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Seventh face-to-face meeting of the High Level Intergovernmental and Stakeholder Advisory Group (High-level Group) - Drafting Meeting for the *Summary for Policy Makers* of the sixth Global Environment Outlook – Cancun, Mexico, *September 24 - 27, 2018*

The High-level Intergovernmental and Stakeholder Advisory Group met in Cancun, Mexico from Sept. 24-27, 2018 to produce the second-order draft (negotiating draft) of the *Summary for Policy Makers* of the sixth Global Environment Outlook. Key objective for the meeting included:

- Reduce the length of all sections of the *Summary for Policy Makers*, especially some sections (e.g. freshwater, cross-cutting)
- Ensure coherence between the main report and the Summary for Policy Makers
- Produce a short, coherent, impactful Summary for Policy Makers which contains a clear red thread or storyline.
- Have a flexible agenda and approach to working through the drafting process
- Ensure that policy section is robust enough to be useful for policy makers
- Address the figures in the current draft, including deciding if they are appropriate and easily understandable
- Ensure that key messages from the *Summary for Policy Makers* are clear for policy makers and Ministers

The High-level Group agreed the following structure and approach to the meeting:

- Be ambitious with the draft, but not be too prescriptive about wording in the draft (this will be negotiated in January)
- The drafting will mainly occur in plenary but there should be flexibility to have some informal drafting groups to address difficult issues, with conclusions from these groups to be brought back to plenary for final decision.

Prior to the meeting, the High-level Group agreed a set of procedural guidance to ensure the smooth running of the meeting. This guidance included:

- The co-chairs of the meeting would be Mr. Paolo Soprano (Italy) and Professor Yi Huang (China) with assistance of the vice-chairs Professor Pascal Houenou (Côte d'Ivoire) and a new vice-chair to be elected at the start of the meeting;
- The meeting is not a negotiation meeting and will not follow traditional United Nations rules for negotiation meetings;

- Suggestions to modify the text of the author's first-order draft of the Summary for Policy Makers would be made by members of the High-level Group, following basic rules of order (e.g. Robert's rules) and the guidance of the co-chairs/vice-chairs of the meeting;
- Members of the High-level Group who are stakeholders will have the same standing as members from governments;
- The meeting will last 4 days, with a detailed agenda to ensure that all portions of the Summary for Policy Makers are fully reviewed and commented;
- Members of the High-level Group will be expected to have fully reviewed the first-order draft of the Summary for Policy Makers and have prepared their initial interventions ahead of time;
- A group of up to 25 Authors and the co-chairs and vice-chairs of the assessment, as well as the co-chairs of the Scientific Advisory Panel, will be present at the meeting to offer support to the High-level Group members during the drafting process.
- Only those authors that are needed for a particular section of the drafting of the Summary for Policy Makers should be present in the plenary. Authors should rotate through the plenary room as their sections of the Summary for Policy Makers are presented for discussion.
- Authors and Co-chairs of the assessment may request to take the floor at the meeting Co-chair's request during the drafting process in order to offer points of clarification on specific wording in the draft, in particular to ensure that messaging in the Summary for Policy Makers respects the findings in the main report.
- Interventions from the Authors should be passed on to the meeting Co-chairs. The timing of addressing the Author's interventions will be decided upon by the meeting Co-chairs.
- The creation of breakout groups will be decided upon by the meeting Co-chairs. These smaller groups would be formed if there are areas of disagreement among the High-level Group members regarding the drafting of a particular section of the draft Summary for Policy Makers. The smaller groups would report back to plenary on the proposals for revising the draft. The smaller groups would only be formed when necessary.

Due to visa issues, Professor Yi Huang from Peking University was not able to attend the meeting, therefore the meeting opened with chair Paolo Soprano and vice-chair Professor Pascal Houenou requesting nominations for a new vice-chair for the group. Ms. Sibylle Vermont from the Government of Switzerland was unanimously acclaimed as the new vice-chair and participated in the co-chairing duties throughout the meeting.

During the 4-day meeting the High-level Group decided:

- The main process for making modifications to the first-order draft of the *Summary for Policy Makers* produced by the co-chairs and authors would be a set of interventions and suggestions made by all the High-level Group members in a 'tour de table' format.
- These interventions would be captured in a tabular format or directly in comment bubbles in the documents for each section of the document.
- Authors and one or two High-level Group members would then be asked to form a drafting team to address these comments and bring a revised version of the section back to plenary for a final read through.
- The final read through would correct any factual or grammatical errors in the revised draft and the corrected document would be presented to the whole group for agreement.
- Any graphics, maps or charts in the original draft that were not easily understandable would either be replaced or removed from the document.
- The *Summary for Policy Makers* would use a format of paragraphs of findings with the first sentence (headline finding) bolded followed by a confidence statement for this headline finding. Any supporting information for the headline finding would be presented in unbolded text followed by a reference to the section of the main report which contains the full analysis of the issues and the references to the literature that has been reviewed to produce the headline finding.
- Along with the main draft *Summary for Policy Makers* a two-page draft *Summary for Ministers* would be prepared and agreed by the High-level Group.
- Co-chairs of the assessment, co-chairs of the Scientific Advisory Panel and authors would be given 1 week (until Oct. 5) to verify any line of sight issues between the new draft of the *Summary for Policy Makers*, the draft *Summary for Ministers* and the main Global Environment Outlook report.

- Any line of sight issues identified by the co-chairs or authors would be presented to the High-level Group for approval by Oct. 9
- Copy and science editing would be performed on the draft *Summary for Policy Makers* and *Summary for Ministers* before they are translated for Member States.
- The translated drafts of both documents would be sent to Member States by Nov. 15 so that they may prepare for the final negotiation session of the *Summary for Policy Makers* planned for Jan. 21-24, 2019 in Nairobi, Kenya.

During the four-day meeting the High-Level Group, selected coordinating lead authors and lead authors, the co-chairs of the assessment and the co-chairs of the Scientific Advisory Panel (The Panel) worked closely together to review, edit and finalise a final draft for negotiation of the *Summary for Policy Makers* of the sixth Global Environment Outlook. A summary of progress and achievements is provided below.

Meeting Summary

1. Introductions, agenda, and opening remarks

The agenda, co-chairing roles and schedule were approved. This was followed by the introduction of new HLG members and opening statements from several High-level Group members.

2. General discussion (Day 1)

After thanking the Government of Mexico and the SEMARNAT for hosting this meeting the Secretariat offered an **initial summary of the status, next steps and deadlines for the production of the main sixth Global Environment Outlook report** and the *Summary for Policy Makers* drafting process. The following sessions then focused on how comments from the completed inter-governmental review process and HLG were dealt with in the *Summary for Policy Makers*, including a review of the major changes made to the chapters in the underlying main document.

The assessment **co-chairs and coordinating lead authors presented their work**, and reflected on comments received during the latest review process, just completed. They also illustrated for the High-level Group members the latest changes made to the body of the underlying document and to the draft SPM, to address the feedback received.

The High-level Group congratulated and thanked the authors for the excellent job undertaken so far, and the authors thanked the High-level Group for their advice and guidance. **The discussion then focused on addressing and providing guidance to the authors** with regards to structural questions related to the *Summary for Policy Makers* (i.e. drastically reducing length of text, eliminating duplication and overlap, deciding the best positioning for the 'policy' section or the 'data' section, etc.). The High-level Group also focused on ensuring that a compelling narrative and a coherent red thread be created across the *Summary for Policy Makers* (i.e. highlighting the urgency to act, the systemic nature of the environmental problems we face, the need for transformational change, the link with the UN Agenda 2030, etc.). The discussion also focused on the modality of work for the *Summary for Policy Makers* drafting process, and on how to optimise the contributions by all authors and High-level Group members.

3. Drafting Sessions (Days 2-3-4)

The High-level Group conducted a first review of sections 1 and 2 of the *Summary for Policy Makers* in detail, in plenary sessions. They summarised key comments and guidance for authors in a tabular format. The main objective of this exercise was to identify the most policy-relevant messages to be retained and highlighted in the reduced text. Noting that the High-level Group tasked the authors to shorten the *Summary for Policy Makers* draft text by approximately half of its original length, this exercise required comprehensive discussion to reach consensus, and was concluded at the end of day 2.

After the High-level Group had completed their review of sections 1 and 2 in plenary sessions, and compiled their guidance, then a drafting group was formed to work on the revised text of sections 1 and 2. Jock Martin provided input from the High-level Group and the co-chairs of the assessment worked with authors to implement those changes to the text.

For days 3 and 4 the High-level Group focused on providing input to the Policy and Outlooks drafting teams by adding comment bubbles to the existing drafts. Suggestions for revisions to these sections were then provided to the drafting teams as a marked-up document. The Policy Drafting team consisted of Klaus Jacob, coordinating lead author, as well as Juan Carlos Arredondo Brun and Edgar Gutiérrez Espeleta from the High-level Group. For the Outlooks drafting team support from the High-level Group was provided by Jurgis Sapijanskas along with the coordinating lead authors from the Outlooks chapters.

In all **five drafting groups were formed** (one for each of the Summary's five sections), as well as a smaller group to work on the initial 'key messages' section. **The drafting groups were small** (6-10 members) **and included the relevant lead authors, the GEO-6 co-chairs and selected HLG members**.

The drafting groups worked to provide their revised text by mid-day on Day 4 of the meeting. They were tasked to address the comments and guidance received by the High-level Group at the meeting, and to significantly shorten and re-draft each of the SPM's five sections. If, during the re-drafting process, any issues of accuracy or of '*line of sight*' between the main document and the Summary for Policy Makers were identified, then the lead authors in the group contacted other authors (not present at the meeting) to consult them on proposed changes and reach consensus. After an initial discussion within the group, in some cases, the group split-up into smaller sub-groups or each individual author worked on their parts of the text.

The two largest drafting groups were supported by Secretariat staff who provided the following outcome summaries.

Outcome of Drafting Group on Summary for Policy Makers Parts 1 and 2 - 25 August – 15:00 – 18:00

Six lead authors, the GEO co-chairs and two HLG members worked very diligently and as a synergic group. They took the SPM draft of August 20th as their starting basis. Co-chairs or authors were pen-holders and the group incorporated all comments/edits that were suggested by the HLG in day 1-2, including those provided by Jock Martin as track changes on Sept 23rd. The group dealt first with the Climate Change issues, and once a strategy to address climate-related comments was agreed, the Climate Change authors split into a sub-group to work on a new draft text. The group then continued working as three smaller sub-groups, to optimize the use of time and of the expertise present in the room. When needed, lead authors contacted other authors by phone, to quickly verify with them any required changes. This approach effectively allowed the entire group of authors (even if those who were not all physically present) to support the SPM re-drafting process. The group concluded its work on parts 1-2 at 18:00.

Outcome of the Drafting Group on Section 4 ("Changing the path we are on") of the Summary for Policy Makers

26 September, 11:30–20:42 hr. (lunch break from 12.30 to 13.45 PM)

Five CLAs (Asrar, Hedden, Lucas, Pereira, Van Vuuren), the two GEO co-chairs (Ekins, Gupta) -in and out- and one HLG member (Sapijanskas) got together in break-out Room 1 and worked arduously on section 4 (Changing the path we are on). This happened in a very collaborative and productive manner. The group was accompanied by one UN Environment's Secretariat member (Kappelle) who provided logistical support on a needs basis. The group used the Summary for Policy Makers draft of August 20th as their starting point. CLAs served as pen-holders. The drafting group addressed all comments/suggestions/edits that were provided by the HLG on Day 2 (Tuesday September 25th), including those provided by Jock Martin in tracked changes on Sunday September 23rd. The group dealt first with the various text pieces of the subsections that had to be shifted to other subsections, in order to enhance the flow of the text. A subsection 4.2. was added to improve the flow, covering elements that were previously included in the other subsections. This led to a renumbering of subsections. The group then highlighted HLG comments and identified where in section 4 they had to be addressed. In the afternoon, the drafting group split first into three subgroups -building from the expertise among the CLAs- and worked on improving individual subsections (4.1., 4.2., 4.3 and 4.4.), while incorporating -as required- pieces of texts from respective chapters to section 4 of the Summary for Policy Makers. In the second half of the afternoon, the group went back into a small plenary to refine the text, going through the subsections paragraph by paragraph. In this way, a revised text for section 4 was developed for subsequent discussion in the large plenary to be held in the main room on Thursday September 27th. The revised section was submitted to the GEO Unit Head (Boileau) at 20.42 hr on Wednesday September 26th. As a result, the group concluded its hard work on section 4 at that time on Wednesday.

