incentives and replace them with smart subsidies that support ecological restoration, while creating additional incentives for forest and ecosystem conservation" (NYDF

2019: 82) and provide "financial institutions and lenders" with "the safeguards necessary to ensure that investments and finance are not supporting deforestation" (NYDF 2019: 17).

Private businesses, for their part, are called upon to increasingly pursue environmentally and socially responsible business models (FAO SWF 2020: 23), and particularly agribusinesses should align their policies and practices with biodiversity conservation goals (FAO SWF 2020: 167).

Summary and appraisal: The reports consider fundamental change to be necessary in order to address continuing forest loss. They conceive forest loss and degradation as driven by – or at least strongly linked to – the global food system, from agricultural production to food consumption. The vision sketched out is blurry and relies chiefly on the supply chain and demand for food. There is considerable emphasis on the role of both individual consumers' awareness and the finance sector. Reports call for the promotion of certification schemes for deforestation-free products as an important tool for achieving required change. Alternatives to current forms of production are sometimes identified, e.g. agroforestry, but with much less emphasis or detail on implementation, whereas there is a general call for sustainable production practices and responsible business models. Governments are asked to replace harmful subsidies with smart ones.

Block 2: Transformative knowledge

Current global assessment reports point out how complex forest-related systems need to be better understood in order to design strategic interventions for system change. While system understanding elements also play a role in many concrete actions and solutions, we focus here on the middle ground between the universal and the locally specific. Four points stand out.

First, there is an urgent need to mainstream biodiversity (conservation) and sustainability into all relevant sectors, including "forest management practices in all forest types" (FAO SWF 2020: 22; see also IPBES SPM 2019: 19). At the same time, the IPBES regional assessment for Europe and Central Asia argues for "vertical coherence of policy targets and institutions at the different governance levels (international, European Union, national, regional)" (IPBES ECA 2018: 784) in addition to horizontal coordination. Trade-offs need to be accounted for (FAO SWF 2020: 162), and the articulation of co-benefits offers an opportunity to make interventions more powerful: "Public policies that combine a bundle of several goals tend to be stronger than those motivated by a single issue because they get more and broader financial support and buy-in" (NYDF 2019: 18).

Second, an important entry point for strategic interventions into the forestry system is seen in subsidy schemes and incentivising practices by governments. Namely, they should "phase out countervailing fiscal and other incentives and replace them with smart subsidies that support ecological restoration, while creating additional incentives for forest and ecosystem conservation" on a large scale (NYDF 2019: 82).

Third, the Independent Group of Scientists argues for establishing "new multilateral agreements to guarantee the protection of the largest tropical rainforests of the planet" (GDSR 2019: 168). Beyond the "coordination of governments — including both producing and importing countries", a comprehensive global forest strategy must encourage "companies, civil society, and indigenous peoples' organizations" to "explicitly align efforts to preserve primary forests, sustainably manage production forests, and restore natural forests in degraded landscapes" (NYDF 2019: 82).

Fourth, the role of research is not made very prominent in most reports, which suggests that knowledge for action may already be abundant but not well connected. Still, the 2020 UNEP report

argues that sound knowledge is crucial for "biodiversity planning and decision-making in changing contexts'' (FAO SWF 2020: 156) and advocates for the improvement of remote sensing and monitoring approaches. The EU also emphasises the general need for further scientific insights to end deforestation and forest degradation, especially regarding climate change, nature-based solutions, forest restoration, and commodity chains (EU 2019: 16).

Summary and appraisal: Overall, closer coordination and integration across sectors (public/private/non-profit), industries (forestry/energy/conservation/agriculture etc.), and scales (from local to global) is recommended as the main lever, in the sense of Chan et al. (2020), for successful sustainability transitions that preserve the world's forests. Various research gaps are identified, but are generally not conceptualised within an overarching strategic vision of transformative change.

Block 3: Transformative dynamics

The dynamic perspective of Loorbach et al. allows connecting recommendations to specific stages of phasing-in or phasing-out processes. The assessment reports, it turns out, generally cover the early stages of both types of processes, but do not address the final stages (break-down/phase-out and emergence/institutionalisation/stabilisation, respectively).

The downward branch starts with ideas for the **optimisation** of existing systems and instruments such as improved land-sparing and land-sharing approaches (FAO SWF 2020: 167). Beginning **destabilisation** can be seen in the call for redirecting private finance to deforestation-free activities (FAO SWF 2020: 13), and the phasing out of harmful subsidies (NYDF 2019: 82). The next stage, **disruption**, is addressed when the FAO states that we must change "the way in which we produce and consume food" as it has been leading to "inappropriate agricultural practices that drive large-scale conversion of forests to agricultural production" (FAO SWF 2020: 22). Proposals for break-down and phase-out do not feature in the reports studied here.

The upward branch of new solutions that are needed begins with approaches still in early stages of **experimentation** and remain somewhat abstract: "Truly participatory approaches that empower local people, combined with incentives to develop alternative resources, can support more-sustainable forest management favouring both people and conservation" (FAO SWF 2020: 163). The following stage, **acceleration**, is connected to quite concrete proposals in the reports. Agroforestry (FAO SWF 2020: 22), integrated land-use planning (FAO SWF 2020: 167) such as landscape or jurisdictional approaches (NYDF 2019: 43), and carbon dioxide removal measures such as restoration of natural ecosystems and soil carbon sequestration (IPCC SR1.5 2019: 17) are recommended as nascent and promising approaches that should be scaled up and accelerated. The last three stages in the Loorbach et al. (2017) framework, emergence, institutionalisation and stabilisation, are generally not conceptualised in the reports.

Summary and appraisal: Taken together, these findings suggest that the first steps of phasing-in and phasing-out dynamics required to achieve sustainability transformations in the world's forests seem more or less clear, but the final stages remain under-conceptualised in the current assessments. This may well reflect the fact that while there seems to be agreement on what needs to be done in general, there is not enough practical on-the-ground experience to imagine how exactly the transformation might evolve once the crossing point is reached. It appears that sufficient knowledge is available on what needs to change, but little has so far been put into action.

Block 4: Emancipation and agency for transformation

The need for more participatory approaches is strongly emphasised across the various reports dealing with forests. Such approaches should “empower local people, combined with incentives to develop alternative resources” (FAO SWF 2020: 163). Together with administrative decentralisation, participatory measures can make forest policy more effective (IPBES ECA 2018: 785). Particularly, under-represented rural communities (NYDF 2019: 81) and “forest-dependent people, who are at risk of being disregarded by efforts meant to advance the SDG agenda” (FAO SWF 2020: 162) ought to be empowered.

In Europe and Central Asia, the IPBES finds promising ideas for local participation have “been underutilized (e.g., between forestry and reindeer husbandry)” (IPBES ECA 2018: 785). Bottom-up processes are seen as conditions to support negotiation and improve conflict management (IPBES ECA 2018: 784). Civil society is a sector that should be emphatically included in action related to forests and agricultural supply chains, given that they can often “influence private acts by creating public pressure or by providing technical assistance and consultation on the various actions needed to improve supply-chain transparency and governance” (NYDF 2019: 52). The FAO highlights the importance of forest-related education which will help societies to tackle grand challenges and “to adapt to changing economic, social and environmental conditions” (FAO GFRA 2020: 122).

The recognition of rights and the establishment of forest tenure security are identified by several reports as crucial steps to ensure that transitions will be not only environmentally sustainable, but also socially fair and inclusive by helping to ensure that poorer segments of society have access to forest resources and by encouraging investment (cf. FAO 2020: 167; IUFRO vol. 39 2020; FAO GFRA 2020: 97). Similarly, the call for cross-sectoral thinking is linked to a vision of justice and equality in the NYDF report, besides arguing that this will make policy instruments most effective. These instruments must “pinpoint uneven power relations that result in injustice and inequalities, and incentivise both individual responsibility and collective action” (NYDF 2019: 9).

Summary and appraisal: Several reports emphasise the need for honest and far-ranging involvement of local communities in forest policies and programmes while also securing their tenure rights, even against vested interests of more powerful actors. They point out that enabling rural, marginalised people to increasingly take their destiny into their own hands may potentially benefit the world’s forest ecosystems as well.

Block 5: Transformative actions and solutions

In the table below, we analysed some of the recommendations identified in the assessments that appear to hold the highest innovative/transformative potential based on actors ("who"), strategic actions ("what") and transformative governance ("how" - inclusive, accountable, informed, integrated, adaptive). When analysing these recommendations, the question of "what" kind of instruments are recommended is the one most easily identified. The "who" should act is often answered, at least roughly or implicitly. However, "how" it should be done predominantly remains rather vague. For instance, the appeal to businesses' intrinsic initiative to become sustainable and deforestation-free appears like wishful thinking to some extent. A possible interpretation is that the need for comprehensive, transformative action is recognised in cutting-edge assessment reports, but how it can work is not sufficiently clear yet. Another theory is that the 'how to' is too contested or seems overly prescriptive to survive intergovernmental negotiations, which most assessments go through. This also corresponds to the finding that there are ideas for the first steps on both Loorbach et al.'s curves, but not for the later stages. These gaps are addressed in chapter 6.2.

