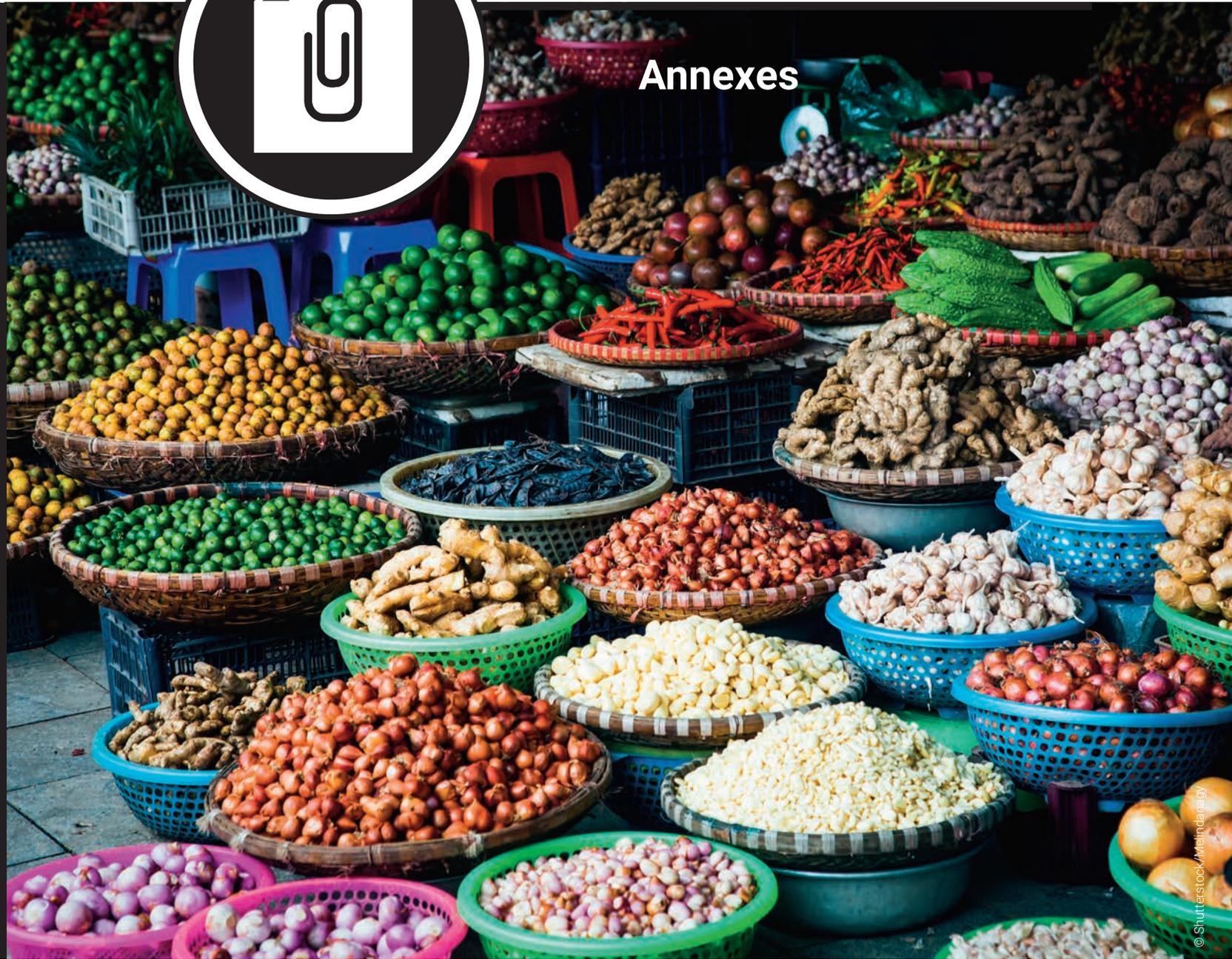






## Annexes



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## Annex 1-1: Mission of the sixth Global Environment Outlook

Within UN Environment's mandate to keep the environment under review, Member States have requested that UN Environment continue to review the environmental dimension of the SDGs, which are at the core of the 2030 Agenda for Sustainable Development (United Nations 2015a). GEO-6 is a powerful tool to strengthen UN Environment's role within the science-policy interface with multiple functions:

- ❖ Support UN Environment's pivotal role in providing assessments, policy analysis, integrative analytics, and approaches to deliver on the environmental dimension of the SDGs, including the follow-up and review process;
- ❖ Be UN Environment's instrument to support member states, major groups, stakeholders, and UN system entities' implementation of the 2030 Agenda through the UN System-wide Strategies on the Environment adopted in 2016;
- ❖ Help UN Environment align its strategic planning to the 2030 Agenda and strengthen collaboration with the rest of the UN system, and in doing so, embed the environment in global normative frameworks, and address emerging environmental issues (UNEP 2016d).

The GEO-6 assessment also supports UN Environment's core principles on delivering the environmental dimension of the 2030 Agenda, including the principles of:

- a. Universality [all people – beyond borders – collective action]: The 2030 Agenda is global, applying to all people in all countries. It is a shared agenda that requires a collective response from the international community, governments, businesses and citizens' groups.
- b. Human rights and equity [pathway to a fair, just and sustainable world]: The 2030 Agenda encourages a more-even distribution of wealth and resources, equitable access to opportunities, information and the rule of law; including the development of new approaches that build capacities at all levels of society.

- c. Integration [acting as a harmonious whole]: Past approaches treated the social, environmental and economic dimensions of sustainable development as disconnected pillars, but the new agenda integrates and balances all three.
- d. Innovation [invention is the master key to progress]: The acceleration and transfer of technological innovations is key to delivering the 2030 Agenda. The world will need new innovation pathways that draw on formal science, traditional knowledge and citizens' common sense (UNEP 2015b).

Compared with previous GEOs, the sixth edition provides the first integrative baseline in light of global megatrends supported by various sources of open and accessible data and information, and a pluralistic knowledge base, with due consideration given to gender and youth, indigenous knowledge, and cultural dimensions. Also new in this edition is the integration and discussion of economic aspects of sustainable development and the dimension of social equity throughout the assessment, not only to strengthen overall policy relevance, but also to highlight that environmental change and degradation cause tremendous pressure on global economic prosperity, social justice and overall human well-being. GEO-6 also reflects on the impact of economic prosperity and social justice on environmental degradation.

The GEO process laid the foundation for continued and intensified socio-economic-environmental assessment across relevant scales, with a thematic as well as an integrative focus, enabling and informing societal transitions and the tracking of SDG goals and targets, as well as previously internationally agreed environmental goals. Therefore, GEO-6 aims to assist Member States, international organizations, and Major Groups (like non-governmental organizations) to position themselves on the most effective pathway for transitions towards a sustainable future over various time frames (2030/2050), considering the extensive inter-dependencies between the environment and people's well-being (e.g. Healthy Planet, Health People).

## Annex 1-2: Range of integrated environmental assessments which the sixth Global Environment Outlook draws from



GEO-6 draws and integrates findings from major global environmental assessments, including IPCC, IPBES, etc.

**Table A.1: Examples of Global Environmental Assessments and their links to GEO-6**

Assessment	Lead Organization	link	Objectives	Links to GEO-6
Assessment Reports of the International Panel of Climate Change (IPCC)	UNEP, WMO	<a href="http://www.ipcc.ch/">http://www.ipcc.ch/</a>	To provide policymakers with regular assessments of the scientific basis for climate change, its impacts and future risks, and options for adaptation and mitigation.	Results were used as a key reference by addressing climate change as a cross-cutting issue, affecting all other themes, including policy responses and outlooks.
Global and Regional Assessments on Biodiversity and Ecosystem Services (IPBES)	UNEP, UNESCO, FAO, UNDP	<a href="http://www.ipbes.net/">http://www.ipbes.net/</a>	To assess the state and trends of biodiversity and of the ecosystem services it provides to society, in response to requests from decision makers.  Strengthen the science-policy interface for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development.	Results were used as a key reference for the state of the environment chapters on biota, land, freshwater and oceans.  Results were used as a baseline also in Part B (policy and governance) and Part C (Outlooks).
Global Biodiversity Outlook (GBO) IV	Convention on Biological Diversity (CBD)	<a href="https://www.cbd.int/gbo4/">https://www.cbd.int/gbo4/</a>	To periodically assess and summarize the latest data on the state of biodiversity and draw conclusions relevant to the further implementation of the Convention.	Used as a key reference in the thematic chapter on biodiversity, including policy responses and outlooks.
World Water Assessment Programme (WWAP)	UNESCO, UN-Inter-agency (UN-Water)	<a href="http://www.unesco.org/new/en/natural-sciences/environment/water/wwap">http://www.unesco.org/new/en/natural-sciences/environment/water/wwap</a>	Comprehensive review that gives an overall picture of the state of the world's freshwater resources and aims to provide decision-makers with the tools to implement sustainable use of water resources.  To provide a mechanism for monitoring changes in the resource and its management, while tracking progress towards achieving targets, particularly those of the MDGs/SDGs.  To offer best practices as well as in-depth theoretical analyses to help stimulate ideas and actions for better stewardship in the water sector.	Reports within the WWAP and their results served as a baseline for the thematic chapter on freshwater, and related cross-cutting issues, including policy responses and outlooks.
World Ocean Assessment I (2015)	Group of Experts of the Regular Process/UN General Assembly	<a href="http://www.worldoceanassessment.org/">http://www.worldoceanassessment.org/</a>	The global mechanism for reviewing the state of the marine environment, including socioeconomic aspects, on a continual basis by providing regular assessments at the global and supranational levels and an integrated view of environmental, economic and social aspects.	Results of the World Ocean Assessment I served as a baseline for the thematic chapter on oceans and coasts and relevant cross-cutting issues, including policy response and outlooks.
Global Land Degradation Assessment/Global Soil Health Assessment (2015)	FAO, UNEP	<a href="http://www.fao.org/soils-portal/soil-degradation-restoration/global-soil-health-indicators-and-assessment/jp/">http://www.fao.org/soils-portal/soil-degradation-restoration/global-soil-health-indicators-and-assessment/jp/</a>	To provide a global scientific assessment of current and projected soil conditions built on regional data analysis and expertise; to explore the implications of these soil conditions for food security, climate change, water quality and quantity, biodiversity, and human health and wellbeing; and to conclude with a series of recommendations for action by policymakers and other stakeholders.	Results of these assessments served as a baseline for the thematic chapter on land and relevant cross-cutting issues, like food security, including policy responses and outlooks.



Assessment	Lead Organization	link	Objectives	Links to GEO-6
Global Land Outlook (GLO) (2017)	UNCCD	<a href="http://www2.unccd.int/publications/global-land-outlook">http://www2.unccd.int/publications/global-land-outlook</a>	The GLO presents an overview of the status of land and a clear set of responses to optimize land use, management, and planning, and thereby create synergies across sectors in the provision of land-based goods and services. This integrated approach is the basis of the conceptual framework for land degradation neutrality, a target which is seen as the driving vehicle for the implementation of the United Nations Convention to Combat Desertification (UNCCD) and an important part of the 2030 Agenda for Sustainable Development.	Results of the GLO were used for the thematic chapter on land and soil and relevant cross-cutting issues, like food security, including policy responses and outlooks.
Global Waste Management Outlook (2015)	UNEP, International Association of Solid Waste Management	<a href="http://www.unep.org/ourplanet/september-2015/unep-publications/global-waste-management-outlook">http://www.unep.org/ourplanet/september-2015/unep-publications/global-waste-management-outlook</a>	To assess the global state of waste management. Develop a holistic approach towards waste management and recognizing waste and resource management as a significant contributor to sustainable development and climate change mitigation. To complement the Sustainable Development Goals of the Post-2015 Development Agenda/SDGs, the Outlook sets forth Global Waste Management Goals and a Global Call to Action to achieve those goals.	Results of the Global Waste Management Outlook were used as a core reference to address key challenges of waste and resource management as cross-cutting issues within GEO-6, including policy responses and outlooks
Global Chemicals Outlook I	UNEP	<a href="http://www.unep.org/chemicalsandwaste/what-we-do/policy-and-governance/global-chemicals-outlook">http://www.unep.org/chemicalsandwaste/what-we-do/policy-and-governance/global-chemicals-outlook</a>	Develop a comprehensive environmental understanding and up to date assessment of the trends and changes affecting the production and use of chemicals, their health and environmental effects, economic implications, and policy options throughout their life cycle. The GCO I is meant to be informative so as to illustrate both the economic interest and the necessity to invest in the sound management of chemicals.	Results of the Global Chemicals Outlook I were used as core reference to address key challenges of chemicals as cross-cutting issues within GEO-6, including policy responses and outlooks
Global Mercury Assessment (2002/2008/2013/2018)	UNEP	<a href="http://web.unep.org/chemicalsandwaste/what-we-do/technology-and-metals/mercury/global-mercury-assessment">http://web.unep.org/chemicalsandwaste/what-we-do/technology-and-metals/mercury/global-mercury-assessment</a>	The Global Mercury Assessment provides the most recent information available for the worldwide emissions, releases, and transport of mercury in atmospheric and aquatic environments. The Global Mercury Assessment is intended as a basis for decision making, emphasis is given to anthropogenic emissions (mercury going into the atmosphere) and releases (mercury going into water and land), that is, those associated with human activities.	Results of the latest Global Mercury Assessment (2013/2018) were used as reference within the air thematic chapter, the cross-cutting theme of chemicals, including policy responses and outlooks.
Global Gender and Environment Outlook (GGEO) (2016)	UNEP	<a href="http://web.unep.org/ggeo">http://web.unep.org/ggeo</a>	The GGEO for the first time provides a comprehensive global overview of the linkages between gender and environment in the contexts of SDGs and 2030 Development agenda. Its objectives are to enable better understanding of the environment through a gender lens, to support better integration of gender perspectives in development and implementation of environmental policies at international and national levels, and to drive impact through partnerships.	For chapter 4 and 17 on Cross-cutting issues the GGEO has been instrumental as a basis for the gender-related language. As the GGEO is specifically looking into gender aspects of diverse environmental areas, policies, data and approaches, the insights of GGEO are also integrated into several other GEO6 chapters and sections.

## Annex 1-3: Theory of Change for the sixth Global Environment Outlook (GEO-6)



Based on the principles of integrated environmental assessments, the theory of change in GEO-6 is embedded in its structure and purpose and based on a social process that moves a community of institutions and people towards a new way of (strategic) thinking and (goal-oriented) acting. Through this social process, the evidence presented in the GEO-6 assessment is considered legitimate, credible and relevant (salient) to the community, which facilitates its acceptance as an input to improved environmental policy, which in turn helps make progress towards sustainable development.

GEO-6 aims to create change through a process that encompasses data, science and experimental and participatory approaches. It uses multidisciplinary perspectives to generate knowledge-based conclusions. GEO-6 also aims to create change by highlighting the benefits and opportunities to citizens and communities from achieving change, even disruptive change. New earth observation and other technologies have revolutionized our ability to understand environmental change and its impacts on human well-being and vice versa. GEO-6 aims to communicate the results of the assessment in a way that can influence action by stakeholders and policymakers. This, in turn, facilitates the development of more appropriate, equitable, and effective policy responses,

including shifting investment, production, distribution, and consumption in more sustainable directions, as well as better governance capacities at multiple scales.

Figure A.1 shows how GEO has impacts through its influence on people's actions:

### Activities and process

The Global Environment Outlook process is designed through consultations with governments and other stakeholders. From these consultations, nominations of government officials, stakeholders and experts who will be involved in the process create the community that will follow, and be influenced by the process. Regular meetings and conference calls are necessary to keep this community engaged in the process and also to obtain their advice so that they feel ownership of the process and the product. Peer review and intergovernmental review processes allow a broader community of experts, governmental officials and stakeholders to contribute their advice and expertise and experience a higher level of engagement. The community members, motivated by a sense of ownership through their participation in the process, become ambassadors for GEO's messages.

Figure A.1: Theory of Change of GEO-6





## Outputs

The four main outputs of the GEO process document the evidence and rationale for the findings that will influence the future path of environmental and sustainable development policy. These outputs include:

- ❖ Six regional environmental assessments which present policy relevant information which is actionable either regionally and/or nationally. These regional assessments allow for a deeper ownership of the findings at a level where governments can act. They also engage different geographic groupings in the process of implementing GEO's findings;
- ❖ Following the publication of the regional assessments, a global environmental assessment is produced, which can look at broader issues, such as the state of the world's environment, presenting the findings at a level where governments, together, can act.
- ❖ One of the main equity issues related to environmental analysis is how environmental impacts and actions are differentiated by gender. For this reason, there is a systemic link with the Global Gender and Environment Outlook.
- ❖ The findings and new knowledge of GEO should be translated and disseminated through the production of teaching and outreach material to stimulate further capacity building. Capacity building makes GEO accessible to a much broader audience such as youth and educators and enables its findings and new recommended directions to be promoted more widely, thereby enhancing GEO's influence on environmental change over a longer period and strengthening the long-term durability of these changes.