On day 3, the drafting groups started to present their revised and shortened draft text back to the High-level Group in plenary sessions. **Sections 1 and 2 were discussed on day 3, and sections 3-4-5 were discussed on day 4**. In this second round of review, the authors were offered final comments by the High-level Group on the revised text. Some final guidance on consistency of presentation and format was also discussed and agreed by the High-level Group, based on inputs from the co-chairs of the Scientific Advisory Panel (i.e. use of bold text to highlight headline messages, consistent use of confidence statements and references back to text of the sections in the main document, etc.). The authors were then tasked to complete the text, incorporating the latest guidance by the High-level Group on content and format. This was completed by 15h30 on Day 4 and was followed by a full read through of the draft *Summary for Policy Makers*.

During the full read through High-level Group members were asked to focus on factual errors or omissions rather than commenting on specific elements of the text. This read through was completed by 18h00 on Day 4, at which point the full text of the draft Summary for Policy Makers was adopted.

In parallel to the development of the text of the Summary for Policy Makers, a shorter draft 2-page *Summary for Ministers* was developed by a small team of High-level Group members. This text was intended to support the discussions of Member States at the January 21-24, 2019 negotiation session and would also need to be redrafted to reflect the outcomes of the negotiation. The full read through of the draft 2-page *Summary for Ministers* was conducted from 18h00 to 19h30 on Day 4 of the meeting. Small factual corrections were made to the text and it was adopted by 20h00 on Day 4.

Conclusions and statements from Group members

The meeting's main objectives were fully achieved, including the preparation and adoption of the draft *Summary for Ministers*. A roadmap for the coming 3 weeks was also developed that would allow for authors to:

- Verify line of sight for both the draft *Summary for Policy Makers* and the *Summary for Ministers*
- Allow for any factual errors in the two documents to be corrected by the High-level Group
- Allow for copy and science editing of the two documents prior to translation into the 6 official UN languages.

The planned session on '*The Future of the GEO*' was postponed to allocate maximum time for the drafting work. A dedicated teleconference on this topic will be organised by the Secretariat in the coming month.

The High-level Group Drafting Meeting was concluded at 20h00 on Day 4, Thursday 27th September 2018.

Annex 1 – Participants List

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Annex 2 – Second-order draft of the Summary for Policy Makers (draft at 18h00 on Day 4)

Second-order draft version 2: September 27, 2018 (19:30)

In accordance with the agreed HLG annotated outline, Singapore, February 2018

Summary for Policy Makers: Sixth Global Environment Outlook

1 What is the Global Environment Outlook?

This sixth Global Environment Outlook (GEO-6), with the theme "Healthy Planet, Healthy People," aims to help policy makers and all of society to achieve the environmental dimensions of the Sustainable Development Goals (SDGs), Globally Agreed Environmental Goals (GAEGs) and the Multilateral Environmental Agreements (MEAs). It does so by assessing recent relevant scientific information and data, analysing current and past environmental policy, and identifying future options to achieve sustainable development by 2050.

Since the first edition of GEO in 1997, there have been many examples of environmental improvements especially where problems are well-identified, manageable, and regulatory and technological solutions are readily available. Much more can be achieved in this regard through more effective implementation of existing policies.

Nevertheless, the overall condition of the global environment has continued to deteriorate since the first GEO despite the environmental policy efforts across all regions and countries. Environmental policy efforts are being overwhelmed by a variety of factors, especially unsustainable consumption patterns. Overall, GEO-6 concludes that human activities globally have degraded the Earth's ecosystems, endangering the ecological foundations of society.

Urgent action is necessary to arrest this situation, and thereby protect people's health and maintain the integrity of the global ecosystems now and in the future. Key actions include reducing land degradation, air pollution and biodiversity loss, improving water management and addressing decarbonisation, decoupling, and detoxification. These require more ambitious policies including sustainable consumption and production, greater resource efficiency, integrated ecosystem management, and integrated waste management.

In line with the SDGs, GEO-6 shows that environmental issues are best addressed in conjunction with related economic and social issues, taking into account synergies and trade-offs between different goals and targets, including consideration of equity and gender dimensions. Governance can be improved at local, national, regional, and global levels, including broad coordination between policy areas. Stronger and better-enforced environmental policies are necessary but not sufficient to meet sustainable development objectives. Incorporating environmental considerations into social and economic decisions, and vice-versa, at all levels is very important.

GEO-6 shows that a healthy environment is the foundation for economic prosperity, human health and well-being. Furthermore, equal opportunities for prosperity and well-being for all that maintain the integrity of ecosystems can be attained, through sustainable development pathways that are shared and pursued globally.

The following sections highlight the main global drivers of environmental change, the condition of the main environmental media, the scale and effectiveness of policy responses, the potential pathways for achieving sustainable development goals in an increasingly complex world, and the data and information needs and opportunities that can support decision making towards achieving those goals.

2 What is Happening to Our Environment and How Have We Responded?

2.1 Drivers of environmental change, megatrends and governance challenges

Population growth and economic development have been acknowledged for many decades as the primary drivers of environmental change. More recently, rapid urbanisation combined with accelerating technological innovation have been additional strong influences. There are wide disparities across the world in the consumption patterns that lie behind these drivers.

These driving forces are also strongly intertwined, complex and widely, if unevenly, spread across the world. They are megatrends, developing at speeds that mean that established governance structures at all levels – global, supra-national, national, regional and local/urban levels – are unable to cope.

Global population in 2018 is some 7.5 bn people with median projections estimating nearly10 billion1 people by 2050, and nearly 12 billion people by 2100 (UN) *(well established)***.** Increases in life expectancy and reductions in infant and other mortality mean that population growth rates will continue to remain positive in all regions except Europe and some parts of Asia (well established). Unequal access to education and lack of empowerment of women contribute to high birth rates (*well-established*). Without changes in production and consumption patterns, population growth will increase environmental pressures *(well-established).*

Urbanisation is happening at an unprecedented rate globally and cities have become the foremost drivers of economic development across the world. More people, especially in emerging and developing economies, are living in cities and towns with the world's urban population expected to rise to 66% by 2050 (*well-established).* Approximately 90% of city growth will occur in low-income countries. Africa is the most rapidly urbanizing region as well as the region expected to experience highest growth in population (*well-established).* Some 30% of urban residents globally have no access to basic services and social protection, with poor women in slums particularly vulnerable.

Coastal cities of all sizes are increasingly vulnerable to sea-level rise, floods and storm surges caused by extreme weather events. In general, those cities in developing countries that are urbanising most rapidly are more vulnerable (*established*). On the other hand, urbanisation can represent an opportunity to increase citizens´ well-being while decreasing their environmental footprint. Lower-impact urban lifestyles can be facilitated by improved governance, infrastructure, services, land-use planning and technological opportunities. Investment in rural areas can reduce the pressure to migrate.

Economic development has lifted billions of people out of poverty and enhanced access to health and education in most regions of the world (*well-established*). Nevertheless, the "Grow now, clean up later" economic model used world-wide has not accounted for climate change, pollution and degraded natural systems. This model has also contributed to increasing inequality within and between countries and will ultimately be more expensive. It cannot sustainably support ten billion healthy, fulfilled and productive people in 2050.

Decoupling of environmental degradation and resource use from economic growth, and associated production and consumption patterns is required for achievement of the SDGs. Partial decoupling can already be observed for some impacts and resources in some countries. Further decoupling requires more fundamental transitions in how we produce, consume and dispose of goods and materials across society. The transitions also need to be supported by long-term comprehensive science-based targets that provide the objective basis for future directions and actions.

The growth in technological innovations since the 1990s is unprecedented, globally and historically, bringing with it many benefits to people's lives, but also with some negative consequences. Some technological and social innovations can reduce the environmental pressures associated with unsustainable consumption and production. Enhancing access to existing environmental technologies could help countries achieve environmental objectives more quickly. Greater application of precautionary approaches to new technological innovations can reduce and unintended negative consequences for human and ecosystem health.

Countries that prioritise low-carbon, resource efficient practices may gain competitive advantage in the global economy. Well-designed environmental policies and appropriate technologies can often be implemented in tandem at limited or no cost to growth and competitiveness and may be positive for employment and development *(established but incomplete).*

Climate change is a priority issue affecting human and natural systems – air, freshwater, oceans, lands and biological diversity—and altering complex interactions among these systems. Past and ongoing greenhouse gas (GHG) emissions have committed the world to an extended period of climate change *(well-established),* which is leading to sea-level rise, ocean warming and more frequent and extreme weather events, while higher atmospheric concentrations of carbon dioxide lead to ocean acidification. This makes climate change a global driver of many environmental, social and economic impacts and heightened society-wide risks.

Society-wide risks are generally more profound and existential for disadvantaged people, particularly women and children in developing countries. Many of the above impacts are serious or irreversible and can lead to loss of livelihoods, increasing morbidity and mortality, economic slow-down, and increased potential for violent conflict and mass migration of people. Measures for more effective adaptation are now urgently required, especially in the most vulnerable regions and among the most vulnerable populations.

The increasing scale, global reach and speed of change in these drivers pose urgent challenges for managing environment and climate change problems. In many domains, our scientific understanding of adverse, increasingly deadly, impacts is

becoming more widespread as is the understanding that the nature of change is sometimes irreversible. The thematic priorities addressed by the GEO-6 have been chosen and analysed with this context in mind and the summaries by theme organised to provide decision makers with the most crucial insights within themes including links to drivers and possible avenues for action.

2.2 The state of the environment

2.2.1 Air

Emissions generated by human activity continue to alter the composition of the atmosphere leading to air pollution, climate change, stratospheric ozone depletion, and exposures to persistent, bioaccumulative, and toxic chemicals (*well established*) [section 5.3].

Air pollution is the main environmental contributor to the global burden of disease, leading to approximately 6.1 million premature deaths and welfare losses estimated at USD 5 trillion annually (*established but incomplete*) [section 5.4.1]. Air pollution exposures are highest for urban residents in low and middle-income countries (*established but incomplete*) [section 5.4.1] and for the approximately 3 billion people who depend on burning wood, coal, crop residue, dung, and kerosene for cooking, heating, and lighting (*well established*) [sections 5.2.4, 5.4.1]. The elderly, very young, ill, and poor are more susceptible to air pollution impacts (*well established*) [section 5.4.1]. **Error! Reference source not found.** shows global premature death rates that are attributable to continued exposure to $PM_{2.5}$.