Call for Action	Who?	What?	How?	Observation
Green finance: Achieving international and national forest goals is not possible without dedicated and reliable financing from domestic, international, public, and private sources to address each of the above drivers of forest loss. This implies a need for new finance streams, but, even more importantly, a redirecting of mainstream finance toward activities that have positive conservation outcomes ('green' finance). (NYDF 2019: 17)	-	"mainstream finance"	Implicitly adaptive-"re-directing"	No actor identified, little information on "what", no explicit information on "how"
Sustainable forest management: *"As a means to bring decision-making closer to the implementation level, four variables are most important for achieving sustainable forest management via nation-wide Forest Programmes: participation, collaboration, inter-sectoral cooperation, and long-term iterative adaptive approaches (Humphreys 2004: 18)."* (IPBES ECA 2018: 785)	"Decision making"	Bring closer to implementation	Cross-sectoral collaboration, participation, cooperation, and long-term iterative adaptive approaches. Inclusive, integrative	"who" is rather vague, "how" is very close to transformative governance, lacking specification only on accountability
Deforestation in value chains: *"Agribusinesses must meet their commitments to deforestation-free commodity chains, and companies that have not made zero-deforestation commitments should do so. Commodity investors should adopt business models that are environmentally and socially responsible."* (FAO SWF 2020: 22 – 23)	Agri-businesses	Meet their commitment to deforestation free commodity chains; make zero deforestation commitments	Accountable	
Deforestation in value chains: *"Agribusinesses must meet their commitments to deforestation-free commodity chains, and companies that have not made zero-deforestation commitments should do so. Commodity investors should adopt business models that are environmentally and socially responsible."* (FAO SWF 2020: 22 – 23)	Commodity investors	Adopt (deforestation-free) business model	Environmentally and socially responsible Adaptive	

Track forest impacts: *"Most programs addressing poverty and human development **do not track forest impacts**, making it difficult to determine how much support is specifically addressing forest loss. However, increased understanding of the link between poverty and resource degradation can help to improve the efficacy of interventions like the formalization of small-scale commercial activities and the adoption of clean cookstoves."* (NYDF 2019: 17)	Programmes addressing poverty and human development	Track forest impacts to determine how much support is specifically addressing forest loss	Increased understanding of the link between poverty and resource degradation can help to improve the efficiency of interventions Informed	
Agroforestry: *"Promote **agroforestry** to increase forestation, decrease soil erosion and strengthen resilience by diversifying income, particularly in developing countries."* (GDSR 2019: 165)	Particularly in developing countries	Promote agroforestry	Strengthen resilience by diversifying income	
Revise incentive schemes: *Governments should also phase out countervailing fiscal and other incentives and replace them with smart subsidies that support ecological restoration, while creating additional **incentives** for forest and ecosystem conservation* (NYDF 2019: 82)	Governments	Phase out countervailing fiscal and other initiatives and replace them with smart subsidies	Support ecological restoration Adaptive.	
"Developing, enabling and promoting access to cleaner energy sources and technologies can contribute to adaptation and mitigating climate change and combating desertification and forest degradation through decreasing the use of traditional biomass for energy while increasing the diversity of energy supply (medium confidence). This can have socioeconomic and health benefits, especially for women and children. (high confidence). The efficiency of wind and solar energy infrastructures is recognised; the efficiency can be affected in some regions by dust and sand storms (high confidence)." (IPCC SRCCL SPM 2019: 22)	/	Access to cleaner energy for combating global warming, desertification and forest degradation		

Appendix 11: The Ocean: How transformative are the recommendations in the assessment reports?

"The ocean is essential for all aspects of human well-being and livelihood. It provides key services like climate regulation, through the energy budget, carbon cycle and nutrient cycle. The ocean is the home of biodiversity ranging from microbes to marine mammals that form a wide variety of ecosystems in open pelagic and coastal ocean." (IPCC SROCC 2019: 4)

"Given the increasing pressures on the oceans, there is no time to waste – mainstreaming biodiversity is an imperative" (FAO GFRA 2020: 160)

All analysed assessments point to the high importance of the ocean for the well-being of the planet and all its inhabitants. Not only the first World Ocean Assessment (WOA 2016) warned that many areas of the ocean have been seriously degraded, the greatest threat to the ocean being the failure to deal with the many pressures caused by human activities. The recommendations given to guide the development of the oceans towards sustainability are examined below for their transformative potential. We follow the framework developed in chapter 3.

Block 1: Transformative vision

A transformative vision includes a far-reaching analysis and critique of the structural or systemic issues that need to be addressed and a narrative combining the 'big picture' of what goes wrong, with 'big answers' that orient and inspire for change. While all assessments underline the enormous importance of the ocean and the services it provides to humans, the need for transformative change is not very explicit outside the IPBES Global Assessment; nonetheless some references can be found. For example, all assessments refer to the 2030 Agenda and SDG 14, and there is a clear acknowledgement of the need to maintain the system, and to better coordinate use and conservation of biodiversity particularly concerning fisheries.

As stressed by the World Ocean Assessment, the ocean is characterised by its fluid nature that results in a high interconnectedness of marine and coastal ecosystems. This interconnectedness (**challenge 1**: Interconnectedness of marine ecosystems and their interactions with socio-economic systems are disregarded) does not only relate to the biological properties, but is as pointed out by the FAO, strongly linked to socio-economic dimensions of i.e. food security and human well-being.

In this context **overfishing** (**challenge 2**: address excessive marine resource use and harmful discharges) is seen as *"one of the most important non-climatic drivers affecting the sustainability of fisheries"* (IPCC SRCCL SPM 2019: 89). The FAO report considers the "*capture fisheries sector…. in need of significant management action..."* (FAO SOFIA 2020: 209) and WOA emphasises that "*the social and economic goals of the fisheries and aquaculture should fully consider sustainable use in order to safeguard future benefits."* (WOA 2016: 318). The FAO report refers to the CBD's Post-2020 Global Biodiversity Framework and acknowledges that this framework will set a *"transformational vision for the delivery of biodiversity mainstreaming"* and continues that "*well-crafted objective-setting can focus the attention of international financing mechanisms, and engender and strengthen cross-sectoral support for actions that contribute to conserving biodiversity"* (FAO SOFIA 2020: 156). It also recommends *"the development of joint biodiversity and food security objectives that recognize trade-offs and are nationally and locally relevant"* (FAO SOFIA 2020: 194). It explicitly uses the term transformative in some places e.g. when referring to its Blue Growth Initiative:

> *"Transformative actions of FAO's Blue Growth Initiative Implementation of BGI projects requires transformative actions that embrace a blue growth model requiring environmental, economic and social considerations. To start with, reducing the pressure on fish stocks often requires a reduction in fishing effort and/or capacity. To achieve this successfully, alternative income-generation activities for fishers are needed." (FAO SOFIA 2020: 177)*

However, the need that such a model requires reducing pressure on fish stocks and this in turn requires alternative income considerations is neither new nor radical nor sufficient to address overfishing. So, the term transformative is used here in a less far-reaching meaning. *"A reduction in fishing effort and/or capacity"* (FAO SOFIA 2020: 178) is emphasised and the assessments further recommend to eliminate illegal, unreported, and unregulated (IUU) fishing, rebuild depleted stocks, reduce the overall ecosystem impacts of fishing, and reduce the negative impacts of pollution (WOA 2016: 417). In consideration of expected climate change impacts in tropical regions (**challenge 1**), the FAO Hand-in-Hand Initiative is presented as an "ideal framework" to streamline planning:

> *"The Hand-in-Hand Initiative aims to accelerate food systems transformation through matching donors with recipients, using the best data and information available. This evidence-based, country-led and country-owned initiative prioritizes countries where infrastructure, national capacities and international support are most limited, and where efficient collaboration and partnerships to transfer skills and technology can be of particular benefit. For example, climate change impacts on marine capture fisheries are projected to be more significant in tropical regions of Africa and Asia, where warming is expected to decrease productivity.* ***Targeted fisheries and aquaculture development interventions in these regions, addressing their specific needs for food, trade and livelihoods, can provide the transformational change we need to feed everyone, everywhere.****" (FAO SOFIA 2020: 8[1])*

Again, the term is used differently. Skills and technology and partnership approaches have certainly improved the situation and allowed for the impressive increases in fish consumption which have taken place in the last decades. Additional reserves may even lie in *"minimizing food loss and waste across the fish value chain coupled with a decline in the use of fish products in animal feeds"* (FAO SOFIA 2020: 171, see also p. 144) and in new technologies that allow to "*move towards more complete utilization of the fish*" (FAO SOFIA 2020: 144). But given the magnitude of the challenge it is surprising that none of the reports explicitly call for reducing consumption or improving distribution in order to reduce pressure from the demand side. Only the IBPES global assessment calls for overall reduction in consumption in wealthier countries without providing details on fish.

Pollution and waste as issues affecting fisheries are mentioned but not at the centre of recommendations. E.g. FAO states that the fisheries sector should reduce its waste but does not go into how to address issues for fisheries or health arising from pollution and increasing ocean plastics.

The IPBES global assessment reaches the conclusion that "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 multi-level coordination across stakeholders on the use of open oceans." They continue with an impressive list of potential actions: "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 [included

[1] Emphasis - as in the following quotations in this appendix and the following appendix - ours

in Appendix 5 of this study]) [(**challenge 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" (IPBES SPM 2019: 20).

Overall, when scrutinising the recommendations, we reach the conclusion that fisheries are discussed in an 'optimisation stage' (according to Loorbach et al. (2017) compare block 3 below): in the face of tremendous challenges and problems calling for substantial need for action, there is a call to address many of these challenges without proposing very far-reaching or radical changes let alone outlining a different overall approach. The pollution of the ocean is identified as a major challenge for biodiversity loss and human health (**challenge 2**), the reports consequently call for a reduced discharge into the oceans of environmentally harmful substances such as fertilisers, pesticides, heavy metals, plastic or untreated wastewater. However, the reports remain relatively vague on how far-reaching the necessary changes should be and how specifically to address them. The FAO report explicitly writes that in addressing the problems, *"special attention should be paid to developing States, SIDS and low-income, food-deficit countries in view of their possible lack of human capacity and finance*" (FAO SOFIA 2020: 171) to find "*alternatives to plastic, including the development of biodegradable materials for fishing gear, and reducing the use of short-life-span plastics*" (FAO SOFIA 2020: 171). Also, the World Ocean Assessment (2016) emphasises the special need to focus on "*growing conurbations without proper sewage treatment systems, such as found in many places in developing countries"* (WOA 2016: 57).