## Drivers, Assumptions and Risks

A main assumption of the assessment process is that the findings will be considered legitimate, scientifically credible and relevant by the intended audiences, especially governments. These three criteria are defined as:

- ❖ **Legitimacy:** considered unbiased and respecting different stakeholder perspectives and conforming to law or authoritative rules.
- ❖ **Credibility:** considered scientifically sound and authoritative. Producing information that can be believed and trusted.
- ❖ **Relevant:** considered timely and related to the needs of the end users.

The GEO achieves legitimacy, credibility, and relevance through several avenues, based on certain assumptions, and subject to some risks, including:

- ❖ A clear mandate is provided by governments to produce the GEO and governments help to define some of the key parameters, such as the timeframe, organizational structure, work plan, outline for the analysis, etc.
- ❖ Sufficient funding is made available, following a clear work plan which is developed and approved by the Secretariat, in consultation with appropriate advisory bodies that are part of the process.

- ❖ A sufficiently large and diverse cohort of authors and experts is engaged to produce the report such that they ensure the scientific credibility of the assessment and can devote the appropriate amount of time to the analysis and drafting of chapters during the approved period of the work programme. This includes peer reviewers and other experts working outside the main drafting process.
- ❖ A robust process for negotiating related products meant for policy makers (e.g. Summary for Policymakers) is undertaken, which is transparent and considers the views of all Member States. These products help increase the legitimacy of the assessment process and, with appropriate endorsement, can lend credibility to these products.

## Outcomes

The outcomes of the GEO process focus on increased awareness of the current state of the environment, knowledge of the possible policy solutions that could be used to address these, including the future implications of not acting and the future benefits of following particular pathways to achieve environmental goals. In order to achieve these goals, the findings of the assessment must be understood and/or used by various actors and applied in their daily work and personal lives:

- ❖ Policy analysts must access and understand GEO's findings, using them appropriately to inform decision makers;
- ❖ More broadly, governments (and potentially other non-state actors) should understand the findings in order to use them to advance their policy work. Governments can also use the GEO methodology to prepare their own regional, national or sub-national assessments if desirable.
- ❖ United Nations and other international organizations should be able to understand and apply GEO's findings in their own assessment, policy work, and practice.
- ❖ Civil society and non-governmental organizations should be able to understand and apply the findings of GEO in their own work, e.g. by influencing the policy and decision-making processes on the environment.

## Impact

The impact of the GEO will be judged by the responses and actions that governments, institutions, and people take in their work arenas and daily lives. To increase the impact of GEO, UN Environment facilitates actions in the following areas:

- ❖ Helping countries strengthen the science-policy interface through the promotion of the GEO findings and process;
- ❖ Promoting the use of evidence-based decision making based on the findings of the GEO, its various derivative products, and other scientific sources;
- ❖ Encouraging, directly and indirectly, changes at the regional and national policy level that are in line with the GEO reports and process.

The theory of change for GEO supports various actors, including national governments, to make progress towards achieving the Sustainable Development Goals. This can be facilitated by incorporating the findings of the GEO into the Agenda 2030 policy process and implementation.

## Annex 1-4: Structure and rationale for confidence statements used in the sixth Global Environment Outlook



### Guidance from the Scientific Advisory Panel

This document is adapted from guidance developed by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), IPBES/5/INF/6.

### Developing and applying confidence terms

Characterizing and communicating the confidence and uncertainty in findings is essential to ensure the scientific credibility of the assessment process, help stakeholders and decision-makers understand the strength and weight of the underlying evidence base and lead to more informed decision-making. This guidance note is intended to assist authors of the Global Environment Outlook (GEO-6) to describe, in a consistent and transparent manner, the confidence and uncertainty associated with their findings. The note suggests a common approach and calibrated language that can be used broadly for developing expert judgments and for evaluating and communicating the degree of certainty.

### What is confidence?

The use of confidence statements in assessments reflects how assured authors are about the findings (data and information) presented within their chapters. Low confidence describes a situation where we have incomplete knowledge and therefore cannot fully explain an outcome or reliably predict a future outcome, whereas high confidence conveys that we have extensive knowledge and are able to explain an outcome or predict a future outcome with much greater certainty.

Confidence terms should always be used in three key parts of an assessment:

1. They should be assigned to the key findings in **Executive Summaries** of the technical chapters in an assessment report.
2. They should be used for the key findings in any **Technical Summary** produced from the main report.
3. They should be used within the **Summary for Policymakers**.

It is not mandatory to apply confidence terms throughout the main text of the assessment report. However, in some parts of the main text, in areas where there are a range of views that need to be described, confidence terms may be applied where considered appropriate by the author team. In no case should the terms be used colloquially or casually to avoid confusing readers. Only use these terms if you have followed the recommended steps for assessing confidence.

### Assessing confidence

As they develop their key findings, author teams should evaluate the associated evidence and agreement within the evidence base. Depending on the nature of the evidence evaluated, teams may either use a qualitative level of confidence or quantify the uncertainty in the finding probabilistically. Qualitative assessments of confidence reflect expert judgment about agreement and evidence. Quantitative assessments of confidence are estimates of the likelihood (probability) that a well-defined outcome will occur in the

future. Probabilistic estimates are based on statistical analysis of observations or model results, or both, combined with expert judgment. However, it may be that quantitative assessments of confidence are not possible for all findings due to the nature of the evidence available.

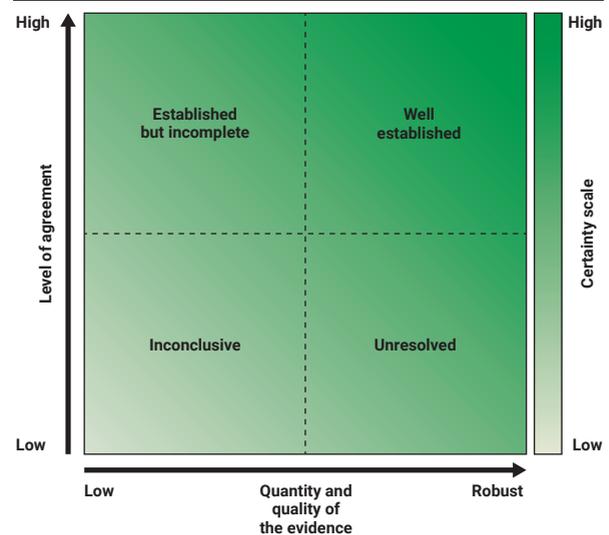
In order to ensure consistency in communication, specific phrases or terms will be used to describe the level of confidence or the extent of uncertainty. The choice of the term used will be based on the author team's expert judgement on the quantity and quality of the supporting evidence and the level of scientific agreement.

The sixth Global Environment Outlook uses a four-box model of confidence (see Figure A.2) based on evidence and agreement that gives four main confidence terms for the qualitative assessment of confidence: "well established" (much evidence and high agreement), "unresolved" (much evidence but low agreement), "established but incomplete" (limited evidence but good agreement) and "inconclusive" (limited or no evidence and little agreement).

### Qualitative assessment of confidence

This section discusses the process and language that all author teams must apply to evaluate and communicate confidence qualitatively. The following factors should be considered while assessing the confidence in a message or finding: the type, quantity, quality and consistency of evidence (the existing peer-reviewed literature and grey literature etc.), and the level of agreement (the level of concurrence in the data, literature and amongst experts, not just across the author team). The author team's expert judgement on the level

Figure A.2: The four-box model for the qualitative communication of confidence



Confidence increases towards the top-right corner as suggested by the increasing strength of shading.

Source: IPBES (2017).



of evidence and agreement should then be used to apply a confidence term (Figure A.2):

- ❖ **Inconclusive** – existing as or based on a suggestion or speculation; no or limited evidence and no clear consensus in the evidence.
- ❖ **Unresolved** – multiple independent studies exist but conclusions do not agree.
- ❖ **Established but incomplete** – general agreement although only a limited number of studies exist but no comprehensive synthesis and, or the studies that exist imprecisely address the question.
- ❖ **Well established** – comprehensive meta-analysis or other synthesis or multiple independent studies that agree.

The **well-established** box in Figure A.2 can be further subdivided in order to give author teams the flexibility to emphasise key messages and findings that the author team have very high confidence in:

- ❖ **Very well established** – very comprehensive evidence base and very low amount of disagreement.
- ❖ **Virtually certain** – very robust evidence base covering multiple temporal and spatial scales and almost no disagreement.

Note that the term “virtually certain” above still reflects a qualitative assessment of confidence. It should not be interpreted probabilistically and does not convey any level of “statistical significance”. These sub-classifications of the “well established” box provide authors flexibility to emphasize findings that may be considered as fact or reflecting scientific consensus.

The degree of confidence in findings that are conditional on other findings should be evaluated and reported separately.

When evaluating the level of evidence and agreement for a statement, it is important to standardise the use of the terms within and across the author teams, and when possible, across the assessment, to ensure their consistent use. The use of the above confidence terms can be standardised by taking key messages and findings in the **Executive Summaries** and discussing, as an author team, what terms should be applied and the reasons why. When appropriate, teams may consider using formal elicitation methods to organise and quantify the selection of confidence terms.

Teams should be aware of the tendency for a group to converge on an expressed view and become over confident in it. One method to avoid this would be to ask each member of the author team to write down his or her individual assessment of the level of confidence before entering into a group discussion. If this is not done before group discussion, important views and ranges of confidence may be inadequately discussed and assessed. It is important to recognize when individual views are adjusting as a result of group interactions and allow adequate time for such changes in viewpoint to be reviewed (Mastrandrea *et al.* 2010). Whichever approach is taken, traceable accounts should be produced and recorded to demonstrate how confidence was evaluated (see section on Traceability).

It is important to carefully consider how the sentences in the key messages and findings are structured because it

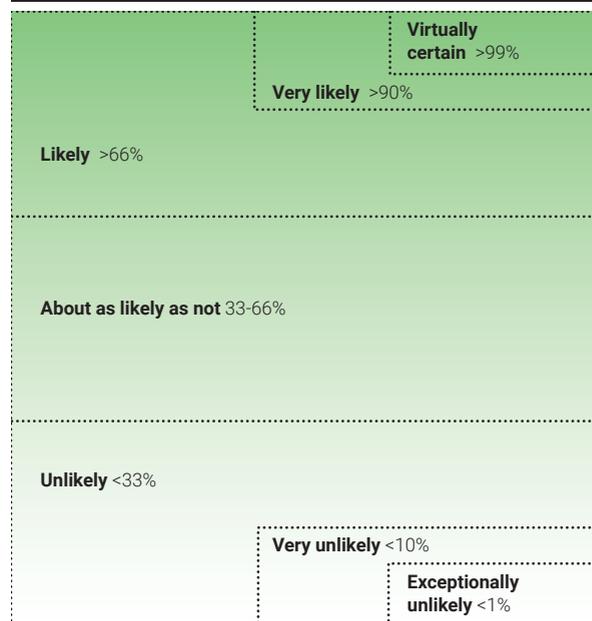
will influence the clarity with which we communicate our understanding of the level of confidence. For example, sometimes the key finding combines an element that is **well-established** with one that is **established but incomplete**. In this case it can be helpful to arrange the phrasing so that the **well-established** element comes first, and the **established but incomplete** element comes second, or as a separate sentence. Where possible avoid the use of the **unresolved** and **established but incomplete** by writing or rewording key messages and findings in terms of what is known rather than unknown. Author teams should focus on presenting what is **well-established** as far as possible in order to make it clear to decision makers what is known. Assigning confidence terms to our key findings will therefore often require that we re-write sentences, rather than simply adding the terms to existing text.

### Quantitative assessment of confidence

In many cases it may be possible to quantitatively assess the uncertainty in an outcome or event. This section discusses the process and language that author teams may wish to apply in order to evaluate and communicate the confidence that an outcome will occur quantitatively. Likelihood expresses a probabilistic estimate of the occurrence of a single event or of an outcome within a given range. Probabilistic estimates are based on statistical analysis of observations or model results, or both, combined with expert judgment.

When sufficient probabilistic information is available, consider ranges of outcomes and their associated probabilities with attention to outcomes of potential high consequence. The author team’s expert judgement on the magnitude of the probability should then be used to apply a likelihood term from Figure A.3.

**Figure A.3: Likelihood scale for the quantitative communication of the probability of an outcome occurring**



Note that the extreme levels of probability are nested within the broader levels of “likely” and “unlikely”.

Source: Adapted from Mastrandrea *et al.* (2010).



Categories in **Figure A.3** can be considered to have nested boundaries. For example, describing an outcome as **likely** or **very likely** conveys in both cases that the probability of this outcome could fall within the range of 95 per cent to 100 per cent probability, but in the case of **likely**, the larger range (66-100 per cent) indicates a higher degree of confidence than **very likely** (90-100 per cent). In making their expert judgement, author teams should start at **about as likely as not** and consider whether there is sufficient quantitative information available to assign either a **likely** or **unlikely** probability range. Only after thinking about this initial range should the author teams consider whether there is sufficient evidence to move to more extreme levels of probability.

Author teams should note that using a likelihood term for a specific outcome implies that alternative outcomes have the inverse likelihood e.g., if an outcome is **likely** (a range of 66-100 per cent) than that would imply that other outcomes are **unlikely** (0-33 per cent probability).

If the author team consider that sufficiently robust information is available with which to make a 'best estimate' of the probability of the occurrence of an event, then it is preferable to specify the full probability range (e.g. 90-95 per cent) in the text without using the terms in **Figure A.3**. Also, **about as likely as not** should not be used to communicate a lack of knowledge, only an estimate of probability based on the available information.

Author teams should be aware of the way in which key messages and findings are phrased. The way in which a statement is framed will have an effect on how it is interpreted e.g., a 10 per cent chance of dying is interpreted more negatively than a 90 per cent chance of surviving. Consider reciprocal statements to avoid value-laden interpretations e.g., report chances both of dying and of surviving (Mastrandrea *et al.* 2010).

Finally, author teams should try not to avoid controversial events, such as impacts or events with high consequence but extremely low probability, in their effort to achieve consensus within an author team.

### How to present confidence terms - Presenting confidence using the four-box model

Confidence terms are communicated as part of the key findings of an assessment. The key findings are set out in the **Executive Summaries** for each of the assessment's chapters in the full technical report. The key findings are the facts and information drawn directly from the chapter. It is recommended that key findings should be set out as follows.

**The first sentence of the finding should be bolded** and contain a confidence term from the four-box model in italics and brackets at the end of the sentence. This first sentence is followed by two to four sentences which then supports the information contained in this first sentence. Subsequent sentences may contain confidence terms within brackets where appropriate. It is not necessary to include confidence terms with each sentence if the whole paragraph falls under the same confidence term.

The words that make up the four-box model and likelihood scale should not be used in the text of the assessment except when formally assigning confidence. If, for example, there was a sentence that used the word "likely" but not with the intended

meaning from the likelihood scale, then the word should be replaced with another (e.g. probably).

### Presenting confidence using the likelihood scale

In some instances, as above, author teams may wish to complement the use of the **well-established** confidence term with a term from the likelihood scale. If terms from the likelihood scale are used then they should be incorporated into the text and italicised prior to the impact or outcome the probability of which they are describing.

### Traceability

The author team's expert judgment of their confidence in the key messages and findings should be explained by providing a clear traceable account. A traceable account is a description in the chapter of the evaluation of the type, quantity, quality and consistency of the evidence and level of agreement that forms the basis for the given key message or finding (Mastrandrea *et al.* 2010). Where possible, the description should identify and discuss the sources of confidence. In order to ensure consistency in how the author teams classify sources of confidence within and across Global Environment Outlook assessments, author teams should use the typology shown in **Table A.2** below.

A key statement in the **Summary for Policymakers** should be readily traceable back to an **Executive Summary** statement(s) that in turn should be readily traceable back to a section(s) of the chapter text, which in turn should be traceable where appropriate to the primary literature through references.

References to the relevant **Executive Summary** statement should be included in curly brackets (e.g. {1.2}).

### Summary of Steps for applying confidence terms

The steps recommended for assessing and communicating confidence for Executive Summaries and Summaries for Policymakers.

1. Identify the chapter's key messages and findings.
2. Evaluate the supporting evidence and the level of scientific agreement.
3. Establish whether the evidence is probabilistic or not (e.g. from model predictions).
4. Where the evidence is qualitative instead or probabilistic, select a confidence term from the four-box model (**Figure A.2**) to communicate the author team's confidence in the key message or finding.
  - (a) Assess the quantity and quality of evidence and the level of agreement in the scientific community.
  - (b) Establish how confident the author team is and select the appropriate term.
5. Where quantitative estimates of the probability of an outcome or impact occurring are available (e.g. from model predictions), select a likelihood term from the likelihood scale (**Figure A.3**) to communicate the author teams' expert judgement of the range of the probability of occurrence.
6. Ensure that there is always a 'traceable account' in the main text describing how the author team adopted the specific level of confidence, including the important lines of evidence used, standard of evidence applied and approaches to combine/reconcile multiple lines of evidence.
7. OPTIONAL: Consider using formal frameworks for assessing expert judgement for each author team.