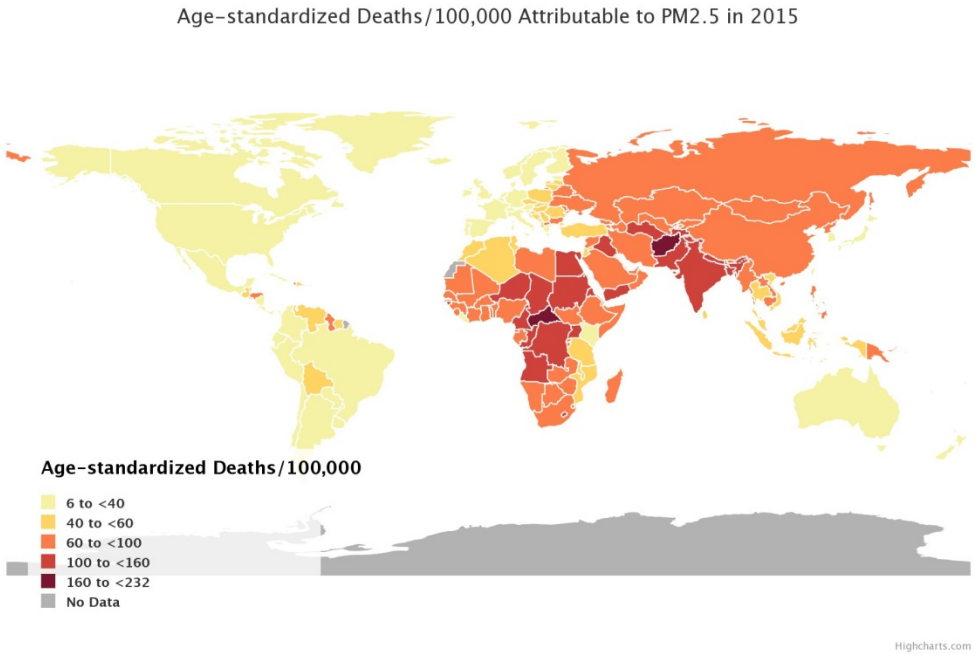

Figure 1: Deaths attributable to ambient PM2.5 air pollution per 100,000 people in 2015 (Source: HEI, 2017). Age standardization allows the estimates to be compared for countries with different age distributions. Note that these estimates do not include deaths attributable to exposure to household air pollution.

Globally, decreasing emission trends in some sectors and regions have been offset by increases in others, including some rapidly developing and emerging economies and areas of rapid urbanisation (*well established*) (section 5.2). As controls have been placed on power plants, large industrial facilities, and cars, the relative contribution of other sources, including agriculture, residential fuel use, construction and other portable equipment, and fires have grown in importance (*established*) [5.2].

Atmospheric concentrations of long-lived GHGs continue to increase, driven primarily by fossil fuel extraction and use for electricity generation, industry, and transport, but also affected by land use, land-use change, and forestry (*well established*) [section 5.2, 5.3.4]. The evidence of current global climate change is unequivocal *(well established)* [section 2.2]. Since 1880, the global average surface temperature has gone up by about 0.8–0.9 °C (*very likely*) [section 2.7]. Eight of the ten warmest years on record occurred within the past decade *(virtually certain)* [section 2.7]. If GHG emissions persist, global average temperatures will continue to increase, crossing the 1.5°C Paris Agreement target by the 2040s (*very likely*) [section 4.2.1]. Current national emissions reduction commitments are only a third of the mitigation required to get onto a least-cost pathway for staying well below 2°C (*well established*) [section 2.7].

Achieving the goal of limiting warming to 1.5°C requires transformational changes leading to deep reductions of GHG emissions and balancing of emissions sources and sinks (*established*) [sections 4.2.1, 5.3.4]. Decreasing emissions of short-lived climate pollutants (SLCPs), specifically black carbon, methane, tropospheric ozone, and hydrofluorocarbons (HFCs), provide opportunities to limit warming in the near term and are a critical component of an integrated climate change mitigation and air quality management program (*well established*) [section 5.3.4].

Government capacity and political will to manage air pollution and climate change varies significantly (*well established*) [section 5.5]**.** Some regions have well-developed systems of national to local policies and enforcement programs (*well established*), although scope and policy ambition levels may differ. In other regions, international agreements or national legislation may exist, but implementation and enforcement are often affected by weak national to local institutional capacity (*established but incomplete*). Between 1998-2010, there was a five-fold increase in the number of national climate laws (more than 1,500 laws and policies worldwide) and by 2012 these laws covered 67% of all emissions *(well established).* Some city and sub-national governments are leading the way with benefits for other parts of their countries (*well established*) [sections 5.5, 12].

2.2.2 Biota/biodiversity

A major extinction event, compromising planetary integrity and Earth's capacity to meet human needs, may be unfolding. Biodiversity refers to living diversity at the genetic, species, and ecosystem levels. It helps regulate climate, filters air and water, mitigates the impact of natural disasters, and helps provide timber, fish, crops, pollination, ecotourism, medicines, and mental health benefits [*well-established*] (6, 6.4.2).

Biodiversity underpins environmental and human health, which are intricately linked. Many emerging zoonotic infectious diseases affecting wildlife, domestic animals, plants, or people, are driven by activities that impact biodiversity, such as agricultural intensification and landscape changes, and zoonoses are estimated to account for more than 60% of human diseases. (6.1, 13; boxes 6.1, 13.1)

Genetic diversity is declining, threatening the resilience of agricultural systems and food security (6.4.1) [*well-established*].

Species numbers and populations are declining; presently, 42 per cent of terrestrial, 34 per cent of freshwater, and 25 per cent of marine invertebrates are considered at risk of extinction (6.5.2). Global vertebrate species population abundances have declined by 60% between 1970 and 2014 (6.5.2) [*well-established*].

Ecosystem integrity and function are declining: Ten out of 14 terrestrial habitats have seen a decrease in vegetation productivity, and just under half of all terrestrial ecoregions are classified as unfavourable status (6.5.2) [*well-established*].

Biodiversity change is also an equity issue, disproportionately affecting poorer people and women and future generations to be deprived of the health benefits of biodiversity if current rates of decline continue. The livelihoods of 70% of people living in poverty depend on natural resources (6, 6.3.4, 6.6.3; boxes 6.5, 13.2) [*well-established*].

The critical pressures on biodiversity are habitat transformation and land-use change, the spread of invasive species, pollution (including microplastics), over-exploitation (illegal trade in wildlife, fisheries, and forest products is worth more than $US 150 billion per year [6.3]), and climate change, which many experts feel will pose the gravest threat in the future as species, including disease vectors, migrate with temperature shifts [*well-established*].

Governance efforts are progressing. Over 180 National Biodiversity Strategies and Actions Plans (NBSAPS) have been submitted to the Convention on Biological Diversity (CBD), though their quality and reliability remains uneven; and two protocols to the CBD provide deeper governance context.

The science-policy interface for biodiversity and nature's contributions to people strengthened in 2012 through the establishment of the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) (6.6.1, 13). The CBD is negotiating the Post-2020 Global Biodiversity Framework, and negotiations continue towards an agreement on the sustainable use and conservation of marine biological diversity beyond national jurisdiction (6.6.4).

Several multilateral environmental agreements provide additional governance architecture on biodiversity, including the Ramsar Convention on Wetlands, the Convention on International Trade in Endangered Species, and others (Annexes 6.1 and 13.1) It is vital that governments support the continual updating of the IUCN Red List and other independent monitoring efforts and that national economic valuation methods include the value of biodiversity.

Safeguarding species and ecosystems require the sustainable use, conservation and sometimes the outright protection of natural habitats [*well-established*]. Implementation, management, and representative coverage of different types of ecosystems remains insufficient. Under 15% of terrestrial and inland waters and under 11% of coastal and marine areas within national jurisdiction are protected areas (6.6.3).

Biodiversity is slowly being mainstreamed or integrated into health, gender, and other equity concerns [*well-established***].** Indigenous people and local communities (IPLC) play a key role in biodiversity protection by offering bottom-up, self-driven and innovative solutions, based on traditional knowledge and the ecosystem approach (13.1). However, protected areas can adversely affect indigenous communities if they are denied access to nature.

Ex-situ conservation of genetic material provides safeguards for maintaining adaptive potential, especially of crop and agricultural species. Yet accelerating biodiversity loss and the large, escalating costs of inaction, including numerous threats to human health, demand an urgent increase in global investment in sustainable use and conservation, and the consistent integration of biodiversity concerns into all facets of economic and social development.

2.2.3 Oceans and coasts

The principal drivers of change facing the oceans and coasts are ocean warming due to climate change and increasing use of oceans and coasts for food-production, transportation, settlement, recreation, resource extraction and energy-production (well established). The main impacts of these drivers are death of coral reefs (well established) {section 7.3.1}, reduced fish stocks and the resulting disturbance of marine and coastal ecosystem food chains (well established) {section 7.3.2}, increased nutrient and sediment runoff (well established) and marine litter (established but incomplete) {section 7.3.3}. These impacts interact in ways that are poorly understood and can amplify the effects (inconclusive). If left unaddressed, there is a major risk that they will combine to produce a destructive cycle of degradation and the ocean will no longer be able to provide many of the benefits humans currently enjoy (e.g., livelihoods, income, employment, aesthetic and cultural and religious values). Improved governance approaches and instruments are needed as current efforts are not sufficient to achieve the aims of sustainable development goals, particularly goal 14 {chapter 14}. Interventions based on emerging technologies and strategic management approaches, such as resilience-based management and ecosystem-based management can contribute to improved conservation of marine ecosystems and resources {14.2.1}. To be effective, such measures must be combined with actions to mitigate and adapt to climate change and reduce inputs of pollution and litter to the oceans while promoting a sustainable blue economy.

Climate change is driving sea level rise, changes in ocean temperature and ocean acidification. Tropical coral reefs are currently being devastated by these changes (well established) {section 7.3.1}. Mass coral bleaching induced by chronic heat and exacerbated by ocean acidification has damaged many tropical reefs beyond recovery (well established). The collective value by coral reefs has been estimated at USD $29 billion per annum. The loss of coral reefs impacts fisheries, tourism, community health and livelihoods and marine habitats (well established). Interventions based on emerging technologies and management approaches (e.g., resilience-based management and ecosystem-based management) to build resilience may help preserve some areas or reef (unresolved) {section 14.2.1} but governments should prepare for the dramatic decline (if not collapse) of reef-based industries.

Map showing the maximum heat stress during the ongoing 2014-17 global coral bleaching event (from National Oceanic and Atmospheric Administration [NOAA] 2017). Alert Level 2 heat stress indicates widespread coral bleaching and significant mortality. Level 1 heat stress indicates significant coral bleaching. Lower levels of stress may have caused some bleaching as well.

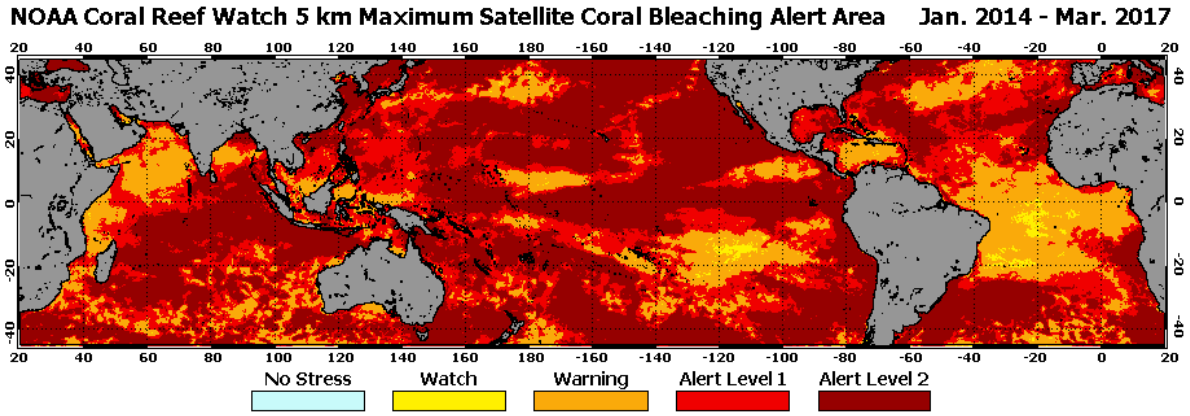

Figure 2: Map showing the maximum heat stress during the ongoing 2014-17 global coral bleaching event (from National Oceanic and Atmospheric Administration [NOAA] 2017). Alert Level 2 heat stress indicates widespread coral bleaching and significant mortality. Level 1 heat stress indicates significant coral bleaching. Lower levels of stress may have caused some bleaching as well.