The need for ***"transformative systemic changes"*** *is* most explicitly voiced regarding efforts to limit global temperature rise to 1.5C addressing **challenge 3** (Fragmented governance of the ocean) (IPCC SROCC 2019: 11). As many States are facing challenges to adapt (IPCC SR1.5 2019: 34), the ***"urgency of prioritising timely, ambitious, coordinated and enduring action***" (IPCC SROCC 2019: 35) or, in other words, the need for a *"**[p]rofound economic and institutional transformative change**"* is emphasised in order to *"enable Climate Resilient Development Pathways in the ocean and cryosphere context"* (IPCC SROCC 2019: 34). Similarly, the FAO report states that ***"transformative adaptation** is urgently needed"* (FAO SOFIA 2020: 211). While already many fishers and aquaculture farmers are adapting, "*institutions and policies need to follow suit"* (FAO SOFIA 2020: 211).

> *"Experience to date – for example, in responding to sea level rise, water-related risks in some high mountains, and climate change risks in the Arctic – also reveal the enabling influence of **taking a long-term perspective when making short-term decisions**, explicitly accounting for uncertainty of context-specific risks beyond 2050 (high confidence), and building governance capabilities to tackle complex risks (medium confidence)." (IPCC SROCC 2019: 35)*

Summary and appraisal: Assessments in the marine area are less explicit on the need for society-wide transformational change and recommendations seem to suggest that sustainable fisheries management as envisaged albeit not achieved over the past decades is possible by supporting sector capabilities, management and rule of law within the sector. Overall, when scrutinising the recommendations, we reach the conclusion that fisheries are discussed in an optimisation stage: in the face of tremendous challenges and problems calling for substantial need for action, there is a call to address many of these challenges without proposing very far-reaching or radical changes let alone outlining a different overall approach. A closer look at the lists of suggested changes makes clear that changes required are at least as profound as in the terrestrial realm. Only with regards to climate change, a stronger language is used but recommendations are not as detailed, the synergies between biodiversity conservation and especially ecosystem-based climate change mitigation and adaptation strategies are

well-developed and clear. Interestingly, there are few calls to consumers, in particular there are no calls to reduce consumption of fish apart from reducing waste. Across all three challenges we find neither a 'new vision' for managing oceans nor compelling new narratives.

Block 2: Transformative knowledge

This second building block for driving transformation refers to **better understanding what kind of knowledge is relevant for transformation**, amidst the rapidly growing supply of data and information. Beyond seeking to understand complex systems, it is about the specific knowledge for supporting this process: What type of knowledge is needed for **identifying those interventions that are strategically placed to stimulate and accelerate comprehensive system change**?

To meet transformative knowledge needs for tackling the three core challenges (1: Interconnectedness of marine ecosystems and their interactions with socio-economic systems are disregarded. 2: Address excessive marine resource use and harmful discharges and 3: Fragmented governance of the ocean), we expect assessment **recommendations to refer to knowledge** (production/exchange/identification) **on issues such as**:

- how to enable or facilitate transformative change for reducing pressure on fish stocks and enabling their recovery,
- which actors are in a position to take initiative and contribute substantially,
- how to halt and reverse the continuously increasing levels of pollution reaching the ocean, at global and national scales,
- effective options in changing direction in high impact sectors (e.g. agriculture, industry, human waste, plastics),
- addressing root causes: e.g. poor environmental accountability for using global commons such as oceans for waste disposal
- how to obtain transformative knowledge and make it accessible
- the decoupling of economies from resource consumption and CO_2 production
- strategies for mitigating and adapting to climate change

Assessments point to different needs for knowledge transfer and capacity building e.g. "*In many regions there is insufficient capacity to assess and manage marine resources*" in the context of increasing fishing effort in developing countries, (WOA 2016: 345) aggravated by the fact that "*[r]ecent analyses of unassessed fish stocks indicate that they are mostly in poorer condition"* (Costello et al., 2012) (**challenge 2**). Most of these stocks sustain small-scale fisheries and are critical for food security in developing countries. "*Better information and the capacity to manage many of these stocks will be needed to improve the situation*" (WOA 2016: 346).

In addition, assessments also "flag issues requiring new knowledge, ... But the specific application of plans to promote recovery of the stock...requires significant scientific and management capacity" (WOA 2016: 34) and "*advanced capacity building is necessary for appropriate skills to be able to use advanced technologies to create wealth from capture fisheries and aquaculture in a sustainable way*" (WOA 2016: 419).

Moreover, we can find summaries on the state of knowledge available as well as knowledge gap "while the fields of fishery and aquaculture science are well developed, there are critical needs for research on small-scale subsistence uses of the marine environment as well as recreational, cultural and spiritual aspects of marine resources. In addition, greater understanding must be developed of the structure, function and dynamics of marine ecosystems and of the economic and social aspects of human

society that depend upon these resources" (WOA 2016: 419). In line with the first finding that there is not really a different vision for the oceans, the knowledge needs are not very focussed on how to achieve transformative change but on how to address some of the recommendations made.

> *"Our knowledge of marine debris has many gaps. Unless we understand better the sources, fates, and impacts of marine debris, we shall not be able to tackle the problems that it raises. Although the monitoring of marine debris is currently carried out in several countries around the world, the protocols used tend to be very different, preventing comparisons and the harmonization of data. Because marine debris is so mobile, the result is a significant gap in knowledge. There is also a gap in information for evaluating the impacts of marine debris on coastal and marine species, habitats, economic well-being, human health and safety, and social values. Because of their ability to enter into marine food chains, with a potential impact on human health, more information on the origin, fate and effects of plastic microparticles and nanoparticles is highly desirable. Likewise, because of their potential effects on phytoplankton, there is a gap in knowledge about titanium dioxide nanoparticles." (WOA 2016: 70) (**challenges 1 and 2)**.*

This quote nicely summarises the overall approach: a strong focus on understanding the system and causal relationships, in need of basic data and information on understanding impacts and effects more than how to move towards a different system or stage where the causes of pollution are reduced.

The IPCC identifies several knowledge needs regarding adaptation to climate change (**challenge 1**) that can be considered gaps in knowledge needed to transform societies, even if they do not address the root causes of the problems i.e. mitigate climate change. Important examples include: how to overcome barriers in tackling climate change e.g. that *"adaptation progress may be hampered by competing economic interests and worldviews (Hamilton and Safford 2015), which can be compounded by limited climate change knowledge (Nanlohy et al. 2015). …[and] Locally context-specific data to guide appropriate adaptation response remains a knowledge gap (Abedin and Shaw 2015; Hobday et al. 2015; Lirman and Schopmeyer 2016; Williams et al. 2016)"* (IPCC SROCC 2019: 89). Likewise, *"Conflicting interests and values of stakeholders (Evans et al. 2016), the path-dependent nature of organisations and resistance to change (Evans et al. 2016) and inadequate collaboration and public awareness (Oulahen et al. 2018) have been reported as socio institutional barriers. A knowledge gap persists in understanding how such limits and barriers interact to suppress adaptation response" (*IPCC SROCC 2019: *94).* Despite considerable advances on participatory decision making for fisheries management that respond to climate change, "*[m]ore research is required on socio-ecological responses to climate change impacts on fishery communities, including such aspects like risk reduction, adaptive capacity through knowledge attainment and social networks, developing alternative skills and participatory approaches to decision making (Dubey et al. 2017; Shaffril et al. 2017; Finkbeiner et al. 2018)"* (IPCC SROCC 2019: 90).

More broadly IPCC finds that:

> *"Decision making processes are supported by **economic evaluations** (Bujosa et al. 2015; Jones et al. 2015), evaluations of ecosystem services (MacDonald et al. 2017; Micallef et al. 2018), **participatory processes** (Byrne et al. 2015) and social learning outcomes, the **development of adaptation pathways, frameworks and decision making** (Buurman and Babovic 2016; Dittrich et al. 2016; Michailidou et al. 2016; Osorio-Cano et al. 2019; Cumiskey et al. 2018), and **indicators to support evaluation** of adaptation actions (Carapuço et al. 2016; Nguyen et al. 2017) through monitoring frameworks (Huxham et al. 2015)" (IPCC SROCC 2019: 92).*

Ecosystem-based adaptation is considered as a good strategy with many win/win options, but systematic analysis of implementation experiences as well as evidence of the long-term viability remain limited (**challenge 1**). While IPCC, for example, concludes:

> *"There is a growing body of literature regarding the effectiveness and economics of EbA. In addition to building resilience to climate change,* ***EbA is expected to bring a wide range of co-benefits*** *that include increasing ecological complexity, with multiple ecosystem services, ...,* ***syntheses of experience from context-specific practical implementation of EbA and assessment of their cost-effectiveness are limited*** *(Narayan et al. 2016)" (IPCC SROCC 2019: 86). Similarly, while ecosystem-based adaptation is considered to be a cost-effective coastal protection tool "such adaptation does, however, assume that the climate can be stabilised. Under changing climatic conditions there are limits to the* ***effectiveness of ecosystem-based adaptation, and these limits are currently difficult to determine****" (IPCC SROCC 2019: 9).*

Summary and appraisal: Knowledge needs and gaps focus on management and implementation of a more sustainable approach to fisheries, a basic understanding of source, spread and impact of waste and pollution including its effects on ecosystem and human health, and on adaptation, particularly ecosystem-based adaptation to climate change. In line with the fact that they do not outline visions of transformational change the knowledge needs are very management oriented, or even more basic. Only regarding challenge 1 in its perspective to climate change, some of the mentioned knowledge needs include aspects on how societies operate and how societal change can be better understood and enhanced. Synergies between climate change mitigation, adaptation and biodiversity conservation are outlined.

Block 3: Transformative dynamics

Regarding excessive marine resource use (**challenge 2**), it remains unclear if assessments consider a system change to be necessary for fisheries management. While some calls, in particular for ending IUU fishing and far-reaching calls for knowledge and capacity needs on considerable proportions of global fisheries seem to suggest far-reaching changes are necessary, very few such changes are suggested. Rather the proposal is to broaden the implementation of existing management approaches to other fisheries, albeit with increasing urgency: "*urgent need to* ***replicate and re-adapt successful policies and measures in the light of the realities of specific fisheries****, and to* ***focus on creating mechanisms that can effectively implement policy*** *and regulations in fisheries with little management*" (FAO SOFIA 2020: 71).

