

Science-Based Pathways for Sustainability

A Future Earth initiative

Background to the Science-Based Pathways for Sustainability Initiative

The environmental and societal challenges facing the world today act at multiple geographical and temporal scales and are inter-related in complex and often unseen ways. Decision-makers no longer have the luxury of tackling individual economic or societal issues without considering environmental concerns and vice versa. The 2030 Agenda for Sustainable Development was adopted by all United Nations Member States in 2015 with the stated aim of providing a common, integrated global framework for peace and prosperity for people and the planet, now and into the future. At the core of the 2030 Agenda are 17 Sustainable Development Goals (SDGs). These goals were developed as an urgent call for action by all countries, and are the most ambitious set of objectives ever set at a global level. However, while progress has been made by governments, civil society and businesses around the world to meet the goals, no country is currently on track to achieve all SDGs and there is still much to do over the next decade to attain Agenda 2030 (Sachs, Schmidt-Traub, Kroll, Lafortune, & Fuller, 2018).

The 17 SDGs are highly ambitious and interrelated so their achievement requires approaches that take into account two key factors. Firstly, achievement of the SDGs will require explicit recognition of the embedded nature of the SDGs (Figure 1). In particular, economy and society rely on the resilience of the Earth's biosphere, and as such, four SDGs, i.e. SDG 6 - clean water and sanitation, SDG 13 - climate action, SDG 14 - life below water, and SDG 15 - life on land, play a central role for achieving all the other SDGs (International Resource Panel, 2015). This group of SDGs is referred to here as the 'Life-Supporting SDGs'. Secondly, achievement of the SDGs requires recognition of the complex spatial and temporal dependencies that exist between them (Nilsson et al., 2018). These dependencies ensure that measures employed to achieve one SDG are likely to engender either positive effects (synergies) and/or negative effects (trade-offs) on measures employed to achieve the other SDGs. Thus, in making decisions on the manner in which SDGs can be achieved, there is a clear need for approaches that enhance synergies between SDGs, while limiting trade-offs at different temporal and spatial scales.

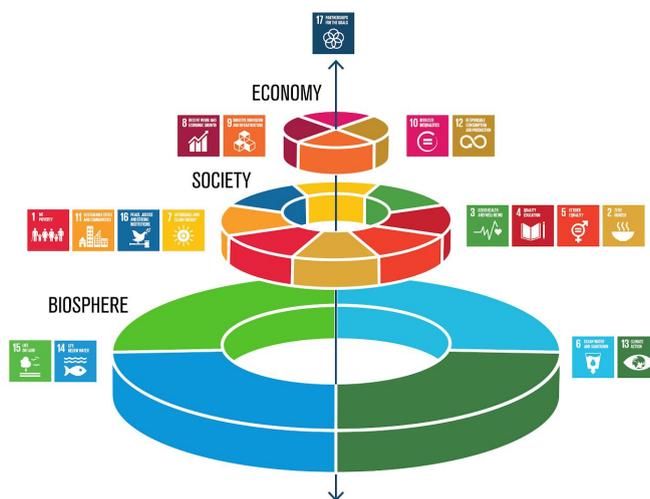


Figure 1: The SDG "wedding cake" illustrating the interconnected nature of the SDGs
Source: Stockholm Resilience Center

The development of integrated pathways¹ to achieve the SDGs is an opportunity to explore the interactions between the SDGs, including synergies and tradeoffs, in a systematic way and to

¹ In the context of this initiative, "integrated pathways" mean that pathways for one of the life-supporting SDGs take into account (i) interactions with other SDGs, including tradeoffs and synergies and (ii) interactions at multiple scales. For example, multi-scalar interactions might consider how a designed pathway for biodiversity in country X interacts with (a) multiple sectors like industry, health and well being and/or (b) geographical scales like a neighboring country, region etc.

identify the key levers of action and barriers to change, which exist at various levels. To be successful in light of the factors identified above, and thus generate crucial knowledge for decision-makers and various stakeholders on SDG achievement, the pathways developed as part of the Initiative take the life-supporting SDGs, given their foundational nature for the achievement of the other SDGs, as the entry point, and analyse synergies and trade-offs with other SDGs. The development of pathways also involves a diverse range of stakeholders to include a variety of expertise and perspectives. Finally, pathways need to be conceived so that they can be subsequently compared and analysed at different geographical scales to allow identification of additional trade-offs and synergies across regional and national boundaries.