The oceans play an important role in the global economy and are likely to become increasingly important. Fisheries and aquaculture currently generate USD 252 billion annually. Small-scale fisheries support the livelihoods of between 58–120 million people *(established but incomplete)* {section 7.5.2). Fish provide 3.1 billion people with over 20% of their dietary protein and contain nutrients important for health. Keeping capture fisheries and aquaculture sustainable requires significant investments in monitoring, assessment and operations management and, in many cases, strong local community‐based approaches {14.4.1}. Measures to minimize the ecosystem effects of fishing have had mixed success. Where resource assessments and monitoring, control and surveillance measures are not available, overfishing, illegal, unreported or unregulated fishing continue and may be expanding (established but incomplete). In this case, capacity building and improved governance emerge as important issues {sections 14.4, 14.5, 14.6}.

Plastic litter, including microplastic, is now found in all oceans, at all depths *(established but incomplete)* {section 7.4.4}. The scale and importance of the problem has received increasing attention in recent years but there are still large knowledge gaps. Our current best estimated suggests that the volume of marine litter is increasing by 8 million tonnes annually, largely from land-based sources (established but incomplete). Marine plastic litter can have significant ecological impacts from entanglement and ingestion and also as a vector for the transport of invasive species (established but incomplete). The growing presence and abundance of microplastics has potential adverse effects on the health of both marine organisms (established but incomplete) and humans (unresolved) {section 7.4.4}. Further, marine litter can have a significant economic impact on a range of coastal sectors, such as tourism and recreation, shipping and yachting, fisheries, aquaculture, agriculture and human health (established but incomplete). The damage to fishing gear alone is estimated at more than USD 72 million per annum and losses to tourism and recreation are estimated at USD 735 million per annum and increasing (established but incomplete) {section 7.4.4}.

Improving waste management, including recycling and end of life management, is the most urgent short-term solution to reducing the input of litter to the ocean *(well established)*. Longer-term solutions include improved governance at all levels as well as behavioral and systemic changes that reduce the production and use of plastic and increase recycling and reuse {section 14.3.1}. Cleaning up coasts and beaches can provide environmental and economic benefits and trapping surface litter in the ocean may be effective in small areas, but these efforts should not distract from actions to stop litter entering the ocean. While many relevant international agreements exist {section 14.3.1}, there is no global agreement that addresses the issue of marine litter and microplastics in a comprehensive and integrated manner.

Policy sensitive indicators used to track the progress in addressing key pressures and drivers may not capture entirely the multiple dimensions of pressures and drivers *(well established)* {section 14.7}. Area-based indicators, such Aichi Biodiversity Target 11 on the coverage of marine protected areas under national jurisdiction alone do not warrant that such areas are effectively managed; nor they can guard against the impact of climate change or pollution (well established) {sections 14.7.1, 14.7.3}. Efforts to develop methods for evaluating the effectiveness of protected areas are therefore critical {section 14.7.1}. The lack of standardization and compatibility between methods used and results obtained in various bottom-up projects makes difficult an overall assessment of the marine litter status at large geographic areas (well established) {Section 14.7.2}.

2.2.4 Land

Adequately feeding 10 billion people by 2050 will need food production and distribution to increase by 50% *(well established)*. Food production is the largest anthropogenic use of land (50% habitable land) *(well established)*. Livestock production uses 77% of agricultural land for feed production, pasture and grazing *(well established)* (Figure 3 below). Furthermore, traditional livestock provides livelihoods for many indigenous and local communities. Changes in land management can address food security while preventing the loss of nature's contributions and promoting gender and social equality *(established but incomplete)* [section 6.1]. Approximately 33% of global edible food is lost or wasted (well established) of which 56% occurs in industrialized countries (well established) [section 5.1.2]. Global food supply requires trade with increasing crop specialization and distribution *(well established)*. However, this geographic concentration of production increases the systemic risk of poor harvests and food insecurity [section 5.1.3]. Increasing productivity has slowed-down agricultural land expansion, but inefficient farming systems are often associated with environmental degradation and biodiversity loss *(unresolved)*.

The breakdown of Earth surface area by functional and allocated uses, down to agricultural land allocation for livestock and food crop production, measured in millions of square kilometres. Area for livestock farming includes grazing land for animals, and arable land used for animal feed production.

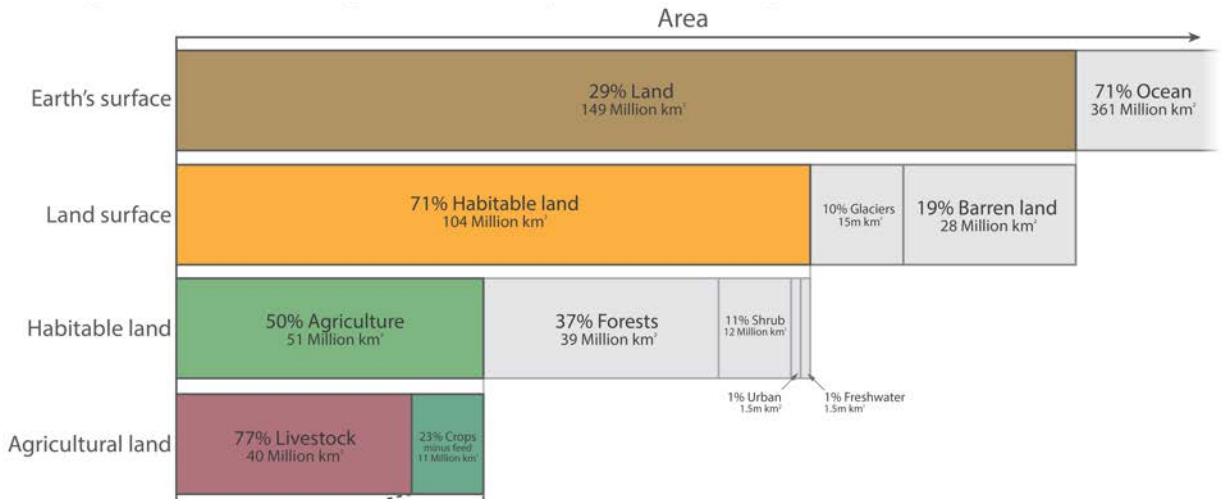

Figure 3: Global surface area allocation for food production (based on FAO Statistics (2017))

Land is the most important asset for most people *(well established)*. Insecure access to land resources hinders sustainable land management *(well established)*. Tenure security of indigenous and other forms of community-managed lands generates billions of dollars' worth of ecosystem benefits through carbon sequestration, reduced pollution, clean water, erosion control, among others *(established but incomplete*). These benefits justify securing land tenure and the right to inheritance for women, indigenous and local communities *(established but incomplete)* [section 5.3.2].

Land degradation and desertification have increased (*established but incomplete*)**,** with land degradation hotpots covering about 29% of global land where 3.2 billion people reside *(well established)* [section 4.2].

Whilst deforestation continues globally, it has slowed down. Additionally, many countries are increasing their forest cover, mostly through plantations and reforestation *(well established)* with significantly lower contributions to people than natural forests *(unresolved)* [section 4.1.3].

Built-up areas, which cover the ground with impervious surfaces, have grown approximately 2.5 times since 1975 *(well established)* and in 2015 accounted for 7.6% of the global land affecting the hydrological cycle and soil functions, and causing urban heat islands. **Achieving the land-related SDGs requires adequate land and water resource management *(well established)*.** Innovative technologies, sustainable land management strategies and land-resource stewardship (e.g. sustainable forest management, agro-silvopastoral production systems, and agro-ecology) are being adopted and, when compatible with local cultures contribute to better management and conservation of land resources *(well established)* [section 4.1]. These strategies are an integral part for reducing hunger (SDG 2). However, currently major national policies and economic incentives for agriculture, renewable energy, infrastructure development and bio-economy often externalize land degradation through lack of land use planning.

Sustainable land use planning can protect high quality, fertile farmland from competing interests, thus maintaining land-based services such as food production, flood and disaster prevention [section 4.1.4]. Policies empowering women, indigenous peoples, family farmers, and pastoralists to ensure secure access to land resources, inputs, knowledge, extension services, financial services, markets and opportunities for adding value and non-farm employment can facilitate SDG achievement and reduce environmental impacts *(established but incomplete).* Closing the gender gap over resources such as land, access to information and technology, and efficient extension services for farmers may increase agricultural productivity and reduce poverty and hunger *(well established)* [section 6.1]. Frameworks targeting land degradation through improved land management, such as UNCCD land degradation neutrality may also contribute to climate change mitigation *(well established).* Yet the policy framework on land management remains scattered, incomplete and mostly voluntary.

2.2.5 Freshwater

Population growth, urbanisation and economic development are increasing water risks across the world, exacerbated by climate change. Slow onset disasters such as water scarcity, droughts and famines lead to increased migration (*well established*) [section 9.2]. Increasing numbers of people are being affected by severe storms and flooding events [section 9.1]. Increasing glacial and snowpack melt due to global warming will affect regional and seasonal water availability, especially in

Asian and Latin American rivers providing water for about 20% of the global population *(well-established)* [section 9.1.2]. The global water cycle is becoming a risk multiplier in terms of both water quantity and quality.

Water quality due to organic and chemical pollution such as pathogens, fertilizers, pesticides, sediments, heavy metals, plastic waste and salinity **has worsened significantly since 1990.** About, 2.3 billion (1 in 3) people still lack access to safe sanitation *(likely)* [section 9.2.1]. Approximately 1.7 million people die annually from treatable diseases, such as diarrhoea and intestinal parasites, associated with pathogen-polluted drinking water and inadequate sanitation *(well-established).*

Human illnesses due to antibiotic resistant infections are projected by WHO to become the main cause of death worldwide by 2050. Antibiotic-resistant bacteria are now found in sources of treated drinking water worldwide *(well-established)* [section 9.2.1] stemming from antibiotics entering the water cycle through domestic sewage disposal, agriculture, intensive livestock rearing, and aquaculture. In addition, various endocrine disrupting chemicals are now widely distributed through the freshwater system on all continents *(well-established)*[see section 9.2.vii.] with long-term impacts on foetal underdevelopment and male infertility (*established but incomplete*).

On the positive side, 2 billion more people have gained access to clean drinking water over a 20-year period. However, women and girls still carry most of the physical burden of transporting water in many developing countries, reducing time available to participate in productive activities and education.