**Table A.2: Sources of low confidence**

Sources of low confidence	Definition and examples	Qualities	Means of dealing with low confidence
Imprecise meanings of words (Linguistic uncertainty)	Vagueness and ambiguity of terms EXAMPLE: When terms such as human welfare, risks, plant reproductive success, pollination deficits are central to the finding.	Reducible Not quantifiable	<ul style="list-style-type: none"> <li>❖ Clear, common definition of terms (IPBES Common Glossary).</li> <li>❖ Protocols as used in agent-based modelling to deal with context dependence.</li> </ul>
Inherently unpredictable systems (Stochastic uncertainty)	Low confidence due to the chaotic nature of complex natural, social or economic systems (sometimes known as 'aleatory' uncertainty). Findings that depend on weather or climate variables, or market prices, will be subject to this low confidence. EXAMPLE: Pollination deficits and values measured at local scales.	Not reducible Quantifiable	<ul style="list-style-type: none"> <li>❖ Clear communication.</li> <li>❖ Using probabilistic approaches.</li> <li>❖ Support large scale, long term multi-site studies to quantify the variation over space and time to characterise the low confidence.</li> <li>❖ Evidence synthesis.</li> <li>❖ Capacity building for researchers and decision makers.</li> </ul>
Limits of methods and data (Scientific uncertainty)	Where there is insufficient data to fully answer the question, due to unsatisfactory methods, statistical tools, experimental design or data quality (also referred to as epistemic uncertainty). EXAMPLE: Impacts of pesticides on pollinator populations in the field, trends in pollinator abundance, estimations of ecosystem service delivery.	Reducible Quantifiable	<ul style="list-style-type: none"> <li>❖ Acknowledge differences in conceptual frameworks (within and between knowledge systems).</li> <li>❖ Improve experimental design.</li> <li>❖ Expand data collection.</li> <li>❖ Support detailed, methodological research.</li> <li>❖ Knowledge quality assessment.</li> <li>❖ Evidence synthesis.</li> <li>❖ Capacity building for scientists.</li> </ul>
Differences in understanding of the world (Decision uncertainty)	Low confidence that is caused by variation in subjective human judgments, beliefs, world views and conceptual frameworks (sometimes called epistemic uncertainty). In terms of policy decisions, low confidence is due to preferences and attitudes that may vary with social and political contexts. This can mean a finding looks different in different knowledge systems that cannot easily be aligned. EXAMPLES: Effects of organic farming look different if you take the view that wild nature beyond farmland has a higher value than farmland biodiversity, and overall food production at a large scale is more important than local impacts. There are divergent interpretations/perceptions of well-being.	Sometimes reducible Not quantifiable	<ul style="list-style-type: none"> <li>❖ Acknowledge differences in conceptual frameworks (within and between knowledge systems).</li> <li>❖ Document, map and integrate where possible.</li> <li>❖ Acknowledge existence of biases.</li> <li>❖ Multi-criteria analysis, decision support tools.</li> <li>❖ Capacity building for decision makers.</li> </ul>

\* Adapted from the IPBES guide on the production of assessments

# Annex 4-1: Towards monitoring the environmental dimension of the SDGs



## Introduction

The Sustainable Development Goals, the Multilateral Environment Agreement indicators and other indicators related to the environmental drivers, state, pressures, impacts and responses are useful for conducting environmental assessments, including on particular aspects of the environment, and multiple levels (global, regional and national). Additionally, socio-economic indicators can be combined with environmental indicators to better contextualized the environment and to understand the linkages between the environment, people and the economy.

The Sustainable Development Goals (SDGs) are a framework which elaborates the global development agenda toward achieving a better and more sustainable future for all. The Sustainable Development Goals are a call for action by all countries – poor, rich and middle-income – to promote prosperity while protecting the planet. They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and increasing environmental protection. A monitoring framework of 244 indicators has been agreed for monitoring the SDGs; however, this indicator framework does not represent a complete list of all information that is needed to understand the planet.

The current GEO publication is accompanied by a statistical annex [https://environmentlive.unep.org/media/global\\_assessment/review\\_documents/annex4\\_1.pdf](https://environmentlive.unep.org/media/global_assessment/review_documents/annex4_1.pdf) which includes tabular information to be used by technical experts to better understand the environment and the nexus between the environment, society and the economy. Additionally, this annex extracts certain indicators from the Statistical Annex in order to highlight the current state of progress towards achieving the environment-related SDGs. Note that the Statistical Annex does not include any analysis or figures. An analysis of the information in the Statistical Annex will be forthcoming in a GEO derivative product entitled: Measuring Progress, which is a follow-up to a publication that was produced for GEO-5.

This annex has taken the data in the Statistical Annex which directly links to particular environmental SDGs and extrapolated information in order to provide a summary of the current state of the environmental dimension of the SDGs.

## Statistical Methods

The phrase, the environmental dimension of the SDGs, does not have a precise definition and there are many different views on what the environmental dimension of development should include (should it include only indicators related to the state of the environment, what about indicators related to access to natural resources such as water or perhaps it should include all indicators, since every aspect of life is related to the environment). For the purpose of this analysis, the list of environment-related indicators from the perspective of the UN Environment Programme will be used. A list of SDG indicators which are considered to be part of the environmental dimension of the SDGs was established by the UN Environment Programme Secretariat and was

presented to the UN Environment Assembly Committee of Permanent Representatives at the sub-committee meeting on 20 September 2018 (see: <https://www.unenvironment.org/events/subcommittee-meetings/committee-permanent-representatives-subcommittee-meeting-14>) - it is also included at the end of this document.

The data in the Statistical Annex and in this paper are based on data which are included in the UN Environment Live Global database (<https://uneplive.unep.org>). The data in the database come from a variety of international databases and other sources, UN Environment maintains strict criteria for the information in the UN Environment Live Global database which include:

1. data must be published by a UN agency or other reputable global entity;
2. data must have transparent methodologies and metadata which is publicly available;
3. data must be compiled at the global level (data which is only available for a single country or region is not included);
4. only data with a timeseries which includes more than 2 timepoints is included; and
5. the most recent point in the timeseries must be no more than 10 years old.

The UN Environment Live Global database also uses a statistical methodology for aggregating national data to produce global, regional, sub-regional and special country groupings; information on aggregation procedures can be found at: [https://uneplive.unep.org/media/docs/graphs/aggregation\\_methods.pdf](https://uneplive.unep.org/media/docs/graphs/aggregation_methods.pdf).

This annex uses simple extrapolation procedures to estimate if the SDG targets would be met based on the current state of the SDG indicators (i.e. no efforts were made to change the current data trend). Thus progress in the next 15 years was estimated to be identical to the progress in the last 15 years at a global level. UN Environment extrapolated the aggregated data using the exponential regression model based on available data points from year to year. The cut-off used for data extrapolation and analysis is the year 2030. We determined if the target will be met or not by comparing the 2030 data to the indicator target. For example, if there is an increase in a target by 5% by 2030, it is considered as a positive progress, a change in condition based on this indicator is shown as a positive direction between 2000 and 2030. The same is applied for any decrease higher than -5 per cent. Any per cent change between +5 per cent and -5 per cent has been considered as representing very little negative or positive change in this indicator between 2000 and 2030.

An indicator is considered to have no data if there is not enough data for global aggregation. To determine this we have followed the global aggregation model explained on Environment Live. Where sufficient data are available, aggregations are performed for all indicators which share a common unit and are believed to be internationally comparable. Indicators which are expressed in national currency or another national unit are not aggregated.



### Progress toward the SDGs

Of the 93 environment-related SDG indicators, there are 20 for which good progress has been made over the last 15 years and if this progress continues then it is likely that these SDGs will be met. However, many of these indicators include particular reporting or funding efforts. For example, there has been an increase in terrestrial, mountain and marine protected areas; the effort to combat invasive species has increased; there has been significant progress toward grid-connected renewable energy; sustainability reporting and mainstreaming in policy has increased; and development assistance for climate change and the environment has increased. For 8 of the environment-related SDG indicators the progress has been

relatively flat and for 7 of the SDG indicators, additional efforts will be needed. In particular, many of the indicators related to the state of the environment show a negative trend (these include indicators related to forests, sustainable fisheries, endangered species, domestic material consumption and material footprint). Unfortunately, this is a very incomplete picture because there is too little data to formally assess the status of 58 of the 93 environment-related SDG indicators – however, scientific research and the current GEO has shown that many of these areas have shown a particular negative trend. A snapshot of the progress toward these indicators is shown in the graphic below and an overall table of progress is also shown.

Figure A.4: Relative progress on SDG indicators



**Figure A.5: Environmental Dimensions of the SDGs – Score Card**



<p><b>SDG 1: End Poverty</b></p> <ul style="list-style-type: none"> <li>Land tenure (SDG 1.4.2)</li> <li>Disasters: persons affected (SDG 1.5.1)</li> <li>Disasters: economic loss (SDG 1.5.2)</li> <li>Disaster risk reduction strategies (SDG 1.5.3)</li> <li>Disaster risk reduction for local government (SDG 1.5.4)</li> </ul>	<p><b>SDG 12: Responsible Lifestyles</b></p> <ul style="list-style-type: none"> <li>Action plans for sustainability (SDG 12.1.1)</li> <li>Material footprint (SDG 8.4.1)</li> <li>Domestic material consumption (SDG 8.4.2)</li> <li>Food loss and waste (SDG 12.3.1)</li> <li>Chemicals convention reporting (SDG 12.4.1)</li> <li>Hazardous waste generation (SDG 12.4.2)</li> <li>Recycling (SDG 12.5.1)</li> <li>Corporate sustainability reporting (SDG 12.6.1)</li> <li>Sustainable public procurement (SDG 12.7.1)</li> <li>Education for sustainable lifestyles (SDG 12.8.1)</li> <li>Research for sustainable lifestyles (SDG 12.a.1)</li> <li>Sustainable tourism strategies (SDG 12.b.1)</li> <li>Fossil fuel subsidies (SDG 12.c.1)</li> </ul>
<p><b>SDG 2: Food Security</b></p> <ul style="list-style-type: none"> <li>Sustainable agricultural practices (SDG 2.4.1)</li> <li>Secure genetic resources for food (SDG 2.5.1)</li> <li>Local breeds for agriculture (SDG 2.5.2)</li> </ul>	
<p><b>SDG 3: Health</b></p> <ul style="list-style-type: none"> <li>Air pollution mortality (SDG 3.9.1)</li> <li>Water-related mortality (SDG 3.9.2)</li> <li>Unintentional poisoning mortality (SDG 3.9.3)</li> </ul>	
<p><b>SDG 4: Education</b></p> <ul style="list-style-type: none"> <li>Environmental education (SDG 4.7.1)</li> </ul>	<p><b>SDG 13: Climate Action</b></p> <ul style="list-style-type: none"> <li>Disasters: persons affected (SDG 13.1.1)</li> <li>Disaster risk reduction strategies (SDG 13.1.2)</li> <li>Disaster risk reduction for local government (SDG 13.1.3)</li> <li>Climate change action plans (SDG 13.2.1)</li> <li>Climate change education (SDG 13.3.1)</li> <li>Community based approaches for CC (SDG 13.3.2)</li> <li>Resources mobilized for climate action (SDG 13.a.1)</li> <li>Climate action support for LDCs (SDG 13.b.1)</li> </ul>
<p><b>SDG 5: Gender</b></p> <ul style="list-style-type: none"> <li>Women agricultural land owners (SDG 5.a.1)</li> </ul>	
<p><b>SDG 6: Water</b></p> <ul style="list-style-type: none"> <li>Safe drinking water (SDG 6.1.1)</li> <li>Wastewater treatment (SDG 6.3.1)</li> <li>Water quality (SDG 6.3.2)</li> <li>Water efficiency (SDG 6.4.1)</li> <li>Water stress (SDG 6.4.2)</li> <li>Water resource management (SDG 6.5.1)</li> <li>Water cooperation (SDG 6.5.2)</li> <li>Water ecosystems (SDG 6.6.1)</li> <li>Investment in water and sanitation (SDG 6.a.1)</li> <li>Local water management (SDG 6.b.1)</li> </ul>	<p><b>SDG 14: Oceans</b></p> <ul style="list-style-type: none"> <li>Marine litter and coastal eutrophication (SDG 14.1.1)</li> <li>Management of marine areas (SDG 14.2.1)</li> <li>Marine acidification (SDG 14.3.1)</li> <li>Sustainable fish stocks (SDG 14.4.1)</li> <li>Marine protected areas (SDG 14.5.1)</li> <li>Fishing regulation (SDG 14.6.1)</li> <li>Fishing contribution to GDP (SDG 14.7.1)</li> <li>Research on sustainable marine technology (SDG 14.a.1)</li> <li>Ocean conservation instruments (SDG 14.c.1)</li> </ul>
<p><b>SDG 7: Energy</b></p> <ul style="list-style-type: none"> <li>Reliance on clean fuels (SDG 7.1.2)</li> <li>Renewable energy (SDG 7.2.1)</li> <li>Energy intensity (SDG 7.3.1)</li> <li>Clean energy research and technology (SDG 7.a.1)</li> <li>Investment in energy efficiency (SDG 7.b.1)</li> </ul>	<p><b>SDG 15: Land and biodiversity</b></p> <ul style="list-style-type: none"> <li>Forest area (SDG 15.1.1)</li> <li>Protection of key biodiversity areas (SDG 15.1.2)</li> <li>Sustainable forest management (SDG 15.2.1)</li> <li>Land degradation (SDG 15.3.1)</li> <li>Mountain protected areas (SDG 15.4.1)</li> <li>Mountain green cover (SDG 15.4.2)</li> <li>Endangered species (SDG 15.5.1)</li> <li>Strategies for sharing biodiversity benefits (SDG 15.6.1)</li> <li>Trade in poached or illicitly trafficked wildlife (SDG 15.7.1)</li> <li>Strategies for preventing invasive alien species (SDG 15.8.1)</li> <li>Progress towards Aichi Biodiversity Target 2 (SDG 15.9.1)</li> <li>Investment in biodiversity and ecosystems (SDG 15.a.1)</li> <li>Investment in sustainable forests (SDG 15.b.1)</li> <li>Protection against poaching, trafficking and trade (15.c.1)</li> </ul>
<p><b>SDG 8: Decent Work and Economic Growth</b></p> <ul style="list-style-type: none"> <li>Material footprint (SDG 8.4.1)</li> <li>Domestic material consumption (SDG 8.4.2)</li> <li>Employment in sustainable tourism (SDG 8.9.2)</li> </ul>	
<p><b>SDG 9: Industry, Innovation and Infrastructure</b></p> <ul style="list-style-type: none"> <li>CO<sub>2</sub> Emissions (SDG 9.4.1)</li> </ul>	
<p><b>SDG 10: Reduced Inequalities</b></p> <p><i>The environmental dimension is not represented in Goal 10</i></p>	
<p><b>SDG 11: Cities and Communities</b></p> <ul style="list-style-type: none"> <li>Access to public transport (SDG 11.2.1)</li> <li>Land consumption (SDG 11.3.1)</li> <li>Urban planning (SDG 11.3.2)</li> <li>Investment in cultural and natural heritage (SDG 11.4.1)</li> <li>Disasters: persons affected (SDG 11.5.1)</li> <li>Disasters: economic loss (SDG 11.5.2)</li> <li>Urban solid waste management (SDG 11.6.1)</li> <li>Ambient air pollution (SDG 11.6.2)</li> <li>Public land in cities (SDG 11.7.1)</li> <li>Local disaster risk reduction strategies (SDG 11.b.1)</li> <li>National disaster risk reduction strategies (SDG 11.b.2)</li> <li>Financial ass. to least developed countries (SDG 11.c.1)</li> </ul>	<p><b>SDG 16: Peace and Justice</b></p> <ul style="list-style-type: none"> <li>Participation in global governance (SDG 16.8.1)</li> </ul>
	<p><b>SDG 17: Partnerships and means of implementation</b></p> <ul style="list-style-type: none"> <li>Science and technology cooperation (SDG 17.6.1)</li> <li>Funding for environmentally sound technologies (SDG 17.7.1)</li> <li>Funding for capacity building (SDG 17.9.1)</li> <li>Mechanisms enhancing policy coherence (SDG 17.14.1)</li> </ul>

Represents a change in condition based on this indicator in a + direction between 2000-2017 (does not represent that the SDG target will be achieved).  
 Represents very little negative or positive change in this indicator between 2000-2017.  
 Represents a change in condition based on this indicator in a negative direction between 2000-2017.  
 Some data is available, but not enough to analyze changes over time.  
 No data is available.