Objectives

To help decision-makers implement the SDGs and move beyond aspirational targets, the Science-Based Pathways for Sustainability Initiative intends to facilitate the co-design of integrated pathways to achieve the four Life-Supporting SDGs at the national, regional, and global levels, while accounting for the full set of SDGs.

The overall objective of the Science-Based Pathways for Sustainability Initiative is to foster integrated and transdisciplinary² approaches that will contribute to knowledge-based decision-making at different scales, that supports the achievement of the SDGs within a resilient, life-supporting Earth system.

The specific objectives of the Science-Based Pathways for Sustainability Initiative are as follows:

- Build, strengthen and connect national, regional and global research communities and links with other stakeholders through transdisciplinary synthesis efforts.
- Generate knowledge to inform policy debates and dialogue and contribute to the development of a shared vision among scientists and stakeholders on societally urgent themes related to the SDGs.
- Influence research agendas by identifying critical knowledge gaps and needs for transdisciplinary efforts in sustainability research, while mobilizing research communities around key research questions.

The Initiative, which is coordinated in three phases (*see timeline below*) by the Future Earth Secretariat, is being driven by the Future Earth science community . This ensures the mobilization and synthesis of sound scientific knowledge while benefiting from Future Earth's vast disciplinary and geographical reach.³ Through a series of national (and/or subnational), regional and global workshops the Science-Based Pathways for Sustainability Initiative mobilises natural and social scientists, humanities scholars and stakeholders to deliver key knowledge and perspectives on different possible pathways to reach targets for a specific topic. The Initiative analyses the risks and uncertainties associated with the different pathways, the implications of different pathways for all other SDGs, and the levers for action.

The Initiative uses targets for the Life-Supporting SDGs as the entry point for pathway development. Targets have the potential to be strong tools to gather momentum, raise awareness and promote action, although successfully implementing such targets through transformative change has become one of today's greatest challenges. The targets used as entry points in the

² Transdisciplinarity is characterised by the implication of non-academic actors in the research process (see Mauser et al., 2013) as opposed to interdisciplinarity (collaboration between scientific disciplines only).

³ The core of the Future Earth network is made of the [Global Research Projects](#), [Knowledge-Action Networks](#), [Regional and National Networks](#).

Initiative are either: (i) chosen from existing policies or strategies that have political and scientific buy-in; or (ii) developed prior to the creation of pathways as part of the Initiative if there are no relevant existing targets.

Box 1: Piloting integrated biodiversity pathways in France

France serves as the pilot country for the Initiative. The first workshop to be held at a national scale will take SDG 15 ('life on land') as an entry point to identify integrated pathways for achieving national biodiversity-related objectives and targets. The workshop will bring together a variety of scientists and stakeholders with expertise in biodiversity and land science, as well as on direct and indirect drivers of biodiversity loss. Its scientific organizing committee is comprised of the main national biodiversity research institutes.

The 2050 vision

The 2050 vision for biodiversity, adopted by the Convention on Biological Diversity (CBD) in 2011, envisions a world of "living in harmony with nature" where, "by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people." In order to achieve this vision, Europe's ecological footprint needs to decrease to 2.2 hectares/capita as compared the current 5.1 hectares/capita by 2050 (Rounsevell, Fischer, Torre-Marin Rando, & Mader, 2018). For this to happen, major social and economic transformation will need to be undertaken to decouple economic growth and biodiversity degradation by 2030.

The 2030 objective

In 2016, France adopted a biodiversity law setting the objective of "no net loss of biodiversity" by 2030, which is in line with the 2050 vision. This will serve as the overall objective analysed and discussed during the workshop through a backcasting scenario exercise. To keep the scope of the two-day workshop feasible and realistic, the scientific committee agreed to focus on three of the main direct drivers of biodiversity loss: habitat degradation, invasive alien species, and pollution.

Co-creating integrated pathways

During the workshop, the 30 participants from science and practice will jointly discuss and identify integrated pathways for society, policy and science to achieve the 2030 objective of "no net loss of biodiversity" in France. In doing so, they will consider various types of interactions with other relevant SDGs, including synergies and trade-offs. This includes goals on potential drivers of biodiversity loss or conservation/restoration, such as SDG 2 (zero hunger), SDG 9 (industrial innovation and infrastructure), SDG 12 (responsible consumption and production); but also goals that could be impacted by the achievement of the 2030 objective, such as SDG 3 (good health and well-being), SDG 6 (clean water and sanitation), or SDG 8 (decent work and economic growth).