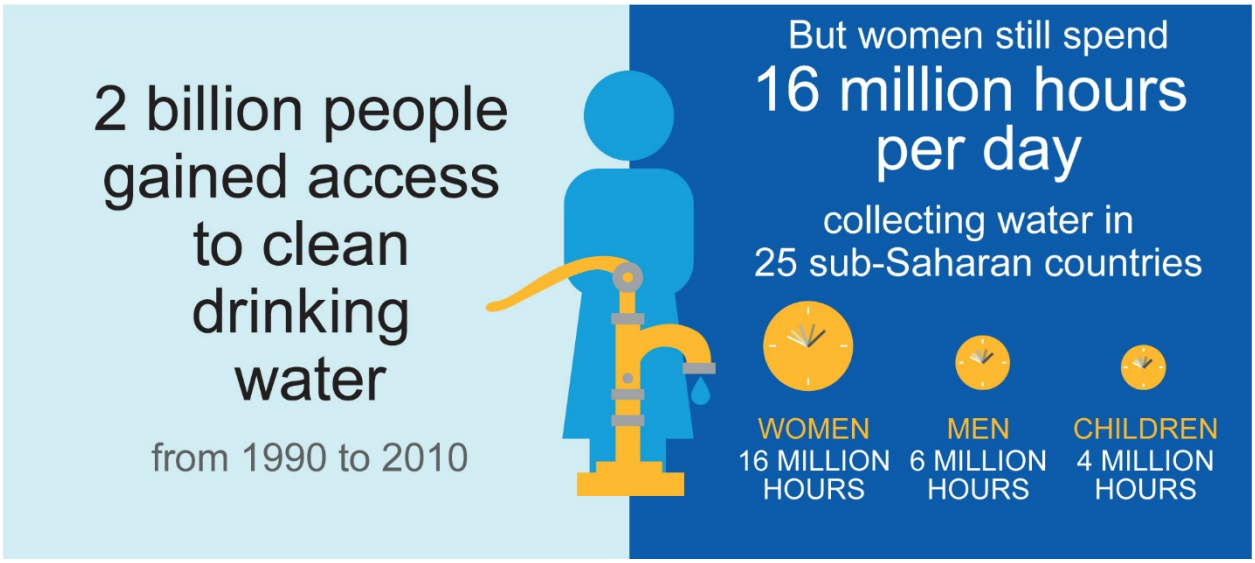

Figure 4: Lack of access to clean water disproportionately affects women around the world, especially in sub-Saharan countries (Source: UNEP/UNICEF 2012)

Worldwide, agriculture uses an average of 70% of all freshwater, rising to 90% in many poorer countries. The competition for more water from cities and industry creates an imperative to improve agricultural water use efficiency while producing more food and using fewer and less harmful inputs *(well established)* [section 9.1.1]. Many aquifers are dropping rapidly due to overabstraction for irrigation, drinking water supply, industrial and mining uses *(established but incomplete)* [section 9.1.1]. Better surface and groundwater monitoring are urgently needed.

Freshwater ecosystems are among the world's most biodiverse habitats and valuable natural infrastructure. Wetlands buffer against climate impacts (both drought and floods) and improve water quality, but 40% of all wetlands have been lost since 1970 through agricultural development, urbanisation, infrastructure development and overexploitation of water resources. Severe consequences include the loss of inland fisheries affecting the livelihoods of millions of people (*likely*) [section 9.3.2]. The total annual economic cost of wetlands losses over 15 years (1996-2011) was estimated at USD 2.7 trillion (*likely*) [section 9.3.1] More investments (both private and public) must be made in sustainable wetland management and restoration.

The decomposition of peatlands, a wetland type that stores more carbon than all the world's forests, currently contributes approximately 5% of annual global carbon emissions (*established but incomplete*) [section 9.3.1]. The thawing permafrost in boreal peatlands, and agricultural conversion of tropical peatlands for palm oil, are causing increased carbon emissions, infrastructure damage and wildfires.

Innovative and integrated policy mixes are essential to manage interactions between water, food, energy, climate change, human health and ecosystems. Good governance includes integrated water resources management (IWRM) as illustrated by integrated flood risk management *(established but incomplete)* [section 16.3], ecosystem-based approaches in sub-national and transboundary basins *(well-established)* [section 16.1], circular economy approaches *(established but incomplete)* [Box 9.3], and substantive progress on decoupling water use from economic growth through increasing water efficiency *(established but incomplete)* [section 16.5]. Such approaches support better land-use planning and cross-sectoral policy coordination between relevant government departments (*well established*) [section 9.4].

Social equity and gender equality remain key aspects in achieving Sustainable Development Goal 6 on freshwater *(well-established)* [section 16.4]. Participatory processes need strengthening to allow knowledge input from local and indigenous communities into decision-making *(well-established)* [section 16.1]. Finally, the realisation of SDG 6 can only be achieved through engaging the public, private and NGO sectors, civil society and local actors and by considering the other interlinked SDGs.

2.2.6 Cross-cutting issues

Several issues cut across all environmental themes. Some - human health, gender, urbanisation, education - relate to *people and livelihoods*; some - climate change, polar regions and mountains, and environmental disasters – are concerned with *changing environments*; and some - resource use and disposal of solid waste, energy, chemicals, and the food system – reflect the use of *resources and materials*. These topics have interdependent dynamics across the environmental themes.

2.2.6.1 People and livelihoods

Environmental and social conditions interact to support and damage human health. Poor environmental conditions which can be changed ('modifiable') cause about 25% of global disease and mortality (*very likely*). Environmental pollution caused about 9 million deaths in 2015 *(very likely)*, from outdoor and household air pollution especially, and contaminated water *(well established)*. .Environmental health effects fall especially on vulnerable or disadvantaged groups related to age (children, elders), ill-health, poverty (within and between countries) and race *(established but incomplete)*. . The risks are systemic, and solutions need to be wide-ranging, tackling sources of pollution but also aiming for co-benefits (*established but incomplete*). Major changes may be needed, e.g. with Healthy-Planet, Healthy People central to our understanding of genuine progress. [section 4.1.1].

The scale and magnitude of the urban footprint is affecting global resource flows and planetary cycles. Cities and their surrounding areas will continue growing in population and size and acting as generators of economic growth *(established but incomplete)*. This urbanization process and prospect represent an enormous challenge for existing subnational governance structures but is also an opportunity to improve human well-being, with potentially decreasing environmental impacts per capita and per unit of production (*inconclusive*). Given the pace of current urbanization, seizing this opportunity depends on planning decisions to be made today *(well established)* [section 4.5].

Gender has a multiplier effect in advancing sustainable development, environmental protection and social justice *(well established)*. All aspects of the environment–drivers, pressures, impacts, perceptions, policies and responses–are shaped by gender relations. Bringing gender perspectives to bear on environmental policies and governance ensures that new and different questions and viewpoints are integrated into environmental assessment, as well as gender-disaggregated data (*well established*), and public resources are more likely to be directed towards human development priorities and investments. [section 4.2].

Education for Sustainable development (ESD) is essential for achieving the SDGs, for promoting a more sustainable society, and accommodating to unavoidable environmental changes (well established). Significant progress has been made around the world with implementing ESD in all educational sectors *(well established)*. However, upscaling of ESD is still needed in order to include it as a core element into the structures of the educational systems globally (*well established*). Policies are needed that eliminate economic and gender barriers to access to education. ESD can also be promoted by non-formal and informal education, including the media. Community engagement, learning by doing, and local learning can play an important role. [section 4.1.4].

2.2.6.2 Changing environments

Climate change alters weather patterns, which in turn exercise multiple impacts on the environment, economics, and society, threatening livelihoods, water, food and energy security of populations *(well established)*. In turn, that increases poverty *(well established)* risks of mass migration, forced displacement, and violent conflict *(established but incomplete)*, particularly impacting vulnerable populations such as small island developing states *(well established)*. Negative impacts are expected even if the current warming is halted at t 1.5C, for example, sea level rise will continue into the future. These risks will amplify under warming beyond 1.5C limits established by the Paris Agreement (*established*) [Section 4.2.1].

Increases in polar surface temperature exceed twice the mean global temperature rise (*virtually certain*). This amplified warming has cascading effects on other components of the polar climate system, with sea ice in the Arctic retreating (Figure 10); permafrost thawing; snow cover extent decreasing; and ice sheets, ice shelves and mountain glaciers continuing to lose mass (*well established*) [section 4.2.2]. These effects in turn have global repercussions, such as accelerated global sea level rise and disturbance of climate and weather patterns.

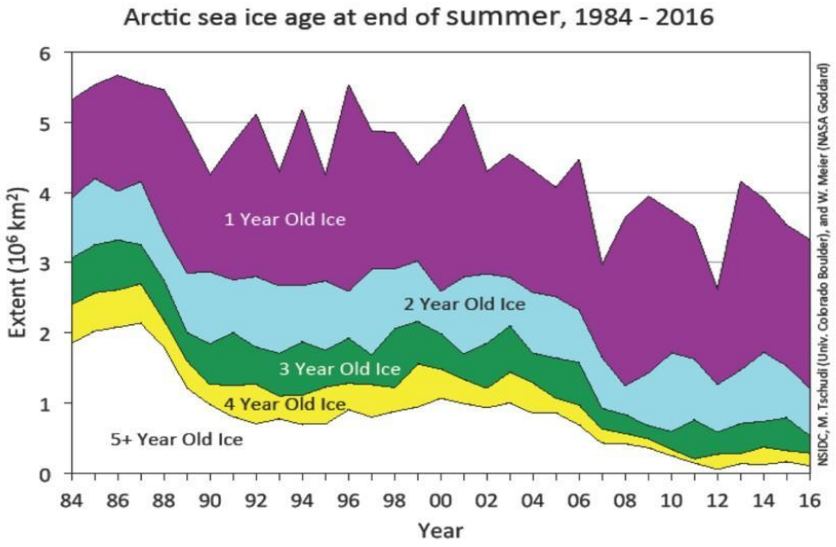

Figure 10: Reduction of the extent in Arctic sea ice. Notice sharp reduction in the area of the old multi-year sea ice (Source: NSIDC, 2017).

The number of people affected by both slow and sudden-onset environmental disasters is increasing due to compounding effects of multiple and interacting drivers. These drivers include climate change and environmental degradation, poverty and social inequality, demographic change and settlement patterns, increasing population density in urban areas, unplanned urbanization, unsustainable use of natural resources, weak institutional arrangements, and non-risk informed policies. Disasters undermine human security and well-being, resulting in loss and damage to ecosystems, property, infrastructure, livelihoods, economies, and places of cultural significance and forcing millions of people each year to flee their homes. {4.1.2}

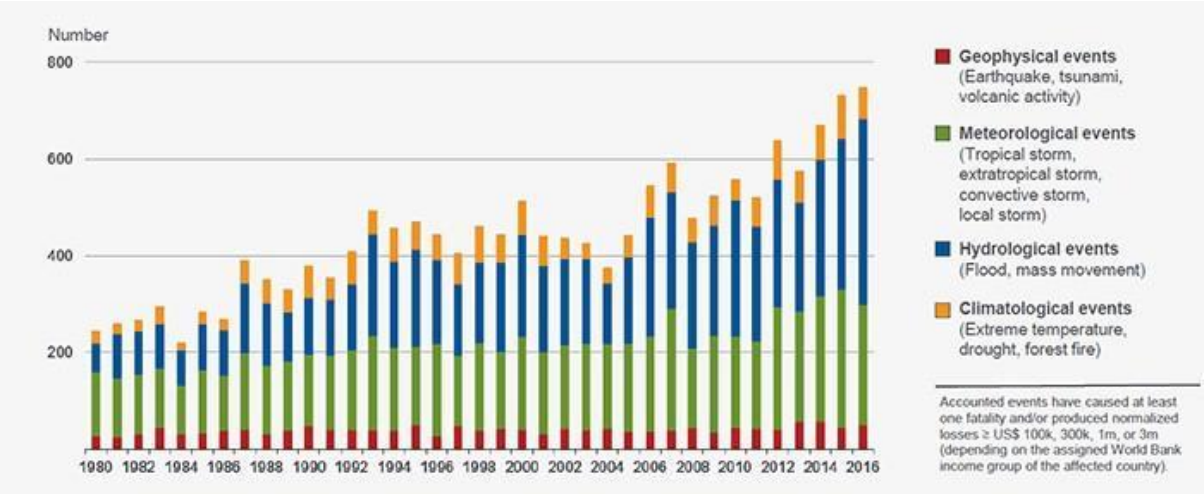

Figure 5: Trends in numbers of loss-related natural events (Source: Munich Re, 2016)

2.2.6.3 Resources and materials

Consumption rates and linear (extract-make-use-dispose) activities have increased resource exploitation beyond the recovery ability of ecological systems with harmful consequences from local to global levels (*established but incomplete*). Globally, 2 out of 5 people lack access to controlled waste disposal facilities. Inadequate and sometimes illegal practices include food waste, e-waste, marine litter, waste trafficking and crime. Developed countries have more policies in place to promote reduced waste and resource efficiency, while developing ones still face basic management challenges such as uncontrolled dumping, open burning, and inadequate access to services *(well-established).* Sound policies for resource accounting and waste management in the context of broader sustainable consumption and production include inter alia a circular economy through reusing, remanufacturing and refurbishing products. (*established but incomplete*) [section 3.1].