Some action has been taken to phase out some of the most immediate and severe sources of pollution (**challenge 2**) e.g. by reducing the risk of oil pollution from tanker damage via MARPOL agreeing on rules to prevent pollution from oil, which "*cover the construction of oil tankers, their operation, what discharges of oily water are permitted, the equipment that must be used and the record-keeping required about any discharges. These requirements have been strengthened over time. In particular, it requires the phasing out of single-hulled oil tankers by, at the latest, 2015.*" (WOA 2016: 445). But we could not identify any generalised proposal for systematically reducing ocean pollution and waste. Thus, neither an understanding of dynamic successive steps nor considerations on which actions or policies at which stage could enhance a transition could be identified.

There are some elements of change along the X curve of phasing in a new approach while phasing out the unsustainable one when it comes to measures regarding climate change. The IPCC calls for experimentation and sharing of experiences: "*Increasing* ***resource mobilisation at the community scale*** *to*

enable communities to experiment and innovate to address the challenges, and then to share their experiences with other communities and build cooperative approaches to promote strategies with successful outcomes" (IPCC SRCCL SPM 2019: 95).

Secondly there is strong evidence on the synergies of conserving and restoring biodiversity, in particular so-called coastal blue carbon ecosystems and adaptation to climate change highlighting that the same measures have a considerable mitigation potential as well.

> *"Coastal **blue carbon ecosystems, such as mangroves, salt marshes and seagrasses, can help reduce the risks and impacts of climate change, with multiple co-benefits.** …. Below-ground carbon storage in vegetated marine habitats can be up to 1000 tC ha–1, much higher than most terrestrial ecosystems [...]. Successful implementation of measures to maintain and **promote carbon storage in such coastal ecosystems** could assist several countries in achieving a balance between emissions and removals of greenhouse gases [...]."*

Conservation is more effective and/or less risky than other natural carbon removal processes "may be more cost-effective in flood protection than hard infrastructure like seawalls (Temmerman et al. 2013; Möller 2019). **Coastal blue carbon can therefore be considered as a 'no regrets' mitigation option** at the national level in many countries, in addition to (not a replacement for) more effective mitigation measures" (IPCC SROCC 2019: 78).

IPCC underscores the need for cooperation and coordination and compiles a long list of issues that need to be addressed in order to enable sustainable development starting with urgent and ambitious emissions reductions.

Summary and appraisal: For fisheries, as mentioned above (Block 1 "vision"), the discussion seems to take place under the aspect of 'optimisation', there are a few calls to better link it to food security and to climate change. Regarding ocean pollution there are some proposals to reduce it by disincentivising or even phasing out some of the most obvious issues such as oil spills from single hull tankers, but there are few proposals on what should be increased or how to reduce pollution. Climate change is the only policy area where some steps are outlined for both phasing in and phasing out. Synergies between climate change mitigation, adaptation and biodiversity conservation are highlighted and conserving and restoring so called 'blue carbon ecosystems' is identified as an excellent option for achieving progress towards all three goals.

Block 4: Emancipation and agency

All assessments highlight the need to include local communities as well as indigenous people and their respective knowledge in decision-making and management across different challenges: thus FAO recommends to "*[e]nsure **fisheries policy** and management decisions are inclusive*" (2020: 212) and IPCC stresses that *"Participatory processes can facilitate the development of networks between coastal communities and environmental managers for the purposes of **developing and implementing adaptation strategies** (Wynveen and Sutton 2015). Improved participatory processes, integrating knowledge systems and improving decision support frameworks may support better-informed decision-making tools in fisheries and aquaculture"* (IPCC SRCCL SPM 2019: 92) (**challenge 2**). Finally the IPBES Global Assessment elaborates that "*[i]n many areas, conservation depends on **building capacity and enhancing stakeholder collaboration, involving non-profit groups as well as indigenous peoples and local communities to establish and manage marine protected areas and marine protected area networks,** and proactively using instruments such as landscape-scale and seascape-scale participatory*

scenarios and spatial planning, including transboundary conservation planning (well established)" (IPBES SPM 2019: 43) (**challenge 1**).

Many calls for inclusion are instrumental in nature, in terms of increasing buy-in and compliance to regulations:

> *"On the challenges to achieving ecological sustainability of global and regional fisheries: … data-poor does not always mean information-poor. Develop and implement better mechanisms to* ***incorporate multiple types of available information, including local knowledge and expertise,*** *and their integration into assessment and management approaches. … Encourage appropriate communication, knowledge mobilization and education across all actors (fishers, scientists and managers) involved in decision-making to improve transfer of information and buy-in compliance to regulations to achieve effective management systems." (FAO SOFIA: 193-194)*

> *"In planning adaptation responses, awareness-raising and* ***stakeholder engagement processes are important for buy-in and ownership of responses*** *[...] as is institutional capacity within local government organisations, whose importance in coastal adaptation initiatives has been emphasised in the recent literature [...]." (IPCC SRCCL SPM 2019: 95)*

> *"****Local knowledge and Indigenous knowledge systems can complement scientific knowledge*** *by, for example, improving community ability to understand their local environment (Andrachuk and Armitage 2015), forecast extreme events (Audefroy and Sánchez 2017) and help to increase community resilience (Leon et al. 2015; Sakakibara 2017; Cinner et al. 2018; Panikkar et al. 2018). Committing resources could strengthen local level adaptation planning (Alam et al. 2016; Novak Colwell et al. 2017) through the inclusion of cultural practices (Audefroy and Sánchez 2017; Fatorić and Seekamp 2017) and Indigenous knowledge systems (Kuruppu and Willie 2015; von Storch et al. 2015).* ***Local knowledge can, however, act as a barrier to adaptation*** *where there is a strong dependency upon such knowledge for immediate survival, to the detriment of long-term adaptation planning (Marshall et al. 2013; Metcalf et al. 2015)" (IPCC SRCCL SPM 2019: 93).*

In other instances the reasons for inclusion go further by also involving acknowledging social learning or access to resources, which allows to reduce vulnerabilities and there is a call to increase the role of social and labour organisations in decision making (IPCC SRCCL SPM 2019: 95), the FAO report states the need to empower fishing communities (FAO SOFIA 2020: 211) and to *"develop and support inclusive institutions and small-scale fisheries organizations, including those representing the rights of indigenous communities, women and marginalized sectors of societies, so that local communities can participate in resource planning, development and governance to secure access to resources and markets"* (FAO SOFIA 2020: 211).

> *"Improving participatory processes strengthens governance decision making and flexible risk management processes (Gerkensmeier and Ratter 2018; Rosendo et al. 2018), while stimulating bi-directional knowledge flow and improving social learning (Abelshausen et al. 2015)." (IPCC SRCCL SPM 2019: 92). Similarly, "Coastal communities can improve the co-production of climate change knowledge (medium evidence, good agreement) through the integration of knowledge systems (Table 5.8)" (IPCC SRCCL SPM 2019: 92).*

In addition to directly involving communities there is a call to improve gender equity: "Ensure that actors along the value chain, in particular women and small-scale producers and processors, have the capacity to seize opportunities and reap their fair share of benefits and **engage fully in sustainable**

and equitable food systems" (FAO SOFIA 2020: 212). "Mainstream gender-inclusive policies to increase the role, well-being and working conditions of women in the sector, including at decision-making levels" (FAO SOFIA 2020: 212).

Finally, the IPCC report (2019) notes that **"Socioinstitutional adaptation responses** are more frequently reported in the literature than ecosystem-based and built infrastructure approaches" and highlights that combinations of all three are even more effective, and ... "**Stakeholder engagement** is necessary (robust evidence, high agreement)" (IPCC SRCCL SPM 2019: 9).

So, all assessments acknowledge the importance of involvement, to a limited extent also of empowerment; community development and socio institutional adaptation is highlighted. But there are few concrete ideas in terms of enhancing agency, or opening up deliberation on different pathways or sustainable futures.

Summary and appraisal: All assessments highlight the need to include local communities as well as indigenous people and their respective knowledge in decision-making and management across different challenges often for instrumental reasons of improving the effectiveness of policy implementation but also with the objective to increase access of less well-off groups to resources and decision making. Inequality, including gender inequality, is considered an issue and there are general pleas to address and reduce it but few, if any, specific ideas or measures. All assessments acknowledge the importance of involvement and to a limited extent also of empowerment, community development and socio-institutional adaptation. But they lack concrete ideas in terms of enhancing agency, or opening up deliberation on different pathways or sustainable futures.