**Table A.3: Description of environment relevant SDG targets and indicators in the SDG Global Indicator Framework**

Goal	70 Targets	93 Indicators
<b>Goal 1. End poverty in all its forms everywhere</b>	1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.2 Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure
	1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	1.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population 1.5.2 Direct economic loss attributed to disasters in relation to global gross domestic product (GDP) 1.5.3 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030 1.5.4 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
<b>Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture</b>	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	2.4.1 Proportion of agricultural area under productive and sustainable agriculture
	2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities 2.5.2 Proportion of local breeds classified as being at risk, not-at-risk or at unknown level of risk of extinction
<b>Goal 3. Ensure healthy lives and promote well-being for all at all ages</b>	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	3.9.1 Mortality rate attributed to household and ambient air pollution
		3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)
		3.9.3 Mortality rate attributed to unintentional poisoning
<b>Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (1/1/0)</b>	4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	4.7.1 Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment
<b>Goal 5. Achieve gender equality and empower all women and girls</b>	5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws	5.a.1 (a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure
<b>Goal 6. Ensure availability and sustainable management of water and sanitation for all</b>	6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services
	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated <b>6.3.2 Proportion of bodies of water with good ambient water quality</b>
	6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
	6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	<b>6.5.1 Degree of integrated water resources management implementation (0-100)</b> 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation
	6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	<b>6.6.1 Change in the extent of water-related ecosystems over time</b>
	6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	<b>6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan</b>
	6.b Support and strengthen the participation of local communities in improving water and sanitation management	<b>6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management</b>

Note: Indicators for which UN Environment is Custodian Agency are marked in blue font



Goal	70 Targets	93 Indicators
<b>Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all</b>	7.1.2 Proportion of population with primary reliance on clean fuels and technology	7.1.2 Proportion of population with primary reliance on clean fuels and technology
	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption
	7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity measured in terms of primary energy and GDP
	7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	7.a.1 International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems
	7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support	7.b.1 Investments in energy efficiency as a proportion of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services
<b>Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</b>	8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead	<b>8.4.1 Material footprint, material footprint per capita, and material footprint per GDP</b> <b>8.4.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP</b>
	8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	8.9.2 Proportion of jobs in sustainable tourism industries out of total tourism jobs
<b>Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</b>	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO2 emission per unit of value added
<b>Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable</b>	11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
	11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate
		11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
	11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	11.4.1 Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/investment) and type of private funding (donations in kind, private non-profit sector and sponsorship)
	11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population
		11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters
	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities
		11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
	11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities
	11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels	11.b.1 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030
11.b.2 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies		
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	11.c.1 Proportion of financial support to the least developed countries that is allocated to the construction and retrofitting of sustainable, resilient and resource-efficient buildings utilizing local materials	



Goal	70 Targets	93 Indicators	
<b>Goal 12. Ensure sustainable consumption and production patterns</b>	12.1 Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	<b>12.1.1</b> Number of countries with sustainable consumption and production (SCP) national action plans or SCP mainstreamed as a priority or a target into national policies	
	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	<b>12.2.1</b> Material footprint, material footprint per capita, and material footprint per GDP <b>12.2.2</b> Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP	
	12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	<b>12.3.1</b> Global food loss index	
	12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	<b>12.4.1</b> Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement <b>12.4.2</b> Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment	
	12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	<b>12.5.1</b> National recycling rate, tons of material recycled	
	12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	<b>12.6.1</b> Number of companies publishing sustainability reports	
	12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities	<b>12.7.1</b> Number of countries implementing sustainable public procurement policies and action plans	
	12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment	
	12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production	<b>12.a.1</b> Amount of support to developing countries on research and development for sustainable consumption and production and environmentally sound technologies	
	12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	12.b.1 Number of sustainable tourism strategies or policies and implemented action plans with agreed monitoring and evaluation tools	
	12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities	<b>12.c.1</b> Amount of fossil-fuel subsidies per unit of GDP (production and consumption) and as a proportion of total national expenditure on fossil fuels	
	<b>Goal 13. Take urgent action to combat climate change and its impacts</b>	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population
			13.1.2 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030
13.1.3 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies			
13.2 Integrate climate change measures into national policies, strategies and planning		13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)	
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning		13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula	
		13.3.2 Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions	
13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible		13.a.1 Mobilized amount of United States dollars per year between 2020 and 2025 accountable towards the \$100 billion commitment	
13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	13.b.1 Number of least developed countries and small island developing States that are receiving specialized support, and amount of support, including finance, technology and capacity-building, for mechanisms for raising capacities for effective climate change-related planning and management, including focusing on women, youth and local and marginalized communities		



Goal	70 Targets	93 Indicators
<b>Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development</b>	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	<a href="#">14.1.1 Index of coastal eutrophication and floating plastic debris density</a>
	14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	<a href="#">14.2.1 Proportion of national exclusive economic zones managed using ecosystem-based approaches</a>
	14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations
	14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	14.4.1 Proportion of fish stocks within biologically sustainable levels
	14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	<a href="#">14.5.1 Coverage of protected areas in relation to marine areas</a>
	14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation	14.6.1 Progress by countries in the degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing
	14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	14.7.1 Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries
	14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries	14.a.1 Proportion of total research budget allocated to research in the field of marine technology
	14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"	14.c.1 Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources
	<b>Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</b>	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally		15.2.1 Progress towards sustainable forest management
15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world		15.3.1 Proportion of land that is degraded over total land area
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development		<a href="#">15.4.1 Coverage by protected areas of important sites for mountain biodiversity</a> 15.4.2 Mountain Green Cover Index
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species		15.5.1 Red List Index
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed		15.6.1 Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits
15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products		15.7.1 Proportion of traded wildlife that was poached or illicitly trafficked
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species		15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts		<a href="#">15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020</a>
15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems		<a href="#">15.a.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems</a>
15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation		<a href="#">15.b.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems</a>
15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities		15.c.1 Proportion of traded wildlife that was poached or illicitly trafficked



Goal	70 Targets	93 Indicators
<b>Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels</b>	16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance	16.8.1 Proportion of members and voting rights of developing countries in international organizations
<b>Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development</b>	17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	17.6.1 Number of science and/or technology cooperation agreements and programmes between countries, by type of cooperation
	17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	<b>17.7.1</b> Total amount of approved funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies
	17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation	17.9.1 Dollar value of financial and technical assistance (including through North-South, South-South and triangular cooperation) committed to developing countries
	17.14 Enhance policy coherence for sustainable development	<b>17.14.1</b> Number of countries with mechanisms in place to enhance policy coherence of sustainable development
<b>Total</b>	<b>72</b>	<b>93</b>

## Annex 6-1: The Principal Biodiversity-related Conventions



 <p><b>Convention on Biological Diversity</b></p>	<p><b>Convention on Biological Diversity</b> The objectives of the CBD are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from commercial and other utilization of genetic resources. The agreement covers all ecosystems, species, and genetic resources.</p>
	<p><b>Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)</b> The CITES aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Through its three Appendices, the Convention accords varying degrees of protection to more than 36,000 plant and animal species.</p>
	<p><b>Convention on the Conservation of Migratory Species of Wild Animals</b> The CMS, or the Bonn Convention aims to conserve terrestrial, marine and avian migratory species throughout their range. Parties to the CMS work together to conserve migratory species and their habitats by providing strict protection for the most endangered migratory species, by concluding regional multilateral agreements for the conservation and management of specific species or categories of species, and by undertaking co-operative research and conservation activities. <a href="http://www.cms.int">www.cms.int</a></p>
	<p><b>The International Treaty on Plant Genetic Resources for Food and Agriculture</b> The objectives of the International Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security. The International Treaty covers all plant genetic resources for food and agriculture, while its Multilateral System of Access and Benefit-sharing covers a specific list of 64 crops and forages. The Treaty also includes provisions on Farmers' Rights.</p>
	<p><b>Convention on Wetlands (also known as the Ramsar Convention)</b> The Ramsar Convention is the only international treaty focused on wetlands. It provides a platform of 170 Contracting Parties working together for wetland conservation and wise use, and to develop the best available data, advice and policy recommendations to realize the benefits of fully functional wetlands to nature and society. The Convention recognized wetlands as ecosystems which are extremely important for biodiversity conservation. Parties to the Convention have already committed to maintaining the ecological character of over 2,300 Wetlands of International Importance covering nearly 250 million hectares, 13-18 per cent of global wetlands.</p>
	<p><b>World Heritage Convention (WHC)</b> The primary mission of the WHC is to identify and conserve the world's cultural and natural heritage, by drawing up a list of sites whose outstanding values should be preserved for all humanity and to ensure their protection through a closer co-operation among nations.</p>
 <p><b>International Plant Protection Convention</b></p>	<p><b>International Plant Protection Convention (IPPC)</b> The IPPC aims to protect world plant resources, including cultivated and wild plants by preventing the introduction and spread of plant pests and promoting the appropriate measures for their control. The convention provides the mechanisms to develop the International Standards for Phytosanitary Measures (ISPMs), and to help countries to implement the ISPMs and the other obligations under the IPPC, by facilitating the national capacity development, national reporting and dispute settlement. The Secretariat of the IPPC is hosted by the Food and Agriculture Organization of the United Nations (FAO).</p>



## Annex 9-1: Water Contaminants and Occurrences

Pathogens	Human and livestock excrement (bacterial)	Inadequate treatment of sewer effluents; sewer and storm water overflows into rivers, lakes and wetlands	90 per cent of child deaths are caused by diarrheal diseases (WHO and UNICEF 2012).	1/3 of all rivers in Africa, Asia-Pacific and Latin America regions (UNEP 2016a)
Parasites (non-bacterial)	Human and livestock excrement (non-bacterial)	Human and livestock excrement; septic leakage into surface and groundwater	Approximately half the deaths of children under the age of five years.	Cities and rural communities in Africa, Asia-Pacific, Latin America, India, Pakistan, China, Nigeria, and Democratic Republic of Congo
Viruses (non-bacterial)		Treated drinking water (Bergeron <i>et al.</i> 2015); natural occurrence in range of concentrations (Kümmerer 2009)		
Antibiotic/antimicrobial compounds	Human excretion; intensive agriculture and aquaculture practices	Sewer effluents; agricultural and urban runoff	Human illness and death due to antimicrobial- and antibiotic-resistant infections	Projected to become a major cause of death worldwide by 2050 (O'Neill Commission 2014)
Nutrients	Agricultural inorganic fertilizer (UNEP 2016a); human and livestock excrement	Inadequately/untreated sewage discharges; urban and agricultural runoff; aquaculture	Eutrophication and algal blooms (OECD 1982; Research Center for Sustainability and Environment-Shiga University and International Lake Environment Committee Foundation 2014)	All five UNEP regions; rural areas in China, India, Thailand and Philippines also affected by excessive chemical fertilizer application (Novotny <i>et al.</i> 2010)
		River contributions of total nutrients to coastal areas increased by approximately 80 per cent during 1970-2000	Effects of harmful algal blooms (HABs) can impact ecosystem functions  Aquaculture; livestock and human health via bioaccumulation of toxicity. (O'Neil <i>et al.</i> 2012)	Thirty-seven Latin American transboundary rivers are highly polluted with wastewaters and agricultural runoff nutrients at the basin level
Sediment	Deforestation; poor agricultural practices; livestock overgrazing; intensive fuelwood harvesting, sand mining; unplanned settlements causing exposed soil surfaces and erosion	Storm-generated runoff can carry sediments, nutrients, heavy metals, pesticides and other pollutants into rivers, lakes and wetlands, particularly in agricultural areas	Sediment-associated pollutants interfere with human water use  Can have health impacts, degrade aquatic organism metabolism and habitats	In Asia-Pacific, some rivers carry high loads of sediment-associated heavy metals
	Changes in sediment flow paths (dykes, channels, urban drainage, dams) can lead to erosion and high sediment loads		Sediment loading to oceans and coastal ecosystems (river deltas, wetlands, beaches, etc.)	
Biodegradable Organic Pollutants	Process characterized by a high Biological Oxygen Demand (BOD) from microbial decomposition of human and livestock wastes, and eutrophication-associated algal blooms, particularly in lakes and wetlands	Industrial and domestic wastewater discharges	Bacterial-mediated decomposition of algae/aquatic plants can cause hypoxia/oxygen depletion in waterbodies, resulting in fish kills and facilitating release of heavy metals from bottom sediments back into water column	Increasing in African, Asia-Pacific and Latin America (UNEP 2016a)  in contrast, decreasing in developed countries with enhanced wastewater treatment
	Industrial and agricultural applications and operations			Rapidly-urbanizing and industrializing countries (e.g., China India; Ethiopia; Mexico) and rivers downstream of major Central Asian cities



Water Contaminant	Contaminant Sources	Pathways into Waterbody	Impacts of Contaminated Water and inadequate Sanitation/Hygiene	Examples of Occurrence
Persistent Organic Pollutants (POPs, including organic pesticides; industrial chemicals and organic neonicotinoid insecticides solvents)	DDT (produced globally); Neonicotinoid insecticides (introduced in 1990s); Organic chemicals and solvents in manufacturing processes	Agricultural and urban runoff; Industrial and domestic wastewater discharges	Accumulates and persists in fatty tissues of humans, fish and other aquatic organisms, damaging their health if toxic; Neonicotinoid insecticides toxic to aquatic invertebrates and biodiversity;  DDT has human carcinogenic and teratogenic risks (e.g., elevated DDT levels found in Lake Kariba ecosystem, and in breast milk of women living in area);	DDT still used in many developing countries to control malaria;  Neonicotinoid insecticides most-widely used insecticides in the world;  Estimated 40 per cent of world land area affected by insecticide runoff  Wide range of industrial chemical processes involving organic solvents;  Reducing DDT use had some positive results (e.g., recovery of eagles and other birds in North America)
	Neonicotinoid insecticides		Contaminate freshwater resources, wetlands, estuarine habitats and marine systems globally  Poses serious threat to pollinators such as bees (IPBES 2017); contaminate food chains  Significantly increases human exposure to synthetic chemicals (Kim <i>et al.</i> 2017).	
Heavy Metals	Industrial, agricultural, medical, technological and mining wastes; stormwater runoff (e.g., highways);	Untreated industrial and municipal wastewater discharges into rivers, lakes, wetlands; land runoff; sedimentation	Can affect human health directly via ingestion of drinking water  Can bioaccumulate in vegetables, rice and other edible plants irrigated with contaminated irrigation water (Arunakumara, Walpola and Yoon 2013; Lu <i>et al.</i> 2015)  Mercury, lead, chromium, cadmium and arsenic have toxic effects on humans and other organisms	Asia-Pacific river waters and sediments contain high heavy metal levels from untreated tannery and metal-finishing operation discharges, and from highway runoff (e.g., zinc in West Java; lead in Erdenet, Mongolia; chromium in some Bangladeshi and Japanese rivers) (Sikder <i>et al.</i> 2013); Chinese urban rivers (Qu and Fan 2010).  South American urban areas  In contrast, heavy metal contamination has generally diminished in EU countries
	Natural contamination (e.g., arsenic in groundwater)			Widespread in Bangladeshi and Indian groundwater; some parts of China, Iran, Mongolia, Pakistan and Nepal (Rahman, Ng and Naidu 2009)
Salinity	Agricultural irrigation drainage; lake and wetland evaporation	High evaporation rates	Most freshwater organisms and ecosystems have limited salinity tolerance (UNEP 2016a); salinization impairs agricultural and industrial water uses  Salt water intrusion can result in salinized water in coastal aquifers	Salinity problems affect one-tenth of all rivers in Africa, Asia-Pacific and Latin America; surface water salinization is major issue in Central Asia
	Intensive agricultural practices; domestic and industrial sewer effluents	Production of salinized soils		
	seawater intrusion	Over-abstraction of groundwater		



Water Contaminant	Contaminant Sources	Pathways into Waterbody	Impacts of Contaminated Water and inadequate Sanitation/Hygiene	Examples of Occurrence
Contaminants of Emerging Concern (CEC's)	Veterinary and human pharmaceuticals; insect repellents; antimicrobial disinfectants; fire retardants; detergent metabolites	Municipal and industrial sewer effluents	Hormone imbalances contributing to reduced human fertility and feminization of male fish (Gross-Sorokin, Roast and Brighty 2006); Increasing evidence of antibiotic-resistant organisms in water sources, possibly altering aquatic microbial ecosystems	US Geological Survey detected these contaminants in 80 per cent of streams sampled in US; also detected in all pan-European seas
	Microplastics and nanoparticles (Kolpin <i>et al.</i> 2002)		Impacts both freshwater and marine ecosystems Microplastics known to contain and absorb toxic chemicals	Global issue (Dris <i>et al.</i> 2015)
Additional Water Quality Concerns	Groundwater pollution associated with oil and gas fracking activities	Discharge of large volumes of "produced water" and associated chemicals enter waterways	Fracking-associated pollutants are being researched (Osborn <i>et al.</i> 2011)	The Americas (Vengosh <i>et al.</i> 2014)
	Lake acidification from atmospheric deposition of fossil fuel emissions	Acid rain	Impacts freshwater ecosystems, including fish and other aquatic organisms	Lake acidification remains problematic in areas lacking soils or bedrock capable of buffering acid rain  Situation is improving where SO <sub>x</sub> and NO <sub>x</sub> emissions have decreased (e.g., affected lakes in New York Adirondack region recovering at different rates) (Driscoll <i>et al.</i> 2016)

## Annex 13-1 Biodiversity Conservation and International Environmental Agreements (IEAs)



The University of Oregon has built the most comprehensive database on IEAs to-date. We searched the [iea.uoregon.edu](http://iea.uoregon.edu) database for IEAs related to biodiversity conservation. The search terms "biodiversity" AND "conservation" were used to search for multilateral and bilateral agreements, which returned 45 IEAs in total. Amendments to agreements already deemed relevant were also excluded here to prevent double counting. After the screening process, 33 IEAs were identified that concerned biodiversity conservation. They were signed within three decades (between 1985 and 2015). Four were bilateral

(signed by only 2 countries) and the rest were multilateral (signed by 3 or more countries). Of the multilateral agreements, the number of signatories ranged from 3 to 196 (median = 7). Twenty-eight IEAs focussed on specific geographic regions while six had a global scope. Of those agreements on terrestrial regions, seven focused on conservation of ecosystems or species within North America, five in Europe, six in Asia, and three in Africa. Seven IEAs also focussed on biodiversity conservation in a non-terrestrial context (Indian, Atlantic, and Pacific Ocean, and the Baltic sea).