Global energy consumption may rise by 63% over 2014-2040, as currently fossil fuel dependent, developing economies, and some developed countries, increase their energy consumption towards the much higher per capita levels of developed economies (*very likely*). Equity and gender issues such as access by all to improved final energy services are still a problem far from being resolved. Despite the fast deployment and cost reduction of renewables and improvements in efficiency, without further stringent measures energy-related GHG emissions will result in a substantial overshoot of the Paris Agreement temperature targets (*very likely*) [section 3.2].

Despite the many benefits brought to humanity, in the most chemicals-intensive era in history their associated pollution is a global problem because toxic substances spread to the most remote environments, particularly to receiving water systems worldwide *(well-established).* Products in everyday use may contain toxic compounds interfering with human and environmental health *(well-established).* Few of the synthetic substances are regulated, with insufficient legislation and enforcement to address associated risks, also missing innovation opportunities and amounting to costs in the order of hundreds of billions of US dollars (*established but incomplete).* Emerging threats requiring adequate precaution and risk management include endocrine disruption, widespread antibiotic resistance and use of nanotechnology. Global chemicals safety would require best management practices in all countries, including the provision of access to this information *(well established).*

Food production, in response to growing and changing consumer demand, is increasing pressure on local ecologies, inequity in access to land and the global climate *(well established).* Agricultural production is the largest consumer of water, a major driver of biodiversity loss, pollution of air, freshwater and oceans, and a leading source of soil degradation. More intensive agriculture has reduced the availability of arable land, while climate change is increasing crop failure risks and diminishing yields more often than enhancing them *(established but incomplete)* [section 3.3]. Providing nourishing and sustainable food for all, as envisaged in SDG2, remains challenged by climate change, natural resource constraints, and demographic trends, and necessitates significant changes in food production, distribution, storage, processing and consumption patterns *(well established)* [section 3.3.3].

3 Effectiveness of environmental policies

Most countries have established a governance structure for environmental policies, introduced environmental policies and there is a great number of multilateral agreements. In part B of GEO 6 the question is addressed: **How effective have these policy innovations and governance approaches been to address the problems and achieve the agreed targets?** The analysis combines an evaluation of case studies on implemented policies with an indicator based approach covering a diversity of policy approaches from different levels in the thematic areas of the report, including the following:

- Provision of information, e.g. access to data on air quality or coral reefs
- Voluntary agreements, e.g. voluntary reporting on the use of water or standard setting for best management practices and sustainability reporting
- Economic incentives and market-based instruments such as free water allowances, individual transferable quotas for fishers or payments for ecosystem services
- Planning for the environment, e.g. adaptive water management, urban biodiversity management
- Promotion of innovation, e.g. innovation for sustainable agriculture or financing for clean cookstoves,
- Regulatory approaches, e.g. exhaust gas standards for cars or wildlife trade bans,
- Governance approaches that include communities, actors from the private sector and civil society, e.g. cities actions on limiting food waste or community-based conservation

Indicators for the evaluation include e.g. for air, the annual mean PM2.5 concentrations (population weighted), ozone depleting substance emissions, and long-lived greenhouse gas emissions. The indicators address a wide range of MEAs and SDGs.

There has been enormous innovation in environmental policies and instruments to reduce emissions and resource depletion. There is no single superior approach that addresses the variety of problems and barriers for a sustainable development and that is applicable in all different contexts. The diversity of approaches and the innovation in policy making is necessary.

Policy design is (at least) as important as policy instrument choice for policy effectiveness. Some common elements of good policy design are (i) setting a long term vision through inclusive, participatory design processes; (ii) establishing a baseline of environmental conditions, quantified science-based targets, and milestones; (iii) effectively integrating environmental, social and economic concerns; (iv) conducting *ex ante* and *ex post* cost-benefit or cost-effectiveness analysis to ensure that public and private funds are being used most efficiently and effectively and social aspects are considered in sufficient detail; (v) building in monitoring regimes during implementation, preferably involving affected stakeholders; and (vi) conducting post-intervention evaluation of the policy outcomes and impacts to close the loop for future policy design improvements.

In many cases, environmental policy making does not meet the suggested criteria for effective policies to its full potential. For example, neither *ex ante* nor *ex post* cost-effectiveness analysis of the policy outcomes has been attempted, making success or failure difficult to evaluate or clear and measurable targets are missing.

Policy innovation increasingly takes place in developing countries. This includes market based and regulatory approaches that provide besides environmental improvements, benefits for the poor. There are examples for environmental policy instruments that provide the poor access to natural resources and income. Examples are the provision of free water in South Africa or policies for sustainable fisheries in Chile.

Environmental policy making is dynamic by scaling up over time. Policies are revised and improved based on experience, e.g. by increasing the level of ambition or choosing tighter instruments. However, such ratcheting up is not applied on a systematic basis. There are few policies which have policy feedback mechanisms built in and hence the potentials of temporal dynamics are not fully exploited. In many cases, no baseline of existing environmental conditions is established, which would be necessary for ex-post or ex-ante evaluation.

Policy diffusion across countries takes place. Successful policies serve as role model for adoption in other countries. Multilateral agreements and policy networks on subnational level serve as catalysts for policy learning across countries. However, there are indication that (voluntary) policy diffusion take place more often in the field of voluntary and innovation promotion, while market based instruments or re-distributive policies, e.g. removal of environmental harmful subsidies or regulatory approaches are less often subject to policy diffusion.

Multilevel governance is a source for policy innovation: on the international level, MEAs support environmental policy making on the national level to pursue related policies. On subnational level, communities and cities, as well as private sector are establishing own policy approaches which is also supportive for advancing policies at other levels.

An integrated approach is key for effective policies. The integration of environmental concerns in the different sectors of policy making at all levels, including agriculture, industry, energy, transport is key for effective protection of the environment. Social and economic aspects need consideration when developing environmental policy.

Environmental aspects find consideration in other sectors, when demonstrating economic and social co-benefits. Tools for ex ante assessment can reveal potential co-benefits. For example, green investment of 2% of global GDP would deliver long-term growth over 2011-2050 that could be at least as high as an optimistic business-as-usual scenario, while minimising the adverse impacts of climate change, water scarcity, and the loss of ecosystem services. Although co-benefit assessments are increasingly applied, the potential is not fully exploited.

The complexity of environmental problems and conflicting interests entails the risk of unambitious and/or delayed policy. Policies are introduced that are “sticky” (i.e. persistent) but not “stuck” (i.e. unresponsive to changing conditions). Often, policy innovations are “second best” solutions, i.e. policies that reflect the political feasibility rather than what would be required to fully address the targeted environmental issue.

The analysis of policy related indicators shows that despite considerable innovation and efforts in advancing environmental policies, efforts and effects are not sufficient so far. Current policies have been insufficient to address the backlog of environmental problems, but they need to continue as the agenda of pollution control, efficiency improvement, planning for the environment etc. is far from being completed. Besides more ambitious and better designed policies, urgent action is needed as resource depletion and growing emissions have partly irreversible impacts on ecosystems, human health and economic costs.

To pursue the Agenda 2030 Sustainable Development Goals (SDGs) and achieve the internationally agreed goals pollution control, clean up and efficiency improvements will not be sufficient. Instead, transformative change, in the sense of reconfiguration of basic social systems and structures, including their institutional framework, social practices, cultural norms and values is necessary. Transformative change enables and combines visionary, strategic and integrated policy making with enabling

of bottom up social, technological and institutional innovation and making systematic use of experiences drawn from such experimentation.

Successful models of environmental governance should be built upon well-designed policies, their implementation and enforcement, pay close attention to early signals from science and society and ensure adequate oversight capacities and investments in knowledge systems, e.g. data, indicators, policy evaluation and sharing platforms. Greater investments are needed in environmental accounting systems to ensure external costs are addressed, and in foresight processes to identify possible future risks, opportunities and conflicts.

Greater application of the "precautionary approach" can reduce risks in a world where threshold and limits are being breached and where endpoints are increasingly uncertain. Achieving progress under greater uncertainty requires coalitions between government institutions, businesses and civil society, to agree on pathways for tackling different societal risks. Vertical coordination between national and local policy levels will be instrumental in accelerating the transition towards sustainable development models.

4 Changing the path we are on

4.1 The need for urgent, sustained and inclusive actions

Current patterns in consumption, production and inequality are not sustainable in a world already under severe environmental pressure. Most environmental indicators are projected to move in the wrong direction *(Well established)* Projected population growth, urbanization trends and economic development significantly increase the demand for food, energy and water towards 2050. Under business-as-usual, resource efficiency in production and consumption (agricultural yields, and nutrient-use, water and energy efficiency) is projected to increase, thereby partly offsetting the demand for key environmental resources. However, these improvements are inadequate to reduce the pressure on already stressed environmental systems. As a result, trends in environmental degradation are continuing at a fast rate and related SDG targets are not going to be achieved (including on climate change, biodiversity loss, water scarcity, excess nutrient runoff and related and algae blooms, land degradation and ocean overexploitation), increasing vulnerability and undermining development already made [Section 21.2]

Indicators related to human development are projected to improve, but trends are insufficient to meet the targets *(Established but incomplete)* At the same time, improvements are projected on global hunger, and access to clean water, improved sanitation services, and modern energy services, but these improvements are not fast enough and large inequalities in access remain to achieve the related SDG targets in many countries. Preventable environment-related health risk factors remain prominent in 2030 (established, but incomplete). For example, global child mortality is projected to decrease significantly, but not enough to achieve the SDG target in many developing countries, especially in Sub-Saharan Africa (established, but incomplete). Furthermore, air pollution is expected to continue to contribute to millions of premature deaths the coming decades. [Section 21.2.2; 21.2.3; 21.2.4; 21.2.6]

Overall, the world is not on track to achieve the environmental dimension of the SDGs and related MEAs by 2030 and 2050. Urgent action is needed to bend these trends (*Established but incomplete*) Overall, future projections show that developments are either too slow or move in the wrong direction (Figure X). A 'grow now, clean up later' approach cannot be sustained in a world already under severe environmental pressure, both for developed and developing countries. For example, increased ocean acidification can severely harm coral reefs, and the proportion of fish stocks within biologically sustainable levels is projected to decrease further. Continuing failure to take urgent action is leading to potentially irreversible adverse impacts, including on critical environmental resources and human health. Current approaches to growth may be more expensive for many countries as it often costs more to clean up later than prevent damage now, while clean up later might not always be possible. For example, a further delay in climate action increase costs of achieving the goals of the Paris Agreement, and at some point make it impossible to achieve them [Section 21.2.3; Section 21.3]