Block 5: Transformative actions and solutions

	Specific intervention
The ocean as a resource	"Promoting shared and integrated ocean governance, including for biodiversity, beyond national jurisdictions." (IPBES GA SPM 2019: 45) "Expanding, connecting and effectively managing marine protected area networks, including protecting and managing priority marine key biodiversity areas and other important sites for present and future biodiversity, and increasing protection and connectivity." (IPBES GA SPM: 45) "Promoting the conservation and/or restoration of marine ecosystems through rebuilding overfished stocks; preventing, deterring and eliminating illegal, unreported and unregulated fishing; encouraging ecosystem-based fisheries management; and controlling pollution through the removal of derelict gear and through addressing plastics pollution." (IPBES GA SPM 2019: 45) "Promoting ecological restoration, remediation and the multifunctionality of coastal structures, including through marine spatial planning." (IPBES GA SPM 2019: 45) "Integrating ecological functionality concerns into the planning phase of coastal construction." (IPBES GA SPM: 45) "Expanding multi-sectoral cooperation by increasing and improving corporate social responsibility measures and regulation in building and construction standards, and eco-labelling and best practices." (IPBES GA SPM 2019: 45)

	"Reducing the environmental impacts of aquaculture by voluntary certification and by using best practices in fisheries and aquaculture production methods." (IPBES GA SPM 2019: 46) "Reducing point and nonpoint source pollution, including by managing marine micro-plastic and microplastic pollution through effective waste management, incentives and innovation." (IPBES GA SPM 2019: 46) "Increasing ocean conservation funding" (IPBES GA SPM 2019: 48) "... improving income and creating livelihood opportunities for women and young people have proved necessary in order to alleviate poverty among coastal communities in the beneficiary countries." (FAO SOFIA 2020: 161) "... in order to ensure that aquatic ecosystems can in the future provide the food that coastal communities depend upon, holistic management needs to be put in place and stewardship of those ecosystems promoted." (FAO SOFIA 2020: 177) "Promote assessment and monitoring of individual stocks and improve transparency at the stock and country level to better understand the status of fisheries at relevant geographical scales." (FAO SOFIA 2020: 193) "Promote appropriate communication and awareness about the impact of illegal fishing on overfishing and fish stock recovery." (FAO SOFIA 2020: 194) "Replicate and re-adapt successful policies and measures in the light of the realities of specific fisheries, and … focus on creating mechanisms that can effectively implement policy and regulations in fisheries with little management." (FAO SOFIA 2020: 71) Reduce harmful subsidies: "Reduce and eliminate harmful subsidies that contribute to overcapacity and overfishing" (FAO SOFIA 2020: 212) "Encouraging effective fishery reform strategies through incentives with positive impacts on biodiversity and through the removal of environmentally harmful subsidies (e.g., IG, G)" (IPBES GA SPM 2019: 46) Integrate fisheries/stakeholders into planning: "Integrate fisheries into broader planning and governance frameworks – fisheries management cannot act in isolation, and should be working alongside other more visible and economically valuable sectors" (FAO SOFIA 2020: 213) "institutional and legal frameworks [should] … determine the possible uses of coastal resources and to govern access to them should take into account the rights of coastal fishing communities and their customary practices compatible with sustainable development" (FAO SOFIA 2020: 133) "Important fisheries adaptation responses in relation to knowledge management include improving participatory processes (robust evidence, high agreement), integrating knowledge systems (medium evidence, high agreement), and stakeholder identification, outreach and education (medium evidence, medium agreement). Ecosystem-based adaptation, community participatory programmes, and improving agricultural and fisheries practices are very strongly supported in the literature (high confidence)." (IPCC SROCC 2019: 536) Biodiversity and food security objectives: "Support the development of joint biodiversity and food security objectives that recognize trade-offs and are nationally and locally relevant." (FAO SOFIA 2020: 194)

The ocean as a sink (waste, discharge of pollutants, fertilisers, wastewater, waste especially plastic)	"**Reduce waste** and increase utilization by developing new products and markets." (FAO SOFIA 2020: 212)
Ocean's role in climate crisis	Restoration and protection of ecosystems: "Ecosystem restoration and protection, particularly in mangroves (Ataur Rahman and Rahman 2015; Bennett et al. 2016; Jamero et al. 2018; Hagedoorn et al. 2019) through community participation programmes (Barbier 2015; Petzold and Ratter 2015; Bennett et al. 2016; Dhar and Khirfan 2016; Jamero et al. 2018) was strongly supported in the literature as a means to improve access to or storage of natural resources (medium evidence, high agreement)." (IPCC SROCC 2019: 534) "Promote marine spatial planning and integrated management of marine and coastal development and marine activities, in line with the ecosystem approach, employing biodiversity-inclusive environmental assessment." (SCBD 2020: 156) "Additional considerations identified by recent studies of ocean related mitigation and adaptation include the need for: early warning and precautionary management; multi-level and multi- sectoral governance responses; holistic, integrated and flexible management systems; integration of scientific and local knowledge as well as natural, social and economic investigation; identification and incorporation of a set of social indicators and checklists; adaptive governance; and incorporation of climate change effects in marine spatial planning ..." (IPCC SROCC 2019: 542) "Ocean-based Climate Change Adaptation Frameworks: Adaptation action in pursuit of a climate resilient development pathway is likely to have a deeper transformative outcome than stepwise or ad hoc responses" (IPCC SROCC 2019: 537)
Governance, international development and cooperation	"Truly enable the mainstreaming of biodiversity in support of sustainable development. This will require more effective communication across sectors, as well as diverse partnerships." (FAO SOFIA 2020: 143) "Promote and strengthen diverse, inclusive and accountable partnerships to effectively manage ecosystems for both biodiversity and food security." (FAO SOFIA 2020: 194) "When implemented together, hard and soft engineering responses provide social (Gracia et al. 2018; Martínez et al. 2018; Woodruff 2018) and ecological (Perkins et al. 2015; van der Nat et al. 2016; Gracia et al. 2018) co-benefits with reduced damage costs (Jeong et al. 2014)." (IPCC SROCC 2019: 534)

Summary and appraisal: The global assessments provide very detailed actions and recommendations on how to improve fisheries management, for example in optimising the monitoring of fish stocks. The overall need for marine spatial planning or rather prioritisation of different uses in different areas and the need for increasing marine protected areas is acknowledged and called for.

Overall the ocean seems to be perceived as the receptor of many of the negative impacts of human activity on earth and the focus lies more on managing or addressing the impact rather than addressing the root causes. As the paradigm in fisheries management is already oriented towards achieving sustainability, and important progress has been achieved in some fisheries, this approach is not questioned.

Appendix 12: Examples from additional reports for recommended actions that hold high transformative potential for selected domains

Additional reports (see Appendix 4) offer diverse recommendations related to transformation to sustainability. Here, examples are provided for different leverage points. In essence, they propose:

> *"[We] must pursue a holistic systems approach that recognizes the food system's interrelationships, build trust and create safe spaces for dialogue amongst system actors acknowledging issues of power and voice, and identify solutions informed by knowledge, experience, and diverse evidence from the scientific community, grassroots movements, farmers, Indigenous Peoples, and others." (GAFF 2017: 859)*

Supply chains and trade

Increasing consumer awareness and a growing set of niche solutions are slowly emerging but will require political backing to develop sustainable alternatives at scales to have an impact. For instance, the EU has been urged to make sustainable food systems an explicit objective of its free trade agreements and to negotiate relevant sustainability provisions (IPES-Food 2019). Moreover, the European Green Deal includes the ambition to lead by example and initiate important changes, including internationally, which could greatly enhance prospects for transformative change.

While the assessments mostly agree with the statement that consumption and production patterns need to be changed to reduce biodiversity loss, few ideas are formulated on how this can happen.

> *"Correcting inefficient economic distortions to resolve institutional failures can serve the common good." (Dasgupta 2021: 75)*
>
> *"Enforcing **standards for re-use, recycling and sharing** also has an important role to play, and is likely to have a positive economic impact, including the creation of jobs."*
>
> *"This often involves short **supply chains and local markets**, as well as food policy initiatives that attempt to build more socially and ecologically sustainable alternative food systems [...]. Farmers also develop niche markets that draw on local and regional qualities, and are creating new opportunities for rural development" (Oxfam 2020: 31)*
>
> *"Trade agreements should (and do, in fact) increasingly include environmental **sustainability provisions**, and the same can be said about international aid spending" (Dasgupta 2021: 74).*
>
> *"Transparency along supply chains could be improved with new technologies including "geospatial data and implementation of **'blockchains'**" (Dasgupta 2021: 74).*

Public funding should be made contingent on **corporate compliance** with transparency rules and "*the principles of key international frameworks, including the UN Guiding Principles on Business and Human Rights, the OECD Guidelines for Multinational Enterprises, and the Principles for Responsible Investment in Agriculture of the CFS [Committee on World Food Securit*y]" (Oxfam 2020: 35). The OECD gives examples of existing guidelines and laws for responsible business conduct (OECD 2019), and the Committee on World Food Security specifies principles that would support a move towards transformative change. These principles include the engagement and empowerment of young people as drivers of

change in agri-food systems; respect of traditional knowledge, especially of smallholder farmers; support for diversity and innovation; participatory and transparent policy; grievance mechanisms accessible to all; and regular assessment of changes and impacts (CFS 2014).

The Dasgupta Review emphasises "*that markets alone are inadequate for protecting ecosystems from overuse"* (Dasgupta 2021: 71) due to imperfect knowledge. The study recommends relying on *"**quantity restrictions** (e.g. on extraction or pollution)"* rather than taxation to better account for externalities; these restrictions should be "*informed by science and supported by legislation*" (Dasgupta 2021: 71).

Citizens should be empowered to **monitor companies** that are "*operating in agriculture and land-related activities*" (Oxfam 2020: 35).

Taxation and fiscal policies

The Dasgupta Review report recommends increasingly relying on **environmental taxation** as a management instrument which is currently underused (Dasgupta 2021: 74). This should be done "*carefully*" to avoid leakage effects and make sure the right elements are targeted (Dasgupta 2021: 74). **Land taxes**, for instance, can contribute to reducing inequality "*by discouraging accumulation, reducing speculation, and constraining the intergenerational transmission of inequality*" (Oxfam 2020: 28).

Innovation in trade practices "*can support a shift to sustainability*" (Dasgupta 2021: 74). While the possible impact of **taxation** is limited, tax policies may nevertheless "*make a difference if they are applied widely and designed well"*, a promising example being Border Adjustment Taxes although technical and political problems still impede their establishment and upscaling (Dasgupta 2021: 74).