**Table A.4: List of International Environmental Agreements signed between 2010 and 2015**

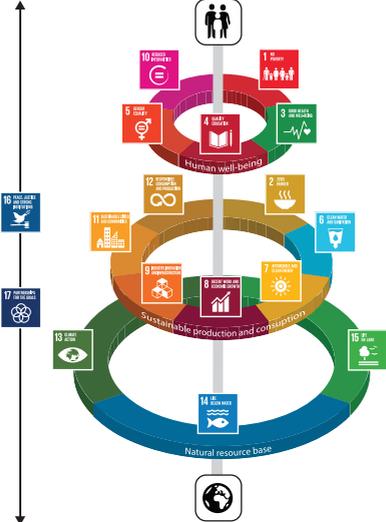
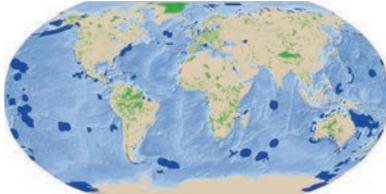
IEA	Year signed	Themes
Agreement on the Protection and Sustainable Development of the Prespa Park Area	2010	4
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity	2010	3
Agreement between the Governments of the Member States of the Association of Southeast Asian Nations and the Republic of Korea on Forest Cooperation	2011	2
Protocol on Sustainable Forest Management to the Framework Convention on the Protection and Sustainable Development of the Carpathians	2011	2
Protocol on Sustainable Tourism to the Framework Convention on the Protection and Sustainable Development of the Carpathians	2011	2
Agreement on the establishment of the Global Green Growth Institute	2012	2
Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific Ocean	2012	2
Protocol Amending the Agreement Between The United States And Canada On Great Lakes Water Quality	2012	1
Benguela Current Convention	2013	4
Protocol on Sustainable Transport to the Framework Convention on the Protection and Sustainable Development of the Carpathians	2014	2
Paris Agreement under the United Nations Framework Convention on Climate Change	2015	3

The IEAs have been categorised into four themes: pollution prevention (1), sustainable use of biodiversity (2), environmental process (3) and protection of ecosystem/species/genes (4) based on the predominant context they fall under.

Source: Mukherjee *et al.* (2018).



## Annex 13-2: Overview of Key Policy Developments and Governance Responses at a Global Level

 <p><b>Convention on Biological Diversity</b></p>	<p>The CBD has been the key convention in the last two decades for biodiversity conservation, sustainable use of biodiversity and equitable access and benefit sharing of genetic resources (IUCN 2018a; 2018b).</p>
	<p>The need for integrating biodiversity science with policy design, analogous to that which exists for climate change, prompted the establishment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) in 2012 (Diaz <i>et al.</i> 2015; Allison and Brown 2017).</p>
	<p>The importance of biodiversity is also recognized in the Sustainable Development Goals (SDGs) 14 (life below water) and 15 (life on land) adopted by world leaders on 25 September 2015 at the UN General Assembly. The clustering of the goals is discussed in chapter 20 (see Figure 20.1)</p>
	<p>An important response to the need for the protection of biodiversity has been the establishment and management of protected areas, reflected in Aichi Biodiversity Target 11 of the Strategic Plan for Biodiversity 2011-2020. The IUCN defines a protected area as “a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values.” (IUCN 2018c). Figure: UNEP-WCMC and IUCN 2016.</p>
 <p><b>NATURAL CAPITAL COALITION</b></p>	<p>The Natural Capital Coalition, which evolved out of the TEEB (The Economics of Ecosystems &amp; Biodiversity) For Business Coalition in 2014 is an international collaboration that aims to mainstream natural capital approaches in the public and private sectors.</p>

# Annex 23-1: Bottom-up Initiative Platforms and Results



Initiative	Location	Platform Secretariat	Platform Participants	Description and Projects	Theory of Change	Initiatives	SDGs	Potential Pathway	Link
<b>Amazon Vision and Coordination and Information Platform (CIP)</b>	Regional (Colombia)	Civil Society, local government	All government, public, civil society, private sector, international organizations	By providing a structure to pool knowledge, increase capacity, and facilitate the deployment of financial resources, CIP aims to support the implementation of GHG mitigation activities, and ensure that the results of such activities (e.g. information, tools, programs and incentives) reach the right beneficiaries.	Knowledge/data platform; Monitoring and reporting; Finance/incentives/subsidies	200	13	Decentralized Solutions	<a href="http://www.pdamazonia.com">http://www.pdamazonia.com</a>
<b>Blue Solutions/ Marine and Coastal Biodiversity Management in Pacific Island Countries (MACBIO - Pacific)</b>	Regional (Pacific Island Region)	National government, international organizations	Practitioners, national governments, regional governments	Collate, document and share successful approaches for addressing marine and coastal challenges. By strengthening institutional and individual capacity, to manage and conserve biodiversity in marine and coastal ecosystems, MACBIO supports sustainable economies and livelihoods of Pacific Island Countries.	Knowledge/data platform		14	Decentralized solutions	<a href="http://macbio-pacific.info/qbook/">http://macbio-pacific.info/qbook/</a>
<b>Climate Initiatives Platform</b>	Global	International organization	All government, private sector, civil society, international organizations	Online portal for collecting, sharing and tracking information on international cooperative climate initiatives among city, region, company, investor, civil society and national government participants.	Knowledge/data platform; Monitoring and reporting	224	13	Decentralized solutions	<a href="http://climateinitiativesplatform.org/index.php/Welcome">http://climateinitiativesplatform.org/index.php/Welcome</a>
<b>Green Growth Knowledge Platform</b>	Global	Civil society, international organizations	Practitioners, international organizations, academic research, civil society, all government	The Green Growth Knowledge Platform (GGKP) is a global network of international organizations and experts, that identifies and addresses major knowledge gaps in green growth theory and practice. By encouraging widespread collaboration and world-class research, the GGKP offers practitioners and policymakers the policy guidance, good practices, tools, and data necessary to support the transition to a green economy.	Knowledge/data platform; Awareness, knowledge, skills development; New organization/business	337	12	Decentralized solutions	<a href="http://www.greengrowthknowledge.org/">http://www.greengrowthknowledge.org/</a>
<b>LifeWeb Initiative</b>	Global	International organization	All government, international organizations, civil society	The LifeWeb initiative highlights biodiversity, conservation and adaptation to climate change needs to donors who are able to create development assistance partnerships, through an online clearing-house and participation in roundtable meetings.	Knowledge/data platform; Finance/incentives/subsidies	18	14, 15, 17	Decentralized solutions	<a href="https://lifeweb.cbd.int/">https://lifeweb.cbd.int/</a>
<b>Non-State Actor Zone for Climate Action (NAZCA)</b>	Global	International organization	All government, private sector, civil society, international organizations, academic research	NAZCA captures commitments to climate action made by companies, cities, subnational, regions, investors, and civil society organizations. NAZCA aims to track the mobilization and action that are helping countries achieve and exceed their national commitments to address climate change.	Knowledge/data platform; Monitoring and reporting	12549	11, 13, 17	Decentralized solutions	<a href="http://climateaction.unfccc.int/">http://climateaction.unfccc.int/</a>



Initiative	Location	Platform Secretariat	Platform Participants	Description and Projects	Theory of Change	Initiatives	SDGs	Potential Pathway	Link
<b>UN Global Compact</b>	Global	International organization	Private sector	The UN Global Compact helps companies align their strategies and operations with Ten Principles on human rights, labour, environment and anti-corruption. It takes strategic actions to advance broader societal goals, such as the UN Sustainable Development Goals, with an emphasis on collaboration and innovation.	Awareness, knowledge, skills development	49861	6, 7, 8, 11	Decentralized solutions	<a href="http://www.unglobalcompact.org/">www.unglobalcompact.org/</a>
<b>NRDC Cloud of Commitments</b>	Global	Civil society	All government, private sector, civil society, international organizations	A platform to highlight the emerging coalitions, networks, partnerships, and other initiatives taking action on energy, water, cities, and other key sustainability challenges discussed at the UN Conference on Sustainable Development (UNCSD, or Rio+20). It is expected to evolve into a platform working toward transparency, engagement, assessments, and accountability for the commitments highlighted.	Knowledge/data platform; Monitoring and reporting	118	Various	Decentralized solutions	<a href="http://www.cloudofcommitments.org/">www.cloudofcommitments.org/</a>
<b>SEEDS of the Anthropocene</b>	Global	International organization	All government, private sector, civil society, international organizations	This initiative gathers "SEEDS" which are existing initiatives that are not widespread. They can be social initiatives, new technologies, economic tools, or social-ecological projects, or organizations, movements or new ways of acting that have that appear to be making a substantial contribution towards creating a future that is just, prosperous, and sustainable.	Knowledge/data platform; Awareness, knowledge, skills development	400	13, 17	Decentralized Solutions, Consumption Change, Global Technology	<a href="https://goodanthropocenes.net/">https://goodanthropocenes.net/</a>
<b>Project Drawdown</b>	Global	Public, practitioners, civil society, private sector, policymakers, government's academic research	Practitioners, civil society, private sector, all governments, academic research, international organizations	Project Drawdown is facilitating a broad coalition of researchers, scientists, graduate students, PhDs, post-docs, policy makers, business leaders and activists to assemble and present the best available information on climate solutions in order to describe their beneficial financial, social and environmental impact over the next thirty years.	Knowledge/data platform; Awareness, knowledge, skills development	100	13	Decentralized solutions	<a href="http://www.drawdown.org/">http://www.drawdown.org/</a>
<b>MIT Climate Co-Lab</b>	Global	Academic research	Public, civil society	Climate CoLab is an open problem-solving platform where a growing community of over 90,000 people - including hundreds of the world's leading experts on climate change and related fields - work on and evaluate plans to reach global climate change goals.	Knowledge/data platform; Awareness, knowledge, skills development; New organization/business	2703	Various	Decentralized solutions	<a href="https://climatecolab.org/contests">https://climatecolab.org/contests</a>
<b>VertMTL.org</b>	Local (Montreal, Canada)	Local government	Public, civil society	As part of its consultation on reducing Montrealers' reliance on fossil fuels, the Montreal Public Advisory Board is challenging the innovation community by asking them to prototype innovative approaches to meeting the needs of Canadians.	Knowledge/data platform; Awareness, knowledge, skills development; New organization/business	58	6, 13, 2, 12	Decentralized solutions	<a href="https://marathoncreatif.sparkboard.com/">https://marathoncreatif.sparkboard.com/</a>



Initiative	Location	Platform Secretariat	Platform Participants	Description and Projects	Theory of Change	Initiatives	SDGs	Potential Pathway	Link
<b>Sustainia100</b>	Global (188 countries in 2016)	Civil society	Private sector, all government, civil society, international organizations, academic research	Now in its fifth year, the Sustainia100 has tracked more than 4,500 solutions to date from all over the world that respond to interconnected global challenges and help achieve the Sustainable Development Goals.	Knowledge/data platform; Awareness, knowledge, skills development	4500	Various	Decentralized solutions	<a href="http://www.sustainia.me/solutions/">http://www.sustainia.me/solutions/</a>
<b>Beautiful Solutions</b>	Global	Civil society	Public, civil society, practitioners	The Beautiful Solutions Gallery and Lab is an interactive space for sharing the stories, solutions and big ideas needed to build new institutional power and point the way toward a just, resilient, and democratic future. It is an online platform, book, and training program designed to give people tools to create the world we want.	Knowledge/data platform; Awareness, knowledge, skills development	18	13	Decentralized solutions	<a href="https://solutions.thischangeeverything.org/">https://solutions.thischangeeverything.org/</a>
<b>EcoTipping Points</b>	Global	Civil society	Public, civil society, practitioners	The EcoTipping Points Project's pragmatic goal is to help people identify "tipping point" levers right at home - concrete actions that they and their community can act upon. The EcoTipping Points Project is dedicated to making the stories and their lessons known through the media, workshops, and direct collaboration with community groups.	Knowledge/data platform; Awareness, knowledge, skills development	125	15, 17	Decentralized solutions	<a href="http://www.ecotippingpoints.org">http://www.ecotippingpoints.org</a>
<b>PANORAMA - Solutions for a Healthy Planet</b>	Global	Civil society, international organizations, national government	Public, civil society, practitioners, all governments, civil society, academic research, international organizations, private sector	A partnership initiative to document and promote examples of inspiring, replicable solutions across a range of conservation and development topics, enabling cross-sectoral learning and inspiration. PANORAMA allows practitioners to share their stories, get recognized for successful work, and learn how others have tackled problems across the globe, by encouraging reflection on and learning from proven approaches.	Knowledge/data platform; Awareness, knowledge, skills development	373	Various	Decentralized Solutions	<a href="http://www.panorama.solutions/">http://www.panorama.solutions/</a>
<b>UNFCCC Momentum for Change Initiatives</b>	Global	International organizations	Private sector, civil society, all governments, international organizations	Momentum for Change is an initiative spearheaded by the UN Climate Change, that recognizes innovative and transformative solutions that address both climate change and wider economic, social and environmental challenges. The initiative features practical, scalable and replicable examples of what people, businesses, governments and industries are doing to tackle climate change.	New organization/organization/business; Finance/incentives/subsidies	627	Various	Global Technology	<a href="http://unfccc.int/secretariat/momentum_for_change/items/6214.php">http://unfccc.int/secretariat/momentum_for_change/items/6214.php</a>



Initiative	Location	Platform Secretariat	Platform Participants	Description and Projects	Theory of Change	Initiatives	SDGs	Potential Pathway	Link
<b>WorthWild</b>	Regional (United States)	Private sector	Public, civil society, private sector, practitioners	WorthWild is a crowdfunding platform for environmentally-conscious businesses, nonprofits, and individuals who want to raise money to fund projects that protect and sustain the planet. WorthWild utilizes technology to rally behind green ideas, guiding first-time crowdfunders and experienced philanthropists through the process of building effective campaigns from start to finish.	New organization/organization/business; Finance/incentives/subsidies	29	7	Decentralized Solutions	<a href="http://www.worthwild.com/">http://www.worthwild.com/</a>
<b>Greencrowd</b>	Regional (Netherlands)	Private sector	Public, civil society, private sector, practitioners	Netherlands-based Greencrowd is founded to accelerate the realization of sustainable energy projects. Investors in Greencrowd projects will realize an environmental impact as well as a financial profit. Greencrowd thoroughly evaluates the risks involved in the project and assures there are guarantees (e.g. insurances, real estate as collateral) to mitigate the potential losses.	New organization/organization/business; Finance/incentives/subsidies	43	Various	Decentralized Solutions; Consumption Change	<a href="https://greencrowd.nl/">https://greencrowd.nl/</a>
<b>Divvy</b>	Global	Civil society	Public, civil society, private sector, practitioners	Divvy is a crowdfunding platform for community sustainability projects. Our platform makes it super-easy for green-minded community leaders to turn their sustainability ideas into reality. If needed, we even help project initiators get competitive quotes from local professionals so that they can focus on engaging their community.	New organization/business; Finance/incentives/subsidies	9	All	Decentralized Solutions; Global Technology	<a href="http://divvygreen.com/">http://divvygreen.com/</a>
<b>Partnerships for SDGs</b>	Global	International organization	Public, practitioners, civil society, all governments, international organizations, private sector, academic research	The Partnerships for SDGs online platform is United Nations' global registry of voluntary commitments and multi-stakeholder partnerships, facilitating global engagement of all stakeholders in support of the implementation of the Sustainable Development Goals.	Knowledge/data platform; Monitoring and reporting	3808	All	Decentralized Solutions	<a href="https://sustainabledevelopment.un.org/partnerships/">https://sustainabledevelopment.un.org/partnerships/</a>