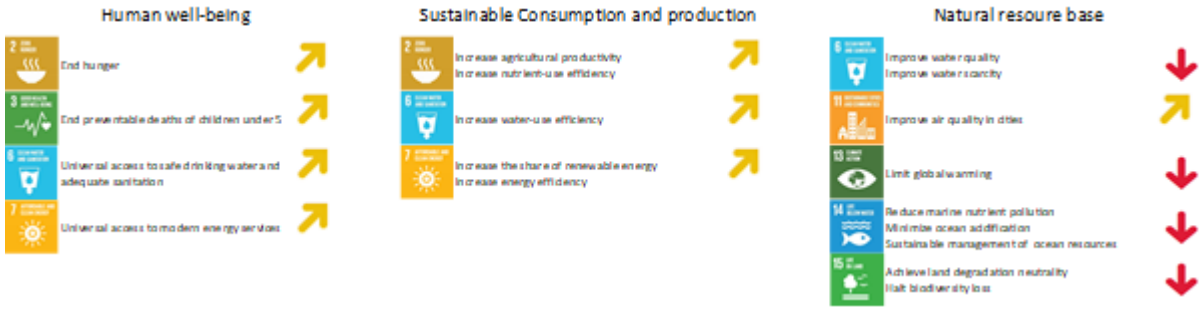

Figure 6: icons address related SDG. Figure to be updated and replaced at a later stage

4.2 Transformative change and an integrated approach are needed

Pathways exists that are able to achieve the healthy planet needed for sustainable development. The literature includes many scenarios that provide information on how to achieve SDG, MEA and GAEG targets. These emphasize a number of key transitions in moving towards a healthy planet. They are associated with achieving sustainable consumption and production patterns for energy, food, and water, in order to prevent climate change, air pollution, land degradation, loss of biodiversity, water scarcity and over-exploitation and pollution of oceans in combination with providing full access to these resources. It includes changes in lifestyle, consumption preferences and consumer behaviour on the one hand, and cleaner production processes, resource efficiency and decoupling, and corporate responsibility on the other.

Transformational changes are needed to meet the targets. These go beyond what can be achieved by environmental policies alone. The rate of change in these pathways indicate that incremental environmental policies will not suffice. Such changes are mix of social and technological improvements and innovations, facilitated by effective policy measures, and cooperation on scales from local to international.

Meeting the goals related to climate change, reducing air pollution and providing sustainable energy for all is possible. It involves a doubling of energy efficiency improvement and lifestyle changes. It also involves a more rapid introduction of 'carbon-free' technologies (including sustainable and equitably-produced bio-energy, hydropower, solar and wind and carbon-capture-and-storage). Land-use and land-use change emissions (including non-CO2 greenhouse gas emissions from agriculture) also need to be reduced. Pathways consistent with the Paris Agreement are characterized by a reduction of carbon intensity of the global economy by 4 to 6 percent per year towards 2050 (compared to 1 to 2 percent per year historically). This would reduce energy system GHG emissions to near zero by 2050.

Eliminating hunger, preventing biodiversity loss, and halting land degradation is possible by combining measures related to consumption and production and distribution of food, and nature conservation policies. Scenarios achieving these goals are typically characterized by 50% faster improvement in yields than business-as-usual, but this strongly depends on changes on the consumption side and food distribution. Halting biodiversity loss also requires measures related to landscape management and protected areas. Green infrastructure can buffer farmers, rural and urban communities against climate shocks such as droughts and floods, mitigate water pollution and increase water supply, while protecting biodiversity. Sustainable agriculture will also require to reduce the nitrogen imbalance to reduce pollution of freshwater systems, groundwater and coastal zones in oceans. Reducing water stress requires more efficient water use, increasing water storage and investing in desalination. Ambitious scenarios in the literature show typically higher water-use efficiency rates than business-as-usual but still fail to reach full water security.

Many synergies exist between policies that address the environment and other dimensions of sustainable development. Significant synergies across human well-being and natural resource targets can be harnessed through interventions related to for instance, education, reducing agriculture demand, and reducing air pollution. Improved education, especially for women and girls, has a particularly strong connection with health outcomes, economic growth, reduced poverty and better environmental management. Meat products require more land than crops (see Figure X). Adopting less meat-intensive diets, where appropriate, and reducing food loss and waste in both developing and developed countries can reduce the increase in agricultural production required to feed 9-10 billion people in 2050. Synergies exists with improving health and nutrition as well as reducing biodiversity loss and preventing, land degradation and water stress. Phasing out unabated use of fossil fuels leads to important co-benefits achieving both climate and air quality goals, the latter having positive impacts on human health, agricultural production and biodiversity.

There are also potential trade-offs between sustainability targets. Land-based climate mitigation (including bio-energy) and agricultural intensification are key measures that would contribute to achieving climate and food targets but could have significant detrimental effects on others. While nearly all scenarios consistent with the Paris agreement rely on land-based mitigation

measures, their use increases demand for land and potentially lead to higher food prices. Increasing agricultural yields can improve overall food availability and reduce pressure on natural land but could also, through higher levels of fertilizers, pesticides and mechanization, lead to land degradation, water pollution and biodiversity loss. Integrated approaches are needed to deal with the synergies and potential trade-offs between the different policies and measures. Understanding interlinkages between measures and targets is crucial for synergistic implementation and policy coherence.

4.3 Innovation for systemic transformation to achieve environmental goals

Coordinated and ambitious policy coupled with social and technological innovation can enable SDG and related MEA/GAEG achievement *(Established, but incomplete)*. Transformative pathways to sustainable development require (i) visions to guide systemic innovation towards sustainability; (ii) social and policy innovation; (iii) phasing out of unsustainable practices; (iv) policy experimentation; and (v) engaging and enabling diverse actors, especially local and indigenous people. Integrated approaches are needed to deal with the synergies and potential trade-offs between the different policies and measures. This requires a vision for sustainable development and leadership to energize popular support. Providing economic incentives, including removal of environmentally perverse subsidies, improving price structures and introducing taxes to internalise social and environmental costs are examples of integrated policies for achieving sustainability goals. [Section 24.3]

Transformative projects and innovative solutions exist that could collectively help in achieving SDGs, MEAs/ GAEGs *(Unresolved)***.** Social, policy and technological innovation is needed. At the local scale, many transformative projects and innovative solutions already exist that could be scaled appropriately. Reviewing bottom-up initiatives reveals ideas, actions, and programmes that seek to achieve the SDGs and involve a wide range of different public and private stakeholders, including: (i) nature-based solutions, including those that draw on indigenous knowledge, such as ecological infrastructure and ecological restoration, (ii) monitoring and reporting innovations including earth observation systems for better information on environmental conditions,, citizen science initiatives that involve citizens in environmental monitoring; and natural capital accounting that integrates economic, social and environmental components; (iii) Circular and sharing economy innovations that involve the increased efficiency of resource use, specifically through new business models that better engage with waste products of other production processes and innovations related to the peer-to-peer sharing of goods and services; (iv) innovations and policies that help to reduce plastics, toxic substances and solid waste; (v) awareness and skills building through sustainability and environmental education to improve public awareness and build relevant skills; (vi) an emphasis on gender equality, women's empowerment and solutions that promote the fair treatment of all from local to global; (vii)decentralization of technologies to educate and engage citizens (e.g. web applications that allow citizens to monitor water quality and to report problems to relevant government agencies); (viii) and smart sustainable cities that, for example, use modern digital technologies to engage and connect citizens in addressing key sustainability challenges of cities, such as transportation, consumption patterns, energy, nutrition, water and waste management. [Section 23.4].

Financial investments and engagement of individuals, businesses and other non-governmental stakeholders is critical to achieve this agenda *(Established, but incomplete)*. Unsustainable products and industrial processes could be phased out by introducing (i) new regulatory mechanisms setting standards (e.g. securing land tenure rights); (ii) financial mechanisms to boost sustainability investments (e.g. on rural electrification); to improve chemical use efficiency and minimise harmful chemicals; to account for (non-)market risks and impacts; (iii) environmental and sustainability education to develop awareness and competencies for sustainability-driven consumer choices, entrepreneurship and promoting viable business models; (iv) exploring and promoting pathways providing opportunities for all stakeholders to participate in a wellbeing economy, and (v) overcoming the inertia of existing unsustainable technologies. [Section 23.5; 24.3].

Transformative change requires adaptive policy, the creation of an enabling environment for niche innovations and the removal of barriers to change *(Established, but incomplete)*. Political, institutional and behavioural changes can enable a sustainable and inclusive transition to environmental sustainability. Local scale policy experiments provide space for policy tailoring and innovation that are closely monitored and also allows for the inclusion of indigenous and local knowledge systems for improved environmental management Redress for environmental degradation through legal mechanisms like access to courts and justice also provide an important mechanism for ensuring inclusive access to a clean and healthy environment for all. [Section 23.3; 23.11; 24.2].

Participatory approaches can help decision makers to identify and pursue innovative solutions towards sustainability. *(Established, but incomplete)*. Participatory and grassroots approaches provide a useful landscape of initiatives and aspirational visions, pathways and solutions from stakeholders to achieve SDGs and MEAs. This includes inclusive innovation in which power and decision-making is relatively decentralized and externalities are internalized. Furthermore, these highlight gaps and blind spots in distributional equity and responsibility for and capacity to address global environmental problems and their solutions. Participatory approaches can help deliver context relevant solutions. For instance, decentralized renewable energy and micro-grids fit nicely in many bottom-up sustainable visions that challenge traditionally modelled large-scale, centralized energy transitions. Accounting for regional differences, gender, and other demographics is important for assessing and addressing problems, including

the need for disaggregated data. SDG policy design and implementation requires alignment of the collective wellbeing of actors from local to other levels, especially taking into account the needs of the vulnerable and most marginalised in society. Information and communication technology (ICT) can drive change, if risks like privacy are minimized. [Section 23.3; 24.3.5].

Strengthened international cooperation, including support to least developed countries, is needed to tackle this agenda. *(Well established).* International cooperation and support, coupled with financial commitments and international funding are critical to achieve this agenda. Effective governance solutions to improve regional cooperation and harmonization across scales include improved management of interdependencies to reduce inter-regional inequalities. Bi-lateral, pluri-lateral and multi-lateral environmental treaties are important governance mechanisms for achieving inclusive and sustainable development across knowledge systems. [Section 19.1; Part B?]

4.4 The benefits that will result from following more sustainable future pathways

Investments in policies that address environmental issues promote human health and wellbeing, prosperity, and resilient societies *(well established).* Sustainable future pathways are intended to enable 'healthy planet, healthy people'. A healthy planet will result in people who live healthier and longer lives: nearly a quarter of all deaths globally in 2012 could be attributed to modifiable environmental risks, with a greater portion occurring in vulnerable populations (children, the elderly, and pregnant women) and developing countries. Achieving SDG targets on child nutrition, access to safely managed water and sanitation and access to modern energy services can significantly reduce death in children under 5 related to malnutrition, diarrhoea and lower respiratory infections, with one scenario study finding that around 440,000 child deaths can be avoided by 2030 and another scenario finding over 130 million cumulative child deaths by 2060. Further, air pollution, the largest environmental health risk, is projected to continue to contribute to significant health impacts, with scenario studies estimating around 4.5 million premature deaths in 2040 and another around 7 million premature deaths in 2050. [21.2.6 and 22.2.5]

Improved health outcomes have significant economic benefits (through a larger and healthier labour force) as well as demographic implications *(established but incomplete)* The health co-benefits of reducing GHG emissions and air pollutants can outweigh the costs of mitigation. For example, global health savings for reaching a 2°C target are estimated to be around USD 54 trillion compared to global policy costs of around USD 22 trillion. Decreased child and maternal mortality, especially when combined with female education and access to reproductive health services, including modern contraception, will likely lead to lower fertility rates in the longer term, curbing population growth, one of the major drivers of environmental degradation - and so highlighting that healthy people can also support a healthy planet. [22.2.5]

5 Knowledge for Action

5.1 More data/knowledge enable better and more effective actions/solutions in more places

The world needs data, information, analyses, knowledge and science to determine what needs to be done to achieve true sustainability across all environmental dimensions before irreversible losses trigger systemic collapse. Achieving the SGDs, MEAs, GEGs and science-based targets will require an integrated approach that considers linkages across different environmental components, building upon disaggregated data generation and incorporating traditional knowledge and citizen science. Integrated data and analyses can prioritize needs, shape effective policies, and strengthen monitoring and evaluation outcomes.