> *"There is also an urgent need to tackle perverse subsidies" (Dasgupta 2021: 74)*

Finance

> ***"Finance** plays a crucial role. A significant portion of the responsibility for helping us to shift course will fall on the global financial system. Governments, central banks, international financial institutions (such as Multilateral Development Banks) and private financial institutions all have a role to play in making the shift." (Dasgupta 2021: 77)*

Green fiscal reform (GFR):

> *"Achieving the SDGs will require the implementation of GFR, at the very least in relation to climate and energy policy, sustainable consumption and production, life on land, and fisheries." (Kehrer et al. 2020: 32)*

> *"Without GFR, economic distortions remain in place encouraging wasteful consumption and unsustainable levels of pollution. GFR has the potential to address such market failures and deliver a number of additional economic, social and environmental benefits, making it an attractive tool for policymakers." (Kehrer et al. 2020: 5)*

> *"If well designed, GFR can boost GDP growth, green investment, employment and innovation, while bringing about environmental improvements (see e.g. COMETR 2007)." (Kehrer et al. 2020: 8)*

"GFR policy instruments are generally more efficient than regulations or soft instruments, as they allow business and individual consumers to decide how best to respond to price increases, and create a dynamic incentive in favour of change. Taxes, charges and fees are associated with very low administrative costs and can often be linked to existing revenue-raising mechanisms. As they are relatively transparent and levied on a few taxpayers, many environmental taxes, especially carbon-energy taxes, are hard to evade. GFR also reduces market distortions because it includes the costs of environmental damage in the price of goods and services, thus contributing to a cost-effective green economy transition." (Kehrer et al. 2020: 8)

"For public entities, the SRI BES Index supports the prioritisation of conservation goals or the amendment of zoning and spatial planning by integrating the state of the ecosystem services into defined areas. For example, the index allows public entities to identify potential ecological scarcities in densely populated urban or sub-urban areas. Further, when it comes to the development of new districts within given settlement areas or the planning of new cities, the SRI BES Index can underscore the need for resource efficiency. It may also support the implementation of conservation or environmental policy with a focus on the relevant Aichi, respectively post-2020, biodiversity framework targets.74 It can also form the basis for nature-based insurance solutions to be fostered together with the public sector and interested stakeholders. Examples are nature-based clean water in water stressed areas; restocking fisheries through mangrove restoration; restoring degraded land to agricultural land by restoring soil; or a screening and prioritization of locations where ecosystem services mitigate natural hazards." (SRI 2020: 45)

Options to increase **development assistance finance** for biodiversity include "*debt forgiveness, direct grants or technical assistance*", ideally combined with "*binding targets on public investments in natural capital to ensure that globally agreed objectives are met*" (Dasgupta 2021: 77).

The Dasgupta Review report recommends establishing "*global, regional and national **insurance funds***" that globally pool risks from environmental disasters and extreme events, and provide reliable relief in the case of shocks (Dasgupta 2021: 78).

"The price of financing or re/insurance should take BES fragility or intactness into account. Highly BES dependent operations in fragile areas may not have a sustainable future and this knowledge should help decision makers allocate resources accordingly. The price the financial services industry charges for providing capital – be it via investments or re/insurance – should reflect BES risk going forward." (SRI 2020: 45)

Land inequality

Governments must "*recognise and **protect customary land claims***", especially of indigenous peoples, including hitherto undocumented rights and always following standards of "*free, prior, and informed consent*" (Oxfam 2020: 35).

Land holdings should be documented in transparent ways accessible to everyone (Oxfam 2020: 35).

"Climate change is both a cause and a consequence of land inequality, reducing agricultural productivity in parts of the world and forcing many off the land altogether. And while large-scale, environmentally damaging monocultures contribute to climate change, the more sustainable land use practices of small-scale farmers and indigenous peoples are threatened by

evictions, deforestation, biodiversity loss, and excessive pressure on water and other natural resources." (Oxfam 2020: 6)

International assessments agree that agricultural land use is the main driver of biodiversity loss. While they argue for transformation of food systems the distribution of agricultural lands – as a prerequisite for food production and biodiversity conservation at the same time – is not prominently addressed. The assessments address consumption and production patterns but do not clearly identify land inequality as underlying causes of biodiversity loss.

Land is very unevenly distributed and increasingly large parts belong to single stakeholders - often companies or financial conglomerates. This rent-maximising land-use by large corporations increases pressure on biodiversity. The Oxfam (2020) report on land inequality argues that "***land inequality is associated with environmental pressures*** *that contribute to climate change, such as the growth of large-scale, environmentally damaging monocultures that maximise economies of scale (Ceddia 2019; Sant'Anna 2016; Tole 2004)".* For significant parts ***o*****f the world's farmland financial assets, with no known physical owner,** decisions may be taken with considerations external to the farm and the agricultural sector (Oxfam 2020: 25). Investing in agricultural land and production by distant investors also means that holding them "*accountable for ... economic, social, and environmental impacts …* [is difficult] *when the investors are geographically and institutionally distant from the operations invested in"* (Oxfam 2020: 31).

This business model seeks profits at the costs of the environment as well as the people in the landscapes. Inequality in land distribution leads to employment structures that are unfavourable for the rural poor. "***Large industrialised farms absorb fewer workers overall and tend to casualise the workforce, pushing real wages down****. Especially in Africa, ...the unfettered continuation of current land inequality trends would create a social and economic disaster of massive proportions." (Wegerif and Guereña 2019)." (*Oxfam 2020: 25)

Much stronger and more decisive than any of the international assessments, the report calls land inequality to be at the heart of other types of inequalities, putting a risk to "***the stability and development of sustainable economic systems and that it undermines the health of democracies*** *(OECD 2014; Stevans 2012; Stiglitz 2013; Easterly 2007)" (Oxfam 2020:??)*

Within the framework for transformative change for biodiversity, this raises special concern. If agency and (local) emancipation are necessary for transformative change, increasingly unequal land distribution and allocation of land rights will hold back movements in this direction. The report argues straight forward that in order to create emancipatory power land inequality needs to be addressed.

While land rights and land distribution are sometimes addressed in rural development contexts, their importance for biodiversity conservation is rarely clearly stated.

"[S]mall producers, peasants, and indigenous peoples – who generally produce more net value per unit area than large companies, and whose land use practices also tend to support biodiversity, healthier soils, forests, and water supplies – should be central to equitable and sustainable development, yet are increasingly excluded while global trends favour land concentration." (Oxfam 2020: 10)

In terms of dynamics, the main challenge is to create space for more sustainable systems to develop and thrive. In addition to securing land tenure, striving for participation and inclusion of knowledge from IPLC identified by the assessments, a crucial role for the state is to protect the operating space

of these actors and support further improvement of small-scale production systems as well as the living conditions of billions of people depending on these, and thereby create agency and emancipation.

> *"For **agrarian reforms** to be effective, they must be **consistent with a country's economic and social policy** and must **include measures to prevent a return to land inequality over time** (Merlet 2020)." (Oxfam 2020: 27)*

> ***"(p)ublic investment is needed** not just for their access to good-quality land, but also for improved public market spaces, protection of national agricultural produce markets from international commodity market pressures, research for improved ecologically sound inputs such as seed and genetic stock, and appropriate storage and processing technologies." (Oxfam 2020: 35)*

Land inequality

> *"can worsen democratic decline (SDG 16), climate and environmental crises (SDGs 13, 15), the risk of pandemic diseases (SDGs 3,6), mass migration (SDG 10), unemployment (SDG 8), and intergenerational injustice (SDG 16). Land inequality affects well-being, livelihoods, and opportunities for all of us, and it further jeopardises the stewardship role that equitable land distribution can play with regard to these broader global trends and crises. Furthermore, land inequality is core to almost every SDG." (Oxfam 2020: 9)*

> *"Climate change is a driver of global inequality, including land inequality. It is already driving down agricultural productivity and driving some people from the land altogether (FAO 2017)." (Oxfam 2020: 16)*

> *"Further studies find that land inequality perpetuates poverty (ILO 2019) well beyond the agricultural sector and creates an unequal distribution of industrial assets that persists over time (Carter 2000)." (Oxfam 2020: 16)*

> ***"Addressing land inequality will not only redress asset and wealth inequality, but will reduce rent-seeking by a minority, improve income equality, and enable more inclusive and sustainable development."** (Oxfam 2020: 18)*

> *"With complex corporate and financial structures, cross-shareholdings, and other inter-relations, **clear lines of responsibility for land use and management are becoming harder to discern**, just as they are becoming more important. It is also difficult to hold investors accountable for their economic, social, and environmental impacts when the primary investors are unknown or geographically and institutionally distant from the operations invested in." (Oxfam 2020: 25)*

> *"Any mechanism to reduce land inequality must be compatible with broad social interests, and be accepted by the majority of the population (Merlet 2020). The construction of institutions and mechanisms responsible for guaranteeing land equality will only be possible with the engagement of all relevant stakeholders. Civil society organisations (CSOs) and local institutions will always have a determining role to play in changing the power relations necessary for the implementation of such mechanisms and institutions (Merlet 2020; Nguiffo 2020). Such changes take time. Land inequalities relate to different rights – from ownership to use and control. The focus of mechanisms should not only be on regulating ownership or rental*

markets. Regulation and oversight of control over land and shareholding mechanisms affecting land will also be necessary. Land inequality interventions should not exist in isolation. Land redistribution efforts, for example, will fail to create sustainable livelihoods, let alone prosperity, and are likely to be reversed if control of land policies, markets, and other parts of the agri-food system remains in the hands of a few (Wegerif and Anseeuw 2020). Context is key. ***To reduce land inequality in a sustainable manner and to optimise land use in order to serve broad social interests, policies and mechanisms must be tailored to each individual situation."*** *(Oxfam 2020: 26)*

"To address land inequality, societies need to ***establish governance institutions with a public purpose,*** *reflecting collective rights, and the ability to act with a certain degree of autonomy" (Oxfam 2020: 27)*

"In a land sector that is becoming more and more corporatised and financialised, a model like the French SAFERs could be an effective way to ***address concentration of land through shareholding****. As Merlet (2020) suggests,* ***new local commissions*** *could be made responsible for monitoring all forms of transfer of rights to use land, whether through purchase, rental, or shareholding." (Oxfam 2020: 28)*

"There is also a need to support more independent and innovative monitoring of companies and investors operating in agriculture and land-related activities, as well as of shareholding and control of production. Investments should be made in data collection, capacity building, and training, including for civil society, as well as mechanisms for redress." (Oxfam 2020: 29)