## Contributed Bottom-up Initiatives



### Workshop Seeds

Workshop	Seed Name	Description
Singapore [MM81]	Renewable energy microgrids	Renewable energy microgrids implemented in climate and disaster vulnerable areas to strengthen the energy security, resilience and the ability for remote or secluded communities to bounce back from climate events.
Singapore	Celebrating Singapore Shores	Platform to bring together marine groups to celebrate the International Year of the Reefs. This occurs every 10 years.
Singapore	Plastic waste footprint calculator	Similar to carbon footprint calculation for individuals, an app/website that approximates the plastic waste footprint of individuals based on their daily lifestyle. The app can then summarize or extrapolate how much the person generates in a week/month/year and provide suggestions on how they can personally tweak their lifestyle to reduce plastic waste.
Singapore	Blockchain open source reporting	Using blockchain as a tool to aid in CSOs reporting. Using technology to ease reporting and measuring data and impact so as it could help CSOs to report and raise awareness.
Singapore	Solar Light Cooperative	Decentralized community and cooperative based power grid. Prioritizes poor and underserved communities. Communities manage their own systems and operates like a cooperative.
Singapore	Implementation of biomimetics for lifestyle change	To keep the linkage between industry and biodiversity conservation. A project to promote biomimicry - technology inspired by nature. Biomimetics as cultural services inspired by ecosystem services. For example, we have swimsuits that are inspired by the skin of the shark, city planning model inspired by the ecosystem itself.
Singapore	Marina barrage	Using barrage as a case study to alleviate flooding issues auto flood gates
Singapore	Using Drone to environmental assessment before development	Collect of Real time environmental informations such as air quality and forest structure
Singapore	Repair Kopitiam	Conducting monthly repair workshops to teach residents in different areas to repair appliances and reduce e-waste. Also involves uploading a series of videos so that anyone can conduct their own workshops. A strength is that everyone can gain repair skills and this also brings back a culture of repairing items.
Singapore	Drainage water level sensors	Sensors to monitor water level of drains and canals to provide real-time site conditions update during heavy storms, to improve response times to floods. This would be really useful for urban cities with dense canal system.
Singapore	Melbourne open data platform for environmental management	Collate information on all the trees in the city of Melbourne
Singapore	Satellite imagery to detect the palms health	Ability to detect the affected trees without a need to destructive methods.
Singapore	Urban Farming by using traditional vegetables	Urban Farming in Tokyo Metropolitan area of traditional and indigenous vegetables. Agricultural cooperatives that keep the traditional seeds to promote regional culture and identity. (for example, white radish)
Singapore	Citizen pollution monitoring	Giving citizens the tools to report on local pollution (especially vehicles). One strength is that it leverages pre-existing technology and another strength is that it makes pollution visible.
Singapore	China Black and Smelly Waters app	Citizens can report instances of foul or smelly water in urban areas through a smartphone app that connects to WeChat. Local government officials have to respond within 7 days to the complaint.
Singapore	Repair Kopitiam	"Kopitiam" is a neighborhood coffee shop. This project is run by SL2 (Sustainable Living Lab). Underneath public housing the organization sets up an area where residents can bring down broken items to get fixed. The volunteers teach the residents how to fix electronics, clothing, household and consumer items etc. Typically items of emotional value. Afterwards, pictures are taken. This is set up somewhere around the city every Sunday.
Singapore	Citizen science reporting	Shared data collected by individuals helping the different cause.
Singapore	Carbon dioxide capture for decarbonisation of atmosphere	Direct air capture of CO2 from ambient air through engineered chemical reactions. The plant sits on top of a waste heat recovery facility that powers the process. Fans push air through a filter system that collects CO2. When the filter is saturated, CO2 is separated at temperatures above 100 degrees Celsius. The gas is then sent through an underground pipeline to a greenhouse.
Singapore	Seed water	You can drink water without plastic bottle water
Singapore	Seaweed farming for livestock feed	Seaweed as a feed substitute for livestock and dairy cattle. Seaweed has been shown to reduce the amount of methane produce by ruminating animals.
Singapore	Transport Network Vehicle Systems	Big data-based transport system. Users hail rides in the most convenient way using smart phone apps. Offers lower ownership costs per passenger-km and reduces environmental impacts of transport. It is a potential solution to reduce private car use. People get to share rides, while still having the comfort and convenience of private transport.
Singapore	Underwater reporting	Using a single video recording equipment and live share the video image for different people are the world to observe without being there
Singapore	Versatile solar panel	Having solar panels everywhere to increase renewable energy use
Singapore	Solar farming	Solar farming, large scale transition to renewable energy. Located on Low yielding agricultural land solar farming has provided Farmers experiencing reducing yields and effects of climate change with an alternative source of income. Additional solar farming supports the reductions of emissions and the transition to renewable energy. Solar farming has also created a new job market and income for many rural communities. Livestock as sheep can still be grazed under and around the panels.
Singapore	Ecological Mangrove Restoration - Restore Ubin Mangroves Initiative	A community project to restore mangroves in abandoned Aquaculture ponds at Pulau Ubin. Mangrove restoration without planting. Community-based effort involving academics, fish farmers, nature enthusiasts, fishermen, marine advocates. Technology - based on scientific geographical mapping of the site to be restored (mangroves)
Singapore	Swapping resources	To reduce buying and encourage swapping existing resources
Singapore	Blue SG - Electric Carsharing	Similar to bike-sharing, 3-4 electric cars with charging stations are placed in heartland carparks. Residents can use it any time. Better than owning their own car.



Workshop	Seed Name	Description
Singapore	Smart Farm	Smart farm uses a variety of technologies to monitor the state of vegetables. It helps farmers to know how much the vegetables and fruits need the sun and waters. It helps to make sure the food security.
Singapore	Karthavyam (Dutiful citizens for SDG)	A hands on student diploma on public problem solving through the Sustainable Development Goals. The diploma is a 6 month programme with 4 pathways where children are taught via films, podcasts, and other media that can be easily shared. Classes involve experiential learning, designing localized initiatives, writing story books, watching films, and engaging with the community. A strength is that it uses visual mediums (filmmaking) to create a decentralized platform for knowledge sharing.
Singapore	Heka Leka	bring together for social cohesion, community building through education.
Singapore	Repair Kopitiam	Bring residents together to learn how to repair broken appliances in order to reduce waste. It also aims to reduce consumption, and also equip residents with employable skills. At the same time, it also preserves legacies of twilight industries (such as cobblers, etc.)
Singapore	Great British Bee Count	Individuals are encouraged to engage with bees (and biodiversity) by taking photos of bees and sharing it on a centralized platform. Individuals can also buy bee saving materials to plant flowers in neighbourhoods in exchange for photos of bees. A strength of the initiative is that it allows for data collection on bees. Additionally, it leverages pre-existing technology.
Singapore	Global Circular Economy Database	A database that captures circular economy initiatives and sharing the information on a central platform. A strength is that it can mobilize many different groups to contribute to the database without much effort. This database can then act as a learning platform for others.
Singapore	Edible cutlery	Cutlery made from wheat, rice, and sorghum. There are over 160 million tons of plastic cutlery used in India every year. An initiative sponsored by the Govt of India.
Singapore	horticulture along the banks of perennial rivers in India	The idea would be to replace plants by trees along the banks of perennial rivers in order to prevent soil erosion and to promote economic growth for farmers.
Singapore	Trash to Treasure (Free flea market)	A free flea market where personal items and belongings that are unwanted can be redistributed to those who need them or could better utilize them. A strength is that it's free for everyone, can be organised anywhere, and doesn't require any technology.
Singapore	Green Roofs	Planned and built green roofs and not just those green roofs that are imposed upon existing buildings. These green roofs can reduce energy use from air conditioning. Well built green roofs also collect rainwater and reduce the flow fast-flowing water, and also reduces the risk of flooding in flood-prone areas. Provides habitat for biodiversity.
Singapore	carpooling	encourage students and faculty members of a given university to use carpooling as much as they can
Singapore	Setting up of Wormery	The setting up of wormeries allows for the decentralization of food waste collection. Food waste is collected locally and composted locally using earthworms. The castings (worm poop) are used as fertilizers and they are sent to the community gardens.
Singapore	Smart Solar Charging	Electric car sharing initiative in Utrecht
Singapore	Skillsfuture SG	Decentralized education through multiple course providers and institutions, conducted on a governmental platform with government funding. A strength is that it leverages government budgets, which are much larger. Additionally, it sponsors and increases the educational level of the country.
Singapore	regulate diet	The aim is to encourage people to change their diet by promoting vegetarian options
Singapore	Environmentalist foundation of India	Volunteering opportunities for individuals to restore urban lakes and rural water bodies through community action. A strength is that it is simple and connects with people's volunteering aspirations.
Singapore	Sustainable Alternative Lighting (SALT) lamp	It is an environment-friendly and sustainable alternative light source that runs on saltwater
Singapore	Community in Bloom	Setting up of localized community gardens in Singapore. Around 2000 of such gardens have already been set up all over Singapore. Gardens are also managed by their own communities.
Singapore	Electricity productions from ocean currents	Production of electricity by the use of underwater turbines based on the difference of temperatures in water.
Singapore	Intel Make Tomorrow	Skills development in using microControllers and IoT for vocational institution students.
Singapore	Refugee crisis management	Using technology to help refugees like a message alert that can reach out to them
Singapore	Fresh Direct Container Farms	A Nigerian entrepreneur turned shipping containers into indoor governments, and employ mainly needy women
Singapore	Smartphone app to monitor energy consumption	Powershop is a company that provides an app platform that enable consumers to track the energy consumption of their home. The tracking is live and accounts for energy inputs from solar PV. The app also provides monetary incentives to reduce consumption by displaying \$ values supported from solar energy input which supports conscious consumption and transition to renewable energy.
Singapore	Solar-powered Water Purification	Used by local communities for water filtration and sanitation. Filtration system within a bottle which allows communities to use the water.
Singapore	Green Building Standards	Setting standards for new buildings construction and renovations
Singapore	App for plant identification	The app helps to identify trees, plants, and flowers. People who see unknown plants, they can take a photo using the app. It plays a significant role in educating people.
Singapore	AI driverless electric cars	To integrate AI INTO our transport system
Singapore	Palm oil-targeting activist organizations like People's Movement to Stop Haze	The seed initiative tries to promote the use of sustainable palm oil in the Singapore market by engaging both F&B sector (supply side) and consumers (demand side).
Singapore	Precious Plastic	A startup that provides open-source guides and designs for communities to create plastic recycling machines and tools. The startup provides support and guidance for anyone interested in creating such machines. A strength is that all the information is open sourced and it allows decentralized recycling initiatives to emerge.
Singapore	Youth Ki Awaaz	A decentralized online platform for people to write stories on social issues. It allows anyone to create a campaign and facilitate change. Additionally, stories are powerful in tackling global challenges and this platform allows anyone to participate.
Singapore	Wearable devices	Wearable devices for people's health



Workshop	Seed Name	Description
Singapore	Gaia Grid	An off grid farming community that uses crowdfunding and social media to create a self sustaining community. It co-ops tribal villages, weeds out social problems, and encourages organic farming.
Singapore	Gravity Light	Using gravity to create electricity
Singapore	Safe spaces for deep conversations on climate change	A NGO that trains facilitators to help facilitate home-based, friend networked conversations on climate change. This activates individuals to lead community actions.
Singapore	Street Feeders of KL	A regular gathering of volunteers to distribute perishable and non-perishable food to the homeless. This also helps increase the understanding on the background of the homeless. The homeless can also be linked to job opportunities. A strength is that this facilitates face-to-face conversations that help connect communities with the homeless. It also offers hope to the underprivileged.
Singapore	UN REDD+ Carbon Credit System in a Quirino Protected	To restore fragmented landscapes and promote planting of fruit trees (for food security as well) and provide subsidy to Farmers for being advocates of the protected area
Singapore	Sharks Fin Database	A centralized database that allows citizens to share the location and names of restaurants that serve sharks fin. This creates awareness of these restaurants and allows citizens to boycott or engage with the restaurants that serve sharks fin. A strength is that this is citizen sourced data that leverages existing technology and is low cost.
Singapore	No Straw Tuesdays	Plastic-lite started 1.5 years ago as a way for people to reduce and be mindful of their plastic consumption. Volunteer-run, self-funded group. Rolling out initiatives among communities to promote lifestyle changes. Taps into the power of social media to galvanise participants. 'No Straw Tuesdays', rolled out in schools one day a week.
Singapore	GrabHitch	A technology platform that connects non-taxi drivers and riders to facilitate carpooling in order to reduce the number of cars and fuel demands. This leverages existing technology and apps to reduce the number of cars on the road.
Singapore	Amsterdam Rain Proof programme	Harnessing urban water runoff for alternative products eg. beer and closing the water loop.
Singapore	Bitcoin Mining Heater for Homeless	Bitcoin mining releases lot of heat energy.
Singapore	Dog Poo Bag Station	Provide self sustainable and convenient way to encourage do owners to clean up after their pets, for pet owner to share their unused dog poo plastic bag with fellow pet owners, to clean up dog poo.
Singapore	Making of pet plastic bottles into t-shirts	Tzu Chi charity employs the use of disposed pet plastic bottles and upscale them into t-shirts and blankets, which are then donated to victims of natural disasters
Singapore	Lendor (app)	P2P library of things (e.g. household objects) that users can borrow, instead of buying for one-time use
Singapore	Innisfree Empty Bottle Recycling Campaign	Customers can bring used containers back to stall (up to 50 points redeemed), get discount on future purchases. Campaign uses statistics on how many bottles have been recycled and repurposed. Appeals to consumers, "feel-good" aspect.
Singapore	500 Women Scientists	Improve openness, equality in science in Latin America. Goal to create scientific culture, promote scientific literacy, embrace technology and sciences. Grassroots movement - get people to recognise the presence of female scientists in particular. Host social events on a monthly basis, invite individuals to chat, speed-dating style. Mentoring, going to schools and talking to girls about S&T, policy in government, does not seem accessible, sense of cultural inferiority (for the Old White Man), means of decolonizing academia and science.
Singapore	Swapaholic	Online clothes swapping platform. Participants bring in pre-loved, quality clothing in exchange for points that can be spent at clothes swapping events hosted around Singapore on a regular basis.
Singapore	Plastic Footprint Calculator	<a href="http://whatismycarbonfootprint.com/plastic-footprint">http://whatismycarbonfootprint.com/plastic-footprint</a> - Calculates an individual's plastic footprint, aiming to use information to educate and reduce usage of plastics.
Singapore	Plastic Bank (app)	<a href="https://www.plasticbank.org/what-we-do/">https://www.plasticbank.org/what-we-do/</a> - Turns waste into currency by incentivising individuals to collect plastics in exchange for rewards which are distributed and authenticated through the Plastic Bank app which uses Blockchain technology. Transfers values into the hands of those who collect plastic.
Singapore	Vegan/Vegetarian UN Environment Meals	Provide vegan/vegetarian options during meals at UN/INGO conferences and events to showcase that vegan/vegetarian meals.
Singapore	Local Water Commissions	Community-organizing in the event of a drought/water rationing, to pool resources, help less abled members collect water, draw on connections. Can also be applied to energy sharing and food security.
Singapore	Grab (app)	Ride-hailing app, expanded to GrabShare, GrabHitch, incentivise passengers by using cheaper prices as opposed to riding individually. Reduces fuel consumption, company can mobilize clean energy vehicles (e.g. electric cars).
Singapore	First climate change course in a Costa Rican University	Addresses lack of existing climate change education and communication in the country
Singapore	SECMDL	An alternative learning school for youth established by local youth in a community. A strength of this is that it is a decentralized, replicable, and self-sustaining project that can be transferred to other communities.
Singapore	Plant Diet/Veganism	include and promote more plant-based menus
Singapore	Sustainable Aquaculture	Integrates multi-trophic systems, using outputs (e.g. waste) of a species as inputs (e.g. food) for species up the chain. Also sources for local/indigenous species to breed in Singapore, to encourage Singapore's heritage, change tastes and preferences to reduce carbon footprint from food imports.
Singapore	Superwomarket	A supermarket/cafe designed by women scientists filled with products they selected. It will have: <ul style="list-style-type: none"> <li>- Products showing carbon/water footprint and relevant SDGs</li> <li>- Products with minimum wrapping</li> <li>- A breastfeeding and expressing space, which will also have a sit-in nurse who can check/give guidance for breast cancer</li> <li>- A communication space (cafe) for women to network, conduct events, etc.</li> <li>- A childcare space with a sitter where young children can play while the mothers are shopping or networking</li> </ul> It will provide a "safe environment" for women to share their expertise.