Advances in collecting official statistics that feed into geographic information systems for environmental monitoring and accounting have expanded knowledge, while highlighting data gaps in every environmental domain. Such gaps limit our capacity to formulate and implement policy solutions. We need more data that links people with the environment. Time series data is vitally important in this regard as it forms the basis for monitoring change. Regular standardized data collection can be translated into statistics and indicators that highlight vulnerabilities within and among communities. Disaggregated data that captures information by gender, ethnicity, race, income, age and geographic region identifies critical differences and promotes effective policy design.

In addition to filling knowledge gaps with new data, enormous gains can be made from consolidating, curating, and increasing access to existing data which is widely dispersed and cannot be easily combined or compared. Common frameworks, initiatives, and political will are needed to merge data sources and make better use of what is available. In this context, the Framework for the Development of Environment Statistics (FDES) and the System of Environmental Economic Accounting (SEEA) and the System of National Accounts (SNA) are robust consensus statistical frameworks and methodological approaches that need to be broadly adopted (Fig. 13). Rationalizing existing and newly collected data is essential for the development of indicators.

Whether an indicator can be measured by earth observation is a major factor in data availability. A revolution in the quality and cost-effectiveness of earth observation data means that indicators that can be measured remotely, such as forest cover, have far greater coverage than those that cannot. For example, satellites can estimate deforestation and land use change with increasing accuracy, but cannot monitor sub-surface ocean environments. Data are particularly sparse for biota, which are mostly measured by *in-situ* observation and genetic analyses. Some freshwater components, such as groundwater and water use, are also data deficient due to challenges in measurement. The dichotomy in the volume of remotely sensed versus *in-situ* data will inevitably grow as earth observation technologies improve.

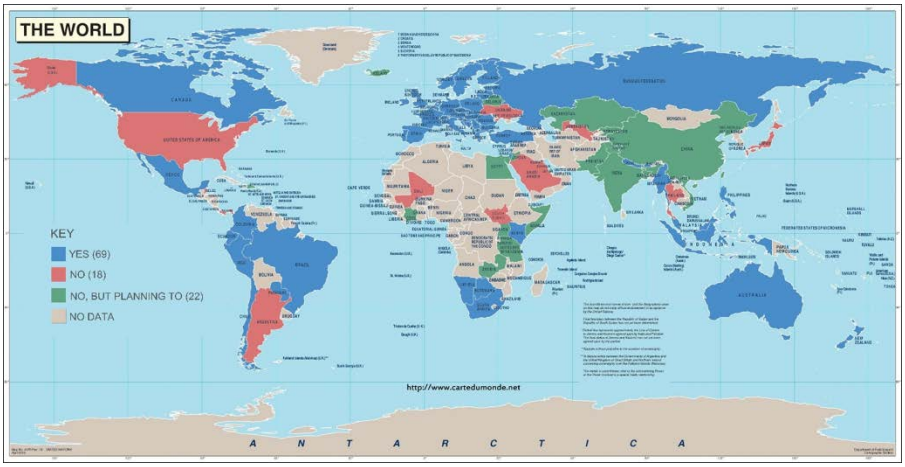

Figure 7: Extent of adoption of SEEA

More inclusive and open access to data is essential for equity, transparency, and best use of data for sustainability and development. The 'open data' movement has gained significant traction in recent years, working towards data being freely available for all. Education is a key component of access, and countries should be forward-thinking in building capacity to analyse and interpret environmental data. For many measures, there is strong imbalance in data access between developed and developing countries. This contributes to global inequality in the ability of nations to understand the environment, its implications for human health, and use of environmental data for socioeconomic gains.

5.2 Opportunities from emerging data sources and the Earth-human systems modelling revolution

Emerging data sources such as earth observation and earth-human systems models, when combined with socioeconomic data and contextual analyses, can enable better policy decisions towards achieving SDGs and MEAs. 'Big data' generated through new approaches and technologies are emerging valuable resources, shifting the landscape of environmental assessment. Evolving artificial intelligence, technological analytics including algorithms, programming, and mechanical methods can advance evidence-based information for decision-making, forming part of what some refer to as the 'fourth industrial revolution'. There is enormous potential for advancing environmental knowledge if big data can be effectively harnessed and interrogated. Stronger collaborations between the public and private sector, especially large corporations involved in big data collection, are critical for promoting economically viable and equitable solutions. Protocols for big data use are continually being developed and refined, but the extreme pace at which big data are evolving opens potential misuse and misinterpretation, raising issues of ethics, privacy and protection that require policy attention.

Future sensor technology should allow detailed data disaggregation of spatial and demographic information. A combination of satellites, airborne and ground-based networks can help monitor developments and impacts at local, regional and global scales in near-real time. The resulting data and information, together with rapidly emerging digital infrastructure, can enable rapid response to changing circumstances. Realising these benefits, however, depends on appropriate governance for data collection, processing, curation and use, along with combining environmental data with context-relevant socio-economic information.

While earth observation is the primary contributor to remotely-sensed big data, citizen science enables timely, cost-effective, collation of *in-situ* data from dispersed sources. When coupled with emerging technologies, such as smart sensors, mobile devices and web applications, citizen science enables collection and/or analysis of large volumes of geographically-referenced data to inform and support decision making, educate the public about environmental issues, and enhance public participation. There are, however, significant challenges in ensuring that citizen science data are of appropriate quality, can be soundly analysed, and results are effectively disseminated.

Traditional knowledge is a globally underutilized resource which can complement science-based knowledge. The UN Declaration of the Rights of Indigenous Peoples in 2007 helped indigenous people to document, revive, and strengthen their knowledge, but capacity building is needed to develop practices for coping with present realities and integration of traditional knowledge with other knowledge systems. Collaborative work between traditional knowledge holders, academia and governments has led to innovative processes, procedures, and tools for data generation and knowledge production and enrichment, which can help in understanding and caring for the environment.

Importantly, data gaps will be an ongoing reality for the foreseeable future and should not delay urgent action. Countries cannot wait for new data before acting, but should implement evidence-based management from current knowledge, then be adaptive and responsive as new knowledge becomes available. Governments and society need to embrace the evolving data landscape, facilitate the development of new information technology skills, and adopt a holistic approach in utilizing both existing and emerging data and knowledge tools.

International cooperation and sharing of data and information resulting from observational networks on Earth and in space are key to success. Continued investment in education and training of next generation of experts and decision makers are essential for keeping the pace of progress on the multi-generational challenges associated with healthy planet, healthy people theme of GEO-6 Outlook.

5.3 The Way Forward

The Sixth Global Environmental Outlook has revealed many of the challenges and opportunities faced by the world today and to 2030 and 2050. The ongoing revolution in data and knowledge, of all types at local, national, and multi-national levels, offers the opportunity to increase our capacity to address environmental and governance challenges and accelerate progress. Most important is the need to take bold, urgent, sustainable and inclusive action that integrates environmental, economic, and social activity on pathways to achieve SDGs, MEAs, and GAEGs and science-based targets.

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Figure 2: Where rapid growth faces high vulnerability

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Figure 4: Global map of species vulnerability

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Figure 6: Proportion of population using improved sanitation facilities in 2015

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Figure 7: Map showing the maximum heat stress during the ongoing 2014-17 global coral bleaching event

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Figure 8: Forest area annual net change 1990-2015

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Figure 9: Global annual average temperature anomalies (relative to the long-term average for 1981-2010).

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Figure 10: Arctic sea ice age and extent (Source: NSIDC, 2017).

To be confirmed

Figure 11: Steps toward policy design, diffusion and integration

UN Environment

Figure 12: Stepwise approach to guided innovation for transformation

UN Environment

Figure 13: Global assessment 2017: summary of result, To be confirmed

Annex 3 – Draft Summary for Ministers (draft at 20h00 on Day 4)

SPM Key Messages: 27 September 2018 (20h00)

Healthy planet, healthy people: why not?

1. GEO-6 identifies the challenge that no-one of the expected 10 billion people in 2050 should be left behind, and that all should live healthy, fulfilling lives within ecological limits.
2. Unsustainable production and consumption trends mean the world is on the wrong path to achieve the healthy planet needed to attain sustainable development.
3. These trends are deteriorating planetary health at unprecedented rates with increasingly serious consequences especially for poorer people and regions.
4. Natural resources like water are over-exploited and polluted.
5. Greenhouse gas emissions have committed the world to an extended period of climate change with multiple and increasing society-wide risks
6. Persistent pressures on biodiversity especially over exploitation, climate change, habitat transformation, invasive species, and pollution are increasing the risks of a sixth mass extinction.
7. Many ecosystems are already degraded, lowering their resilience to adapt to climate change and enhancing risks of irreversible impacts.
8. Antibiotic resistant infections are projected to become one of the main causes of death worldwide by 2050.
9. No affordable wastewater treatment technologies are currently available to remove antibiotic residues. Investments in new technologies would have huge benefits
10. The impacts of pesticides, heavy metals and plastics are growing and life-threatening. Neurotoxic and endocrine disrupting chemicals impacts are multi-generational.

Transformational change: a call for integrated policy action

11. The social and economic costs of inaction often exceed the costs of action and are inequitably distributed and often borne by the weakest in society.
12. At present environmental policy alone is not sufficient: Urgent, cross-sectoral policy actions by governments and stakeholders are needed to address systemic challenges;
13. Environmental policies for sustainability would benefit from integrated objectives, science-based targets, economic instruments and international cooperation.
14. Actions to dematerialise and detoxify production and consumption systems combine human health, resource efficiency and ecosystem-based management objectives.

Governance of innovations: innovations in governance

15. The objectives of healthy planet and healthy people are mutually re-enforceable; fundamental innovations in economic development are urgently needed to meet them.
16. Food, energy, mobility and chemicals are primary examples of systems of production and consumption needing most innovation.
17. Bottom-up, niche, technological and social innovations point the way to transforming these systems to sustainability.
18. Technological innovations are part of the solution but can also create new risks. Precautionary approaches can reduce these risks, including risks of irreversible impacts.
19. Countries that prioritise low-carbon innovations and their deployment alongside resource efficiency actions may increasingly gain competitive advantage in the global economy.
20. Achieving progress under greater uncertainty requires coalitions between governments, business, civil society, and research to agree on desired pathways for system transitions.
21. Many urban and rural innovative projects could be developed and replicated and thereby collectively help in achieving SDGs, MEAs and related GAEGs.
22. New models of sustainability governance should balance economic, environmental and social considerations and promote education for sustainable developmentdeve development.

Harvest time: knowledge for sustainability

23. These new governance models should also ensure adequate investments in knowledge, and act on early signals from science and society to avoid unnecessary harm and costs.
24. Environmental data from satellites has increased exponentially, enabling quicker actions across the world in response to extreme weather events; more can be harvested
25. More investment is needed in indicators that use data time series from satellites, in-situ monitoring, statistics, traditional and local knowledge to better inform policy actions
26. Investments are needed in environmental accounting to ensure unaccounted for costs are internalised into economic decision making for sustainability.
27. Harnessing the ongoing data and knowledge revolution to support sustainability could transform capacities to address challenges and accelerate progress