"This lack of ***transparency*** *around land investments is consistent with the increase in the use of complex corporate structures, cross-shareholdings, and financial market interests in land, as described in Chapter 3." (Oxfam 2020: 29)*

"In addition, ***public entities need to be fully transparent****. Public support, including development finance for investments or projects, should be contingent on the release of all relevant information." (Oxfam 2020: 29)*

"To respond effectively to land inequality, it is ***essential to interrogate and challenge support for elite- and corporate-driven growth, commodification of land and natural resources, and the global push for greater productivity and ever greater returns on investment in the agri-food sector****" (Oxfam 2020: 31)*

"Horizontal inequality*, which is inequality based on gender, ethnicity, or culture in specific groups of people, is interconnected with land access, ownership, and control. These types of inequality seriously undermine sustainability" (Oxfam 2020: 33)*

"Strengthen land-related regulation*: Governments should develop land ownership, land use, and land distribution policies and institutions to address patterns of land inequality and their drivers. At national and decentralised levels, these should be reconceived based on broad social consensus, in light of contemporary circumstances and taking into account the full range of causes and impacts of land inequality. Invest in well-functioning land registries Governments and their partners should invest in institutions and technology for efficient and fully transparent land registries, including at decentralised levels. Land registries should include*

information regarding institutional ownership and control of land through sophisticated financial instruments, including listed and unlisted funds. This provides an informed basis for land taxation and other redistributive measures." (Oxfam 2020: 34)

*"It will **give a voice to a broader base of rural populations, strengthening democracies and making policies more participatory and, subsequently, less elite-biased**. Its direct relationship with environmental inequality makes addressing land inequality a basis for more environmental sustainability, improved global biodiversity, strengthened bio-cultural conservation, and justice – although this will require ensuring that climate mitigation strategies minimise the demand for land and the consequent risk of exacerbating land inequalities. All of the above will be necessary stepping-stones towards more resilient and sustainable societies, where populations, even the most marginalised, including women, youth, indigenous peoples, and local communities, can thrive and migration is unnecessary as a last resort in economies with minimal labour absorption." (Oxfam 2020: 34).*

*"**A transformative agenda of this magnitude is not optional. It is urgent and is in the interests of all humanity, for more resilient, sustainable, and equitable societies.** Change will require broad-based action, involving state institutions at all levels, donors and development partners, the private sector, and, not least, people's organisations, farmers, and all those who make their living from land." (Oxfam 2020: 35)*

*"Recognise and protect **women's land rights**: Governments should ensure gender equality in land rights, in law and in practice. This requires a range of actions, from legislating for equal opportunity and rights to encouraging adaptation of social norms, attitudes, or behaviours that support women's self-directed decision-making and ability to benefit from land. Legal mechanisms should enforce women's rights to land when they are under threat and provide mechanisms for redress, including in **collective land tenure systems**." (Oxfam 2020: 35)*

*"Although it will not reverse land inequality, **protecting collective land rights** assures the well-being, livelihoods, and the **ability to retain land of at least 2.5 billion people worldwide**, mostly indigenous peoples and local communities. (Wegerif and Guereña 2019)" (Oxfam 2020: 29)*

*"Respect and **strengthen civil society institutions and capacities**: Strong CSOs have a key role to play in monitoring, **promoting accountability,** and challenging power relations. Powerful and representative constituency-based organisations – belonging to farmers, pastoralists, indigenous peoples, women, and fisher folks – can ensure that the voices and priorities of land users are heard." (Oxfam 2020: 35)*

First is the need to assert the primacy of international human and environmental rights law. Indeed, a whole set of legal rules are in place to protect investors' rights in the frame of the World Trade Organisation, as well as in bilateral investment treaties or in the investment-related clauses of free-trade agreements. These provisions tend to undermine the capacity of nations to maintain policies, laws and practices protecting human and environmental rights. According to the Tribunal, there is an important risk of a widening gap between international human rights and environmental law and international trade and investment law. UN bodies urgently need to take action; otherwise key questions will be resolved by private tribunals operating entirely outside the UN framework.

The second call concerns the need to hold non-state actors responsible within international human rights law. The Tribunal is of the view that the time is ripe to consider multinational enterprises as

subjects of law that could be sued in the case of infringement of fundamental rights. The Tribunal clearly identifies and denounces a severe disparity between the rights of multinational corporations and their obligations. Therefore, the advisory opinion encourages authoritative bodies to protect the effectiveness of international human rights and environmental law against the conduct of multinational corporations.

Sustainable land management and protected areas

To make **sustainable land management** practices more attractive to farmers, higher incentives should be offered to scale up innovative ideas. In particular, *"[a]gri-environment schemes and Payments for Ecosystems Services (PES) are obvious candidates for further development*" (Dasgupta 2021: 71-72). Agroecological systems ought to be promoted "*as alternatives to industrial agriculture*" (GAFF 2017: 21) through locally organised communities and markets (GAFF 2017: 18). Apart from crop farming, sustainable "*models for livestock systems*" are to be elaborated, piloted, and scaled up (GAFF 2017: 22).

The Dasgupta Review goes further and proposes concrete actions to be taken in order *„to meet rising demands for provisioning services while safeguarding regulating and maintenance services."* (Dasgupta 2021: 73) including:

> "• ***changing the balance of crops*** *intended for human food and animal feed, closing gaps in agricultural yield could go some way without expanding agricultural land further … .*
> • ***Establishing clear boundaries for conservation and agriculture*** *(known as 'land-use zoning');*
> • ***making payments to avoid habitat conversion and reducing food waste;***
> • *strategically deploying technology, infrastructure or knowledge;*
> • *and introducing* ***standards and certification schemes***
>
> *…strategies for avoiding habitat conversion,* ***sustainable production systems*** *can effectively deliver multiple ecosystem services. Regenerative agriculture, organic agriculture, agroforestry and low-trophic level aquaculture are capable of enhancing regulating services (such as pollination and air quality regulation) even while providing food."* and
>
> *"A shift to sustainable patterns of consumption and production will require us to* ***embed environmental considerations along entire supply chains****." (Dasgupta 2021: 74)*

Governments, finance and education need to

> *"[b]uild more sustainable and equitable production models and food systems: Governments should support the more resilient and sustainable production models of small-scale producers and family farmers. This means allowing them greater autonomy from corporate production systems and the ability to get reasonable returns from employing agroecological, or at least low-external-input, production practices, linked with local markets."*
>
> *"Resilient seed systems are rooted in the science, practice, and movements of agroecology. Agroecology addresses the economic, political, and social elements of transforming the industrial food system. It is not another "tool in the kit" but a direct response and counterpoint to the industrial food system" (GAFF 2019: 5)*
>
> ***"Technological innovations can contribute enormously to reducing our footprint."***
> ***"****Genetically modified crops can increase yields even while reducing the contribution food production makes to climate change and to biodiversity loss"*

*"**Vertical farming and meat analogues** can increase yields, while reducing the contribution food production makes to climate change and biodiversity loss."*
"[t]he state has an enormous role here for helping to finance and coordinate the investment that will prove to be necessary to help shift to a sustainable future." (Dasgupta 2021: 73)

Moreover, a "*paradigm shift*" towards **functional** diversity **in crops**, i.e. "*a portfolio of 'best-fit' varieties [...] specifically adapted to different contexts, functions and needs*" would be needed (Seeds of Resilience_Compendium of Perspectives on Agricultural B: 16). Ideally, this would encompass a more **active role for farmers** "*as real partners who inform and advise the crop improvement process*" (GAFF 2019: 16). Special programmes could be launched to develop "agro-biodiversity conservation and seed production at the community level involving specialists, experienced farmers, and scientists-agrarian" (GAFF 2019: 13)

An interesting recommendation aimed at disrupting the current system is to ***"[d]ismantle agrochemical dealers** and replace [them] with agroecology advisors*" (GAFF 2019: 12), but how this could be done remains unclear.

Protected Areas, which "*have an essential role in conserving and restoring our natural capital*", should be "***extended** and integrated into the surrounding land and sea*" (Dasgupta 2021: 74). They generally require "*[m]ore investment*" (Dasgupta 2021: 71) and their management should closely involve local populations (Dasgupta 2021: 74).

Besides avoiding further degradation, **restoration** is seen as imperative in an attempt to balance the various demands for ecosystem services, alongside better planning frameworks (Dasgupta 2021: 72). Restoration measures include "*habitat management, rewilding, allowing natural regeneration and creating sustainably productive lands and seas*", broadly speaking (Dasgupta 2021: 71). Ecosystem restoration is actually "*an opportunity for many economic sectors*" (SRI 2020: 25).

Measuring economic progress

"Identify opportunities to build solid application metrics that can be integrated into true cost accounting narratives (i.e., soil carbon)
- *Integrate water and other interdependencies along the food value chain into TCA frameworks" (GAFF 2017: 28)*

"Degradation of ecosystem services could be significantly slowed down or even reversed if the role of biodiversity and its full contribution to economic production were an integrated part of decisions made by governmental entities, companies, and other stakeholders (Paul et al. 2020). Species loss can destabilise ecosystems and can suddenly disrupt the flow of benefits from nature to people because of the interconnection of species and ecosystems (Hooper et al. 2012; Cardinale et al. 2012)." (SRI 2020: 13)

*"**Natural capital accounting** is a necessary step towards the creation of inclusive wealth accounts. It enables us to understand and appreciate the place of Nature's services in our economies, including the services that are usually overlooked; it enables us to track the movement of natural capital over time (a prerequisite for sustainability assessment); and it offers us a way to estimate the impact of policies on natural capital (a prerequisite for policy analysis)." (Dasgupta 2021: 75)*

"Increased investment in physical accounts and in ecosystem valuation would improve them. ***International cooperation in the construction of national accounts and the sharing of data*** *would improve decision-making around the world. Harmonisation of national accounts should be coupled with technical assistance." (Dasgupta 2021: 75)*

Whether nature is accounted for in economic measures is critical for how we interpret productivity. Contemporary models of economic growth and development tend to consider only produced and human capital as primary factors of production, but not explicitly natural capital (Review, Chapter 13). Typically, Total Factor Productivity estimates are thus biased upward and should be treated with scepticism. "*Improving and using* ***measures of productivity that account for the use of, and impact on, Nature*** *are crucial if we are to understand what improved productivity means. There are several initiatives, such as the OECD's greening productivity measurement workstream (OECD 2017a), that have made a start."* (Dasgupta 2021: 76)

Private banks, institutional investors, and insurance companies should systematically assess "*Nature-related financial risks*" to raise awareness, supported by "*global standards"* that need to be developed, with the ultimate idea "*to have them assess and* ***disclose their use of natural capital***" (Dasgupta 2021: 77). A recent publication by Swiss Re urges insurers and reinsurers to systematically **assess SDG outcomes** and trade-offs of their financial decisions (SRI 2020: 38).