Workshop	Seed Name	Description
Singapore	Greening the GEO Conference	<p>The next GEO meeting will be more green. We must practice what we preach. It could potentially include: vegetarian/vegan meal options, remote conferencing options using conferencing robots (e.g. "Double")</p> <p>(This will be an inclusive option for persons who cannot travel, such as those like myself who cannot travel due to childcare, or persons with mobility issues), paperless, less air conditioning, sustainable hotel practices, smaller carbon footprint (less plastic), sourced by renewable energy</p> <p>The existing 2009 UN Environment guidelines (<a href="http://www.greeningtheblue.org/sites/default/files/GreenMeetingGuide.pdf">http://www.greeningtheblue.org/sites/default/files/GreenMeetingGuide.pdf</a>) could be updated through online consultations with the GEO authors (e.g. "what do you want to see in the next GEO conference?"), and then e-published together with GEO-6 as a spin-off product.</p>
Guangzhou	Reduce the consumption of wildlife	<ul style="list-style-type: none"> <li>- Reduce consumption of wildlife (e.g. do not eat wildlife)</li> <li>- Reduce the purchase of wildlife products</li> </ul>
Guangzhou	Light and Shadow Ocean Pavilion	<ul style="list-style-type: none"> <li>- The public should not visit the aquarium of the captive cetacean; (reduce the number of captive cetacean because captive conditions are not suitable for their growth)</li> <li>- The public could visit the Light and Shadow Ocean Pavilion (where physical visit could be replaced by Light and shadow technology)</li> </ul>
Guangzhou	Museum of environmental photography	- To build environment protection photography museum
Guangzhou	Sharing Community and say "NO" to waste	- Propose potential mechanism for sharing to promote sustainable development in cities.
Guangzhou	Cellphone sharing	<ul style="list-style-type: none"> <li>- Frequent replace of cellphones is not encouraged</li> <li>- Cellphone recycling is encouraged</li> <li>- Cellphone sharing is encouraged</li> </ul>
Guangzhou	Reduce the use of solid wood furniture	- Reduce the use of solid wood furniture
Guangzhou	Development and utilization of natural gas hydrate	- Natural gas hydrate resource is very rich, which could be used by humans for 1000 years. Currently, lots of resource spots are found and exploration tech is greatly improved; How to encourage all countries to explore natural gas hydrate in a clean manner should be a priority.
Guangzhou	Intelligent Green Building	- Intelligent Green Building is able to utilize natural spontaneous process (e.g. air convection) to reduce energy consumption.
Guangzhou	Anhydrous aluminum radiator	Technology which emphasizes the use of electricity instead of coal is an efficient approach to increase energy efficiency and decrease carbon emission. E.g. Anhydrous aluminum radiator
Guangzhou	Use of Big Data tech to change citizen purchase behavior	Big Data has significant impact on environment awareness promotion and consuming behavior by normal citizens.
Guangzhou	Distributed intelligent energy storage technology	- Distributed intelligent energy storage, energy internet, intelligent energy community
Guangzhou	Online intelligent detection of drinking water purification system	This initiative consists of following elements: Internet, online monitor, artificial intelligence, artificial manufacture, purification tech (e.g. physical filtration and chemical decomposition), big data and cloud computing
Guangzhou	Reduce water consumption in daily life	Residential wastewater could be recycled for other utilization (such as toilet and car washing)
Guangzhou	Tableware made of sorghum flour as substitution of disposable tableware	Tableware could be made of sorghum flour; Such tableware could be utilized as substitution of disposable tableware.
Guangzhou	Reuse and recycling of daily necessity packages	Package of daily necessities (e.g. make-up, shampoo etc.) could be reused and recycled.
Guangzhou	Self drink container	When customer brings drink container themselves at drink shop, they could enjoy discount. This could reduce the number of disposable container.
Guangzhou	Plastic limit and environmental court	To establish environment court
Guangzhou	Plastic limit in universities	University prohibit the use of disposable tableware and thin-plastic bag.
Guangzhou	Simplify packaging of express delivery	If packages of express delivery could be simplified, it is a way to reduce amount of waste.
Guangzhou	Reduce use of plastic, use environmental friendly makeup and packaging materials	This initiative recommends to reduce use of makeup which contains plastic molecules. It could be implemented in a similar way as the plastic bag limit in supermarket in previous years.
Guangzhou	Environment education	All the responsible people take efforts to promote environment education in regional areas with clear objective.
Guangzhou	Transfer air into fresh and clean water	After transferring, such water is fresh and clean, which could meet highest standards.
Guangzhou	Brain-computer interface	Collect EEG (brain language) in human brain and build corresponding database; Once there is brain wave, there will be corresponding computer language to enable robot action.
Guangzhou	MR Disaster Prevention	To promote disaster prevention education
Guangzhou	Decentralized distribution	Community Supported Agriculture, Farmers market
Bangkok	Global CEO alliance	The initiative is to get to the core of private sector engagement/establishing the value-proposition from the Sustainable Development Goals (what's in it for private sector)
Bangkok	Initiative on sharing economy	For example, platforms such as Uber, AirBnB, clothes swapping etc. There is growing movement where under-utilized resources are being used more efficiently – i.e., most cars sitting idle; this is expanding into all sorts of new areas and gets to the heart of SCP.



Workshop	Seed Name	Description
Bangkok	Innovation lab that functions as an incubator for ideas	To help scale-up small-scale innovation/ technological entrepreneurial ideas (i.e., recycling innovation idea for cans)
Bangkok	Green rooftops in urban spaces	Use to grow food, clean water, ....application of green infrastructure; these efforts could up hugely up-scaled
Bangkok	Rain water harvesting	Particularly in the urban context where there are fewer and fewer permeable surfaces...
Bangkok	Ethical fashion industry	-Use discarded fabrics and textiles from the fashion industry; - Use circular economy concept and applying it to the design, production, retail, and purchasing and of fashion products: addressing a range of issues including exploitation, fair trade etc. while tackling sustainable production and environmental protection.
Bangkok	Solar panel windows for skyscrapers	Massive renewable energy potential for the urban env; vast amount of glass in skyscrapers represents enormous potential for an emerging technology that turns windows into solar panels. (Yale 360: Transforming Buildings into Energy Producers)
Bangkok	Box-type solar cookers for rooftops	Relatively simple, low-tech, low cost
Bangkok	Big data and business intelligence	At scale to tackle Zero discharge of illegal chemicals/ dyes in the supply chain
Bangkok	Low-carbon initiatives	Climate Change Asia initiative launched at AIT – a pioneer initiatives in the region- helping to understand how vulnerable habitats can be restored.
Bangkok	Climate smart agriculture and community forestry	
Bangkok	Intelligent transportation systems	For major cities to tackle air pollution, resource efficiency, safety... fixed route software integrated in all cars, integrated scheduling systems, fully integrated CAD/AVL system,
Bangkok	Global public awareness campaigns	To counter some of the rhetoric that some government leaders are spreading regarding climate denial
Bangkok	Urban green infrastructure - urban parks connectivity	Deliberate urban planning and design that focuses maximizing connectivity of urban green space in including inner city parks; softening park edges and better connections to the peri-urban fringe
Bangkok	Green infrastructure for urban heat stress reduction	Encourage capital infrastructure improvement projects (such as more regular street-upgrades, community level heat-reducing practices like tree plantings, etc.)
Bangkok	Lowering the age of decision-makers	Tackle social barriers, address countries that have age limits. (Italy, France etc.)
Bangkok	Small scale renewable energy projects	Examples include residential solar panel projects, smaller hydropower plants
Bangkok	Innovating and strengthening traditional agricultural knowledge	Counter balance to the forces that are downgrading TKL; seeing soil as a living matter that needs to be cared for
Bangkok	Food systems approach - from upstream to downstream	Multi-sector engagement at every stage
Bangkok	Natural capital accounting	To link nature conservation and development impact and catalyze technological services (i.e., e-waste tracking)
Bangkok	Resource-oriented sanitation	Convert wastes in the waste chain back to agricultural inputs/food systems
Bangkok	Circular economy and extended producer responsibility	Reuse of e-waste, old-phones, etc.
Bangkok	Technology in renewable hydrogen	as an element of the circular economy
Bangkok	DIY waste management systems	Use recycled materials for furniture
Bangkok	Knowledge-sharing strategies	Use digital platforms to share ideas
Nairobi	Smart Energy microgrids	
Nairobi	Smart H2O	Smart H2OSM is a user-friendly app that is freely available to all citizens world-wide. With just one-click, it allows them to report leakages, violations and water waste very easily and in very little time. Through Smart H2OSM, citizens can partner with their water utility and be proactively involved in saving water.
Nairobi	Smart agriculture (productivity crops)	
Nairobi	Biogas (waste)	
Nairobi	Earth Observation	"Sanivation" and "locate it." Task force on high resolution spatial data to track defecolity in school, health, transport, and energy. The seed requires technology, evidence (??), and communication. Very simple app, upload to Airbus platform. The seed is just starting up in Norok County, Nairobi. The seed is innovative as it is a low-cost application and a global platform. Addresses SDGs 3, 4, 10
Nairobi	Education - connectivity of schools	Use technology to produce quality education. Use kindles instead of wastes and reduce paper use. Addresses SDG 4.
Nairobi	Affordable air quality monitoring	Low cost sensor devices
Nairobi	Crowdsourcing behavior with smart apps	
Nairobi	Products from plastics	Produce petroleum products from plastics, reuse plastics. Innovation from producing threads of 3D printing. This seed has a "microeconomy approach."
Nairobi	Awareness building	



Workshop	Seed Name	Description
Nairobi	Ecoflame - toilet that separates solid/liquid waste	Solid waste management system that recycles waste to produce biogas. This technology produces energy from compost. Portal toilets fit within houses. Waste is baked in a 90 degree parabolic mirror and turned into charcoal. Ecoflame has been in use for a while and has over 10,000 users in Naivasha (??). The product does not smell
Nairobi	Residential rooftop solar energy	Catalyst for creating social awareness for energy issues. Addresses SDGs 13, 9, 7, 11. This seed is gaining momentum globally. Example from Pham Binh (Vietnam), Durga Prasad Dawadi (Nepal), and Peter Mburu (Kenya)
Nairobi	Smart energy	
Nairobi	Rooftop rainwater harvesting	
Nairobi	Water/agriculture management in Iran (small grant program by GEF)	Water management Iran to address local community and health. The seed has many small projects to engage communities and farms to prevent dust and sand storms. Addresses SDGs 1, 6, 8, 17. The seed is already established and engaging with government and local communities. This seed is currently operating around the border of Iran and could scale up to neighbouring countries to address desertification. The seeds main weaknesses are its difficulty to link national government and local communities' civil society. Several actors are involved including the media, government, local communities, private sector, banks/investment.
Nairobi	Protected areas in Madagascar	Protected areas in the east of Madagascar for the Credit Carbon, reducing deforestation, and promoting smart climate agriculture. The seed addresses SDGs 2, 3, 6, 7, 8, 13, 15. Deforestation is prevented through alternative economic opportunities. The seed's main weaknesses include the need to promote across the rest of the country the idea of climate smart agriculture, and it is unclear if people will accept new ideas/ approaches. Actors involved include the rural population and local government.
Nairobi	Electric cars/Tesla and trucks	This is an established seed that addresses SDGs 3, 7, 8, 9, 11, 12, 13. It is based in EU, US, China, and some ME countries. The seed replaces diesel/gasoline vehicles. With the Tesla app you can get real-time info on the vehicle through the software integration in cars. Particularly promising is that Beijing sells more EVs than regular vehicles with a 40 per cent subsidy of the cost from the government. Three main weaknesses can be identified: (1) energy infrastructure issues if electricity generation comes from coal or fossil fuels, (2) congestion problems can just get worse, (3) rebound effect, (4) competition with e-bikes. Actors involved include business, consumers, and individuals. Superchargers, hydrogen batteries (and other tech breakthroughs) could make EVs faster and easier.
Nairobi	Innovative public transport	This includes e-ships for public transport and tourism. The seed addresses SDGs 3, 7, 8, 9, 11, 12, 13. It is currently in start-up phase and based in Iraq. The ships are to be cheaper for consumers, energy efficient, faster, can alleviate road accidents, reduce congestion, and improve safety. Weaknesses include congestion, potential conflict with water, could conflict with pollution of air, water, waste. Actors involved include business, govt, and individuals.
Nairobi	Car and bicycle sharing	This addresses SDGs 3, 7, 8, 11, 12, 13. It is established and in use in at least hundreds of cities (Mobike in 110 cities). The seed uses clean energy, is a low cost solution, and easy to implement/upscale. Major weaknesses include the need for an app/smart phone, too many bikes lead to crowding and accidents. Enabling conditions include infrastructure and critical mass; proper education and respect for cultural issues, many co-benefits for integration with other smart-city initiatives.
Nairobi	E-pay initiatives/cashless systems	This seed addresses SDGs 5, 9, 8, 12. It is established in some countries and a start-up in others, but examples can be found globally. It is innovative as it adds convenience, reduces the need for cash, and allows for easier exchanges. There is a global megatrend towards this seed and can help with sustainable consumption and production. The seed's main weaknesses are waste and the increased consumption of solid waste.
Nairobi	Reduce packaging	Optional packaging when purchasing goods, package free shops, plastic bag bans, taxes. This seed addresses SDGs 2, 6, 9, 11, 12, 13. It is at the start-up stage and examples can be found in Dresden, Germany and other places. It is innovative and beneficial as it includes: (1) biopackaging from agricultural waste which closes system loops, (2) reduces food waste, (3) incentive alternatives, (4) visible and a good communication tool. It is a very scalable solution. There are three main weaknesses: (1) bulk/wholesale - health/sanitary issues, (2) alternatives to plastics could be worse and potentially increase the amount of bags used, (3) compostable/biopackaging needs inputs that add stress to agriculture. Actors involved include citizens and governments, business, urban shops and retailers.

## Workshop Seeds-Based Visions



Workshop	Pathway	Description
Bangkok	Smart Communities (Decentralized Solutions focused)	<p>This alliance proposed a vision and an approach for developing what they described as “smart communities” – a new and radically different vision for future built environments. The basic premise of the envisaged future presented here, is to challenge the conventional model and principles of urbanism and the traditional processes through which existing cities grow, evolve and function. The idea which builds on the so-called New Urbanism concept seeks to address the disconnection between the current models of urban/ city-planning and interactions at the peri-urban interface that characterize today’s-built environments. For example, the group aimed to address the inefficiencies with urban and suburban sprawl, simplistic and counterproductive patterns of metropolitan growth, perverse incentives around infrastructure investment, rural-urban migration etc.</p> <p>The proposed Smart Communities Alliance brings together several common elements and mutually reinforcing attributes that lead to development of smarter and more sustainable communities. The main ‘seeds’ or game-changers ideas that are part of this alliance include: circular economy, sustainable peri-urban agriculture, microfinancing, intelligent and sustainable transportation systems, and public/ community awareness. This alliance proposes to address all five regional environmental challenges identified. The group felt that the Smart Communities vision was relevant to all 17 Sustainable Development Goals but in particular those related to 1, 3, 6, 7, 11, 12, 13 and 17 with an emphasis on the following synergies: smart changes, behavioural choices, sustained investments in R&amp;D, innovation and clean technology, political and social adaptability (and adaptive governance). Finally, as a point of clarification, the group indicated that the intention of the Smart Communities was not to convert existing large cities, but rather, to shape future build environments and areas that are currently in the early stages of urbanizing.</p> <p>The Smart Communities Alliance received a final score of 17 and succeeded in addressing a number of Sustainable Development Goals and leveraging synergies between urban sustainability objectives and sustainable (or eco-centric) urban infrastructure investments. One of the most important enabling conditions for bottom-up approaches to succeed is sustainability, and the need for gap analysis. Here, the alliance was able partially successful, however a major shortcoming was a lack of discussion on the need for social and political acceptability.</p>
Bangkok	Smart Future (Lifestyle Change focused)	<p>The second alliance in the visioning exercise, proposed a holistic approach to bringing together and catalyzing large-scale behavioural changes through a process of “influencing the influencers”. Here, the alliance stressed the importance of finding a new delivery mechanism to identify who the main private and public sector leaders (or influencers) are to communicate a single value proposition about the Sustainable Development Goals.</p> <p>As a secondary approach, the alliance discussed the need to target consumers, and to leverage the opportunities brought about through big data/ data revolution. The alliance suggested that the Smart Futures vision was relevant to all 17 Sustainable Development Goals and addressed all five regional challenges. The common attributes of this alliance include: disruptive innovation technologies (e.g., smartphone applications, cloud computing, social networking), data-driven decision systems, sustainable/ smart cities, agro-economy solutions, highly inclusive/ people-centric initiatives, integration, meaningful private-public partnerships, and results-based performance to improve decision-making processes.</p> <p>The Smart Futures Alliance received a final score of 9 from the SAP and despite some promising game-changing ideas, and several areas of convergence, the alliance was ultimately unsuccessful as they rolled a higher dice. Reflecting on the process, the group found that the principal barrier was that their ideas were too broad and that their main inputs were spread across too many competing (and sometimes mutually exclusive) objectives.</p>
Bangkok	Planet Tech (Global tech focused)	<p>The third and final alliance was the ‘Planet Tech’ group presented a futuristic, hyper technology rich vision of the future with a focus on planet altering technologies and of Earth systems including: geoengineering/ carbon capture storage technologies, mesopelagic exploration, planetary tech, and artificial intelligence. The proposed vision was predominantly geared towards addressing macro/ planetary scale environmental challenges including climate change, biodiversity and complex atmospheric-ocean related issues. The common thread for this alliance was the potential for plenary harm and conversely opportunities for transformational ‘planet-alerting’ solutions. The main Sustainable Development Goals that the Planet Tech Alliance was targeting include 12, 14 and 17.</p> <p>Several institutional obstacles and gaps were identified including mechanisms to circumvent conflict, intergovernmental and global governance issues (e.g., UN Security Council issues).</p> <p>The Planet Tech Alliance received a final score of 8 and struggled with a scenario that was overly complex, far too doomsday oriented and ultimately not inspiring or compelling enough. Their high dice roll meant that their scenario also did not succeed. The group acknowledged that the overall concept was not conducive and/or accessible enough to attract meaningful political engagement and that they needed to refine their technology dominant strategy.</p>



Workshop	Pathway	Description
Guangzhou	Proposal 1	<p><b>How are the seeds combined?</b> The habitat is essential for survival. In order to ensure coexistence between humans and animals, new and appropriate links must be developed.</p> <p><b>How does the proposal help realize the pathway – toward what SDGs?</b> To provide better habitat condition for animals, which do good for biodiversity.</p> <p><b>What policy changes are needed to help realize the proposal in this pathway? How can policies help deal with any trade-offs related to other SDGs?</b></p> <ol style="list-style-type: none"> <li>1. Public awareness of animal protection</li> <li>2. Laws and regulations for animal protection</li> </ol>
Guangzhou	Proposal 2	<p><b>How are the seeds combined?</b> These seeds have similar features, which could share similar support on policy and addressing mechanism.</p> <p><b>How does the proposal help realize the pathway – toward what SDGs?</b> Nowadays online shopping produces large amount of plastic waste, which is difficult to be either recycled or degraded and also causes significant environmental burden. By limiting use of plastic and solid wood furniture, negative environment impact caused by these could be reduced. What policy changes are needed to help realize the proposal in this pathway? How can policies help deal with any trade-offs related to other SDGs?</p> <ol style="list-style-type: none"> <li>1. Implementation of Plastic Limit.</li> <li>2. Waste management and categorization.</li> <li>3. Concrete policies and regulations need to be developed under framework of environment protection law.</li> <li>4. Public awareness of environment protection</li> </ol>
Guangzhou	Proposal 3	<p><b>How are the seeds combined?</b></p> <ol style="list-style-type: none"> <li>1. Constructions and facilities are everywhere in the community, advanced energy techs can be applied.</li> <li>2. Model sustainable community is easy to scale up, copy and paste.</li> <li>3. Communication and cooperation between communities, cities and different countries are helpful to combine all the seeds.</li> <li>4. Community could be the “lab” for green tech.</li> </ol> <p><b>How does the proposal help realize the pathway – toward what SDGs?</b> This proposal could help achieve following goals: Goal 3: Ensure Health and Well-being Goal 4: Quality Education Goal 6: Clean Water and Sanitation Goal 7: Affordable and Clean Energy Goal 9: Industry, Innovation and Infrastructure Goal 11: Sustainable Cities and Communities Goal 12: Responsible Consumption and Production Goal 13: Climate Action Goal 17: Partnerships for the Goals</p> <p><b>What policy changes are needed to help realize the proposal in this pathway? How can policies help deal with any trade-offs related to other SDGs?</b></p> <ol style="list-style-type: none"> <li>1. Campaigns to raise public awareness</li> <li>2. Cut land and tax policy</li> <li>3. Public fundings from government</li> </ol> <p>These aspects could help increase energy efficiency.</p>
Nairobi	Behavior change	<p>Use seeds for ISO-like framework to standardize sustainability for national governments (i.e., standards for waste, recycling, packaging, etc.)</p> <p>Policy changes needed/trade-offs related to other SDGs:</p> <ul style="list-style-type: none"> <li>- UN resolution</li> <li>- national level legislation</li> <li>- how to sell to national govts - competitive advantage, better business opportunities for leading companies</li> </ul>
Nairobi	Global Tech	<p>Proposals:</p> <ol style="list-style-type: none"> <li>1. healthy people</li> <li>2. smart cities conference</li> </ol>



Workshop	Pathway	Description
Nairobi	Decentralized Solutions	<p>Consists of climate smart agriculture, protection of forests, healthcare and promotion of gender equality</p> <p>Seeds are combined with guidance from national/local committees. SDGs addressed: 1,3,10,11,13,15,17,16</p> <p>Challenges: linkages between national and local community/ potential risk to marine life, and sending messages to high-level policy makers and media to increase public awareness</p> <p>Policy changes needed/trade-offs related to other SDGs:</p> <p>Potential risk to marine life is there is an increase in agricultural fertilizer. Need for strengthening link between local governments and communities. Inviting investment from private sector. Need to work across silos between healthcare, agriculture, forest protection. Need to identify and engage all stakeholders to increase public awareness. Important for high-level policymakers to understand local activities - GEO can help facilitate this.</p>
Singapore	Alternative energy solutions to promote mixed land use	Ppps lock in guaranteed customers for the solar farm; drones can be used for solar farm citing; citizens can help monitor operations through iterative feedback loops
Singapore	Smart ag systems for sustainable development	The tech seeds we came up with can support the urban ag and community indigenous knowledge in the existing seeds.
Singapore	Appification for Everyday Lifestyle Changes	Cover different aspects of daily life
Singapore	Straw-lite Campaign 'Same Taste, Less Waste'	Builds on Straw-lite Campaign to extend to local businesses and eateries, getting eateries in Singapore to not give out straws as a default, working on various zones, to approach eateries to reduce straw usage.
Singapore	Sustainable Urban Living	Green buildings are used for urban farming. These urban farms produce edible cutlery as well as food. Biomimicy technology and ride sharing further promote the community's sustainability
Singapore	No impact on the environment	They can be implemented in the same institution, namely the university or a private company
Singapore	Change from Consumers to Community	All relate to sharing rather than consuming and building communities
Singapore	Energy efficient community	Green building standards require a wide set of sustainability building and renovation rules, and require roofs to be used by solar cooperatives.
Singapore	Sustainable Urban food production and consumption	Both seeds reduce waste from food consumption, and address sustainable production of food.
Singapore	Community resilient gardens	Goals: SDG 10, 2, 12, 13, 3, 8, 6. The proposal aims to create synergies between the different seeds proposed by incorporating different metrics and initiatives of environmental sustainability with the fair employment of employees that are mentally challenged.
Singapore	A Containerized, Modular, Sustainable City	Each of our seed in this proposal address a specific urban city challenge, with the function/technology of the seed being transformed into to create a transportable container module which makes up the building blocks of a sustainable city.
Singapore	Urbanites (engaging citizens in community environment action)	<p>Create an international cities platform online where data and environmental action is aggregated. Multiple features are included on this platform, including environmental education, citizen information reporting, enforcement, skills education embedded in circular economy concepts and also logs/pins where activities are for the nearby communities to participate in. SDG 17 is fulfilled through multiple partnerships</p> <ol style="list-style-type: none"> <li>1. Safe space conversations to tie sustainability to very local impacts (SDG 13)</li> <li>2. After activating these citizens, they contribute by engaging with this online platform. They can choose to be active citizen information providers, signing up for skills education etc... (SDG 12, 11, 4)</li> <li>3. The platform is not a passive platform but actively engages experts and practitioners. E.g., citizen reporting of biodiversity can be linked to Researchers; citizen reporting of vehicle or water pollution is linked to regulatory enforcement officers, after finishing skills education they can provide paid services (SDG 3, 4, 8)</li> <li>4. Education arm of the app provides both environmental and skills based education (aka udeMY but specialized in environment such as circular economy, repair, waste management, composting skills etc) (SDG 4, 9)</li> <li>5. Aggregation of multiple community initiatives, including waste reduction, plastic pollution, biodiversity, poverty and hunger (SDG 1, 2, 15, 14) learn from different cities and communities as everyone will upload their initiatives to this platform</li> <li>6. App enables easy access to action</li> </ol>



Workshop	Pathway	Description
Singapore	500 Cientificas (500 Women Scientists)	Getting people to know female scientists (perhaps due to our family-oriented, traditional culture female scientists will be perceived as more approachable, as most people identify with the "advice of a mother or a sister". This will help create a local science culture and improve scientific literacy. By working with other seeds we can increase the reach of female scientists, motivate women to incur in traditionally male-dominated fields, and improve equality and access.
Singapore	Off Grid Rural Development	<p>Gaia Grid is the foundation of the seed proposal - crowdfunding from social media to purchase degraded non-forested land. Regional farmers are mobilized to do organic farming on the land. Volunteers from the community that need jobs and skills development are invited to help. Farm uses off-grid clean energy. Volunteer programme is set up to develop framing skills that can be used for future integration back into society and explicitly addresses social issues such as alcoholism and drugs that plague the neighbouring community. (SDG 1, 2, 3, 7, 8, 12)</p> <p>By connecting to additional seeds we achieve extra SDGs synergistically:</p> <ul style="list-style-type: none"><li>- Environmentalist foundation of India: explicitly uses land and water restoration projects and tools (SDG 6, 15)</li><li>- SECMDL; Karthavyam; Youth Ki Awaaz: Alternative education which provides bottom-up experiential learning and skills development through mediums like story-telling, filmmaking and using local issues and indigenous local knowledge and perspectives (SDG 4, 18)</li><li>- Safe Spaces for Deep Conversations on Climate Change: Introducing climate change perspectives into community conversations using issues that are very relevant to the community to bring abstract global debates into a local context (SDG 13, 17)</li><li>- Watly: Bringing access to technology to rural areas in order to give communities access to global networks (SDG 9)</li></ul>



### Climate CoLab Semi-Finalists

Proposal	Description
<b>C'SQUARE - Urban Comfort Rating</b>	C'SQUARE is an online-based application with the objective of empowering citizens by rating places in urban areas concerning their comfort level (thermal comfort, air and noise pollution, security, safety and beauty/cleanliness) and proposing solutions for solving trade-offs to minimize its impact on the environment.
<b>Youth Informing Communities on Climate Change Adaptation through building homes</b>	We are putting forward a strategy encouraging youth to lead an environmentally efficient, educational strategy through the expansion of housing. The solution will promote environmental education with the skill to adapt to future issues in First Nations communities in Canada.
<b>An innovative model harmonizing ecology, emotions, and economy of the villages</b>	A model Ecovillage showcasing fulfilment of the village community needs of food, water, waste, and energy while meeting the maximum SDGs
<b>Local organization for the promotion of environmental data analysis</b>	This proposal proposes the implementation of local agencies that address this problem in a systemic and proactive way, working in conjunction with government agencies, academic institutions and different groups of civil society.
<b>Global complementary currency pegged to the production of organic living biomass</b>	The Organic Monetary Fund, set up as a division of the International Monetary Fund, will help to achieve almost all SDGs in record time
<b>Adding value to all waste at source through blockchain technology and IoT</b>	Recyclebot is a blockchain-based waste management platform that allows any waste buyer to source specific waste directly from the producer, giving you the ability to buy, sell and reduce waste wherever you are, when you want. Unlike landfills, Recyclebot provides an affordable, fast and safe way to add value to all waste right where it is generated.
<b>Synergistic Solutions Global Network</b>	Networking existing resources and engaging women and youth to deliver proven solutions to address ten Sustainable Development Goals.
<b>Leo Leo Eco-Transport</b>	Leo Leo Eco-Transport aims to foster economic empowerment and promote food security while ensuring sustainability in Arusha city. Leo Leo Eco-Transport is proposing a visionary and innovative synergistic solution to sustainable development of food security, reliable access to solar energy utilization, economic empowerment, employment opportunities and climate change that affects the surrounding environment.
<b>Beekeeping as mechanism of biodiversity conservation and livelihoods improvement</b>	Alohen, partnering with Barefoot College, will establish adoption of beekeeping practice in Tanzania. Following its expansion strategy, Barefoot will further develop the project in Madagascar, Liberia, India and Pacific Islands, through its network of training centers worldwide. The main objective of the project is to create conservation awareness, empowering on the modern beekeeping methods, targeting women from rural areas and supporting them by creating local social enterprises based on bees' byproducts. Such project was initiated by BC in Zanzibar in 2015, creating the B.Barefoot Honey brand to provide trainings and markets for local women beekeepers. Replication was initiated in India in 2016.
<b>New clean energy tech will reverse climate change, eliminate world poverty</b>	Disruptive 0E energy tech works better than fossil/nuke at a better value, based on a new, previously undocumented aspect of physics.
<b>Media houses and institutions for communication awareness on the 17 SDGs</b>	Media Groups are mainly associated with local political issues and propaganda, rather than ensuring communication awareness on the 17 SDGs.
<b>Binder-less board made from coconut husk and sugarcane bagasse</b>	Ecovon are developing sustainably sourced, newly engineered wood made from coconut husk and sugar cane bagasse better for people and planet.
<b>Culturing the future with permaculture</b>	Build a physical Permaculture Resource Hub. A space where people can network with individuals and projects, as well as catalyze community organization and action. Our mission is to build resilience at the personal, household and community levels while creating thriving examples of abundance based on ecological wisdom.
<b>Climate protection by the elderly</b>	A brief, the elderly plants a fast growing fruit bearing tree rich in proteins and minerals. Once the tree starts bearing fruits, these fruits are then distributed in the market by either his children or son in laws. His children will be given an incentive of Rs 100 for the work of transporting the commodities to the government market. Once the government procures the fruits it distributes it to the anganwadis, orphanages and old age homes free of cost under ministry of social welfare scheme.
<b>ClimeDoc to achieve SDGs</b>	A documentary on impacts of climate change significantly contributes promotion of appropriate actions to achieve SDGs in developing nations
<b>Cut out red meat to pause climate for 25 years</b>	Eliminating grazed animal consumption will buy 25 years to fix emissions and will profoundly benefit 7 SDGs and 5 Planetary Boundaries
<b>Biochar electrode for the recovery of acid mine drainage produced by Tailings</b>	Tailings have a real potential for contamination of ecosystem told the relaxation of metals and metalloids that should manage adequately.
<b>ClimateCoop</b>	Blockchain based collaboration and governance platform enabling dynamic community development and project formation for SDGs, e.g. ClimateAction
<b>Global waste reduction and climate change slowdown through systemic approach</b>	We're intended to create a holistic systemic approach and processes on waste reduction which is easily adaptable to any country.
<b>Transforming plastic garbage into plastic timbers to preserve forests</b>	A solar powered extrude machine that uses innovative technology to transform plastic garbage into plastic timber to reduce deforestation.
<b>System approach for greening the conventional agribusiness</b>	Alliancing Green producers and green consumers for green future
<b>Acacia: Answer to climate change, economic empowerment and food security in ASALs</b>	The adoption of acacia Senegal tree species/Licorice as an agroforestry system for the benefit of environment and populations in ASAL areas.
<b>Business plan for production and marketing of compost from urban solid wastes</b>	Converting urban solid wastes into compost forms will have social, economic and environmental benefits; and helps to reduce GHG emissions
<b>Youth Climate Leaders (YCL)</b>	Young people traveling the world and working together to learn more about climate change and start their careers as climate leaders
<b>Framework for community-based sustainable development</b>	A modular sustainable development framework for communities that is cognizant of the synergistic nature of infrastructure and society.



Proposal	Description
<b>Waste, a source of resource-learn to empower</b>	This project utilizes poor women affected by dumped waste by providing earning source at the same time preventing production greenhouse gas.
<b>Living Energy - connecting science, design and nature to light up our world</b>	Living Light is an atmospheric lamp which harvests its energy from the plant living next to the lamp itself. The light of the lamp is produced by 'plant microbial fuel cell technology': energy generated by bacteria in the soil which release electrons while breaking down organic compounds of the plant. These collected electrons, for which we have created a storage mechanism, produce enough energy to light up the LED lights for about an hour in the current phase of development. Because the Living Light symbiosis and extra-ordinary lamp, we have given it an extra-ordinary switch: by softly stroking the leaves transforms this ordinary plant into a Living Light.
<b>An environmental conservation approach to handling oil and gas in Uganda</b>	Development of oil deposits in an environmentally conscious manner
<b>Land for life: an alternative to slash-and-burn in the world's rain forests</b>	"Guama", an integrated agroforestry model, is transforming family livelihoods, saving rain forests; restoring degraded soils and landscapes
<b>Population control</b>	Population control solves EVERY identified problem facing humanity. You don't get more synergistic that that.
<b>Potential for zeolites for conserving moisture in drought prone areas of Africa</b>	Moisture conserving ability of Zeolite minerals can be exploited to enhance crop and tree production in drought prone areas of Africa.
<b>Leveraging telecommunication for decoupling SDGs using a whole systems approach</b>	Building an ICT-led citizen movement to address some of the Sustainable Development Goals and climate action from the bottom up.
<b>Adapting the indigenous approach to climate change adaptation and mitigation</b>	The project is dedicated to emphasizing the indigenous adaptation and mitigation techniques adapted by local communities in responding to climate change issues.
<b>Solar based poly-generation system that can provide power, heat, and clean water</b>	Our system uses Solar concentrators to provide Power, Heat and clean water at 1/3rd the capital cost of SolarPV and has no disposable costs.