This also necessitates a shift to **longer-term perspectives** which are until now not usually followed by financial actors, as processes of "*Nature's diminution can be felt over long time-horizons"* (Dasgupta 2021: 78). Financial regulators and supervisors should promote this shift "*by changing their own assessment horizons and using their regulatory powers*" (Dasgupta 2021: 78).

Consumers have an important role in pushing financial firms to channel their investments into projects and companies that do not degrade nature, by insisting on transparency and coordinating **boycott** campaigns where necessary: "*Reputation matters to firms, and that can be exploited by citizens*" (Dasgupta 2021: 77).

Seeds

"This advocacy ranges from defending local seed systems to ensuring that small-scale farmers have a stronger voice in international decision making fora. The legal implications of laws and policies eroding or protecting seed ownership for farmers are significant, and farmers and their organizations and allies need to be a part of these decision making processes. For example, Pat Mooney proposes to create an independent Civil Society Mechanism (CSM) for the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) using the model currently in place for the Committee on World Food Security (CFS). Full participation of farmer and civil society organizations at these meetings would ensure seed and agroecology issues are addressed, and could impact a wide range of seed policies at both the international and national levels." (GAFF 2016: 5)

"developing a coordinated strategy could facilitate the participation of farmers, women, and Indigenous Peoples in policy negotiations, surface common challenges, priorities and creative solutions, as well as encourage the release of the funding and investment required to enhance community based seed systems"(GAFF 2016: 19)

"Affecting change at the government, policy, and governance levels requires us to integrate food systems thinking into policy processes at all levels, develop strategies for connecting

sustainable small-holder farming practices to global target benchmarks, and establish what metrics can drive better performance in food systems." (GAFF 2017: 16)

"Track and support the FAO policies and programs related to agricultural biodiversity and agroecology, including the Scaling Up Agroecology Initiative, the Commission on Genetic Resources for Food and Agriculture, and the International Treaty on Plant Genetic Resources for Food and Agriculture. Reform FAO Regional Conferences to include seed dialogues and introduce seed and agroecology issues into the agendas of the Governing Body of the ITPGRFA at ministerial-level regional conferences."(GAFF 2019: 11)

"Advocate for the full use of flexibility in the WTO TRIPS agreement concerning the protection of plant varieties." (GAFF 2019: 11)

"Advocate for the elimination of plant breeders' rights in UPOV91." (GAFF 2019: 11)

"Haussmann proposes to strengthen the partnership between farmers and the public and private sector seed improvement establishment. This could include the participatory development and evaluation trials of varieties that are adapted to the local context, training of farmer seed producers, and public-private-farmer partnerships that include farmers as partners and co-creators of new research and business models to enhance agricultural biodiversity" (GAFF 2016: 16)

"The open access to source seed, the active participation of smallholder farmers, the availability of growers and processing facilities on a contract basis and a well-developed marketing network have reduced transaction costs, enabling the emergence of a wide range of seed enterprises, particularly in the private sector. This system utilizes the best of what both the formal and informal seed systems have to offer, and, perhaps most importantly, has provided smallholder farmers with market access and more options for their farming enterprise." (GAFF 2016: 14)

"Donors can also work together to leverage funding for and investment in community based seed systems. In addition, donor agencies can support further research on community based seed systems, especially in relation to how these systems can be supported by international laws, policies, and conventions instead of being undermined—as is currently happening." (GAFF 2016: 20)

Research and training

"Research novel ways to make markets work for the custodians of agricultural biodiversity. Research and develop seed network-building methodologies and strategies. Research the functional contribution of seed diversity to agro-ecosystems properties, including provision of regulating, supporting, and provisioning ecosystem services. Research low-cost seed conservation technologies." (GAFF 2019: 14)

"Create a required course teaching the preservation of local seeds in agricultural universities." (GAFF 2019: 15)

"Embed sustainability principles, progressive business models, and leadership into business management training and post-secondary curriculum" (GAFF 2017: 14)

Appendix 13: Questionnaire as sent to project teams

MAIN QUESTION: How can international development cooperation projects be more oriented towards transformative change?

Block 1: Transformative vision: Overhaul of the ideological underpinnings of social-ecological systems

Based on a far-reaching critique of development and growth paradigms, and making explicit the values that favour sustainable societal welfare, a new narrative will have to combine the big picture with orientation and inspiration for required changes.

- Does the project build a transformative vision? How so?
- What is the theory of change behind the project?
- Does the project contribute to a change of narrative? How so?
- What could the project have done differently to be more oriented towards transformative change?

Block 2: Transformative knowledge: From seeking to understand complex systems towards designing strategic interventions for system change

For driving transformative change, the choice of what needs to be known (prior to deciding about action) becomes central.

- What measures for knowledge generation does the project promote, and do they have (sufficient) transformative potential?
- In particular, have the relevant sectors been included?
- Do they follow a strategic approach to knowledge for system change?
- What could the project have done differently to be more oriented towards transformative change?

Block 3: Transformative dynamics: Understanding phase-in and phase-out sequences. Generating momentum and using triggers. Navigating change into the 'right' direction.

Transformation processes imply radical system change – these changes can be stimulated, nudged, and navigated, but not really managed or controlled. Nonetheless, biodiversity policy and care for the global environmental commons would greatly benefit from a better understanding and recognition of system dynamics.

- Outline the two curves: what is to be replaced? What can possibly replace it?
- Has the project and/or recent political measures taken transformative dynamics into account? How so?
- In particular, is anything done to destabilize…. phase out the unsustainable system?
- What could the project have done differently to be more oriented towards transformative change?

Block 4: Emancipatory power and capacity for transformation:

Spaces for deliberation, negotiation, emancipation: the ‚future as a commons'. Political capacities for pursuing own visions of a good life. Expect resistance and seek ‚just transitions'.

- Whom does the project enable in the sense of political agency?
- Has resistance been anticipated and addressed? (or have measures been chosen that will not create resistance)
- Did the project open up spaces for emancipatory (public) exchange?
- What could the project have done differently to be more oriented towards transformative change?

Block 5: Actions & governance: A broad range of situation-specific interventions.

Their impact/success depends on the right governance modes (how?), the right actors (who?) and instruments (what?).

HOW? **Inclusive governance:** for each step of the governance process all relevant actors need to be included and their role defined.

- WHO? Are the key agents for transformation identified and included in the pathway/project? Are power regimes and related discourses, values and interests analysed and addressed? Are potential losers of the transformation and their expected losses assessed?
- WHAT? Are the direction and goals of the initial vision for transformation acceptable to key agents (input legitimacy)? Are the means and instruments of the governance process acceptable to key agents (throughput legitimacy)? Are the final outcomes of the actions acceptable to key agents (output legitimacy)? Are processes inclusive but manageable?

HOW? **Accountable governance:**

- WHO? Who takes decisions on how to transform? Do the key agents take leadership in the transformation? Do all relevant agents take ownership and accept responsibility addressing all potential "responsibility gaps"? Do agents take responsibility for adverse effects on third parties and vulnerable groups? Who gets to decide it is time to transform?
- WHAT? Do "protagonists" of the transformation process take responsibility for assuring legitimacy as identified in "inclusion"? How will governance actors justify the legitimacy of transformation measures? Do participatory processes generate ownership without deterring important stakeholders? Are evaluation processes (adaptive governance) connected to political consequences and potentially sanctions? How will governance actors justify the legitimacy of transformation measures? How can key agents be held responsible?

HOW? **Informed governance:**

- WHO? Are knowledge holders involved? Are different forms of knowledge and epistemological cultures taken into account?
- WHAT? What transformation mechanisms/ instruments exist? What do scientists, local people and other knowledge holders know about the performance of these instruments? Do communication and collaboration processes allow for the inclusion of different knowledge systems (for instance be offering appropriate formats and boundary objects)?

HOW? **Integrated governance:**

- WHO? Are relevant agents collaborating connecting relevant political and non-political processes for the transformation? Are political levels and implementing agents collaborating in an efficient, complementary governance? Do sustainability considerations have the necessary priority in policy design, political decisions and implementation processes?
- WHAT? What is the level of integration of policies, finance and information in order to coherently support the aspired development path? Do (formalised) platforms enable and facilitate the proactive integration of relevant policy and governance processes to coherently incentivise the transformation? Do institutional configurations and the political mandate/will support the integration as a prerequisite for transformation?

HOW? **Adaptive governance:**

- WHO? Do Change agents take leadership in facilitating learning processes? Is the performance of the governance process frequently evaluated and improved, e.g. revisit a policy after 5 years and adjust if necessary?

- WHAT? Is there a solution that can be improved or does the system require innovative experimentation and learning? Do regulatory systems as well as human, institutional, financial and social capital support the implementation of the transformation pathway/project?

A first result from this process is that even for the projects we are involved in ourselves, it is not easy and sometimes not possible to answer the questions in Block 5. This would take more time, depth and knowledge than we are aware of.