Workshop outputs

The insights from the workshop will be published as a report that is both accessible for science and policy. The report should also be designed to feed into the development of the *Stratégie Nationale pour la Biodiversité* (SNB3), which will be finalised in late 2020 or early 2021, as well as the CBD post-2020 biodiversity framework.

Workplan and timeline

Our ambition, within the next two years is to launch national initiatives in at least ten different countries, and to plan two regional integration workshops. The Future Earth Secretariat is working with several National Committees of Future Earth and other partners to see where these workshops could be organised locally, along with the appropriate fundraising efforts. The three phases of the Initiative are as follows (Figure 2):

- **Phase 1 (from 2019)** - National workshops, aiming to produce synthesis products on the pathways for reaching specific, locally-relevant sustainability targets by taking into account interactions between the SDGs. They bring together and build on existing research and policy initiatives. This work is initiated by local science communities including the National Committees of Future Earth and includes:
 - Thematic workshops taking Life-Supporting SDG-related challenges relevant to the local context, such as biodiversity, land, water or ocean, as entry points.
 - Transversal workshops integrating the outcomes of thematic workshops, including synergies, tradeoffs, risks, and interactions between the different pathways.
 - Cross-scale interactions (e.g. the impact of targets and pathways at the national level on other countries and regions' ability to achieve the SDGs) as a key area of investigation.
- **Phase 2 (from 2020)** - Regional workshops aimed at discussing and synthesizing national workshops outcomes, including analysis of cross-scale interactions between national pathways and targets and the definition of regionally-relevant pathways. This work will be initiated by Future Earth's regional committees, regional centers, and the regional networks of Global Research Projects and Knowledge-Action Networks.
- **Phase 3 (from 2022)** - International workshops aimed at discussing and synthesizing local and regional outcomes and identifying cross-scale interactions between targets and pathways. This work will be led by Future Earth's Global Research Projects and Knowledge-Action Networks.

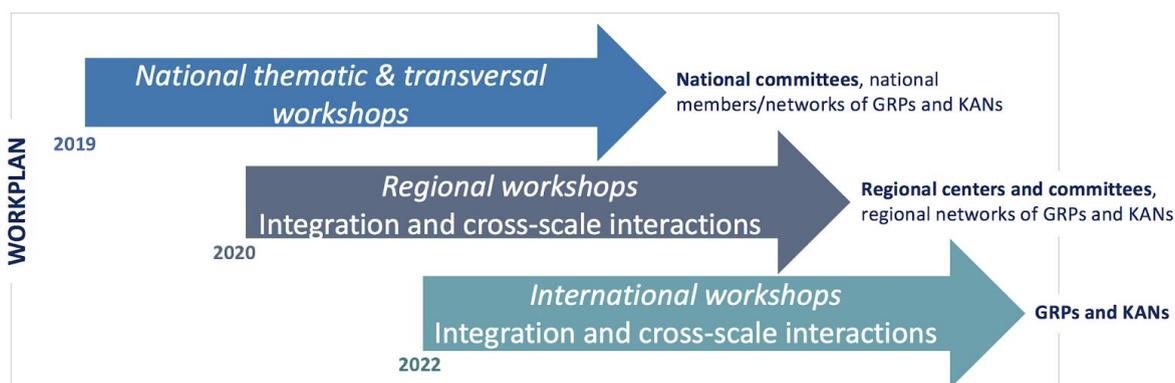


Figure 2: Workplan for the Science-Based Pathways for Sustainability Initiative, with on the right envisioned roles for each entity of the Future Earth community: Global Research Projects (GRPs), Knowledge-Action Networks (KANs), National committees and Regional Centers and Committees

Methodology

The Science-Based Pathways for Sustainability Initiative will achieve its objectives through the following activities that will ensure a broad engagement with research communities, policy-makers and civil society:

1. **Interviews** with key scientists and stakeholders before and after the workshops to select priority objectives and targets to treat in the workshops, and to identify relevant synthesis outputs from the process that would be useful for stakeholders.
2. **Scientific workshops** which will include researchers and a variety of relevant stakeholders as appropriate for the selected themes and which will be the main forum for exploring interactions between SDGs and developing integrated pathways.
3. **Dissemination activities** with policy-makers and stakeholders to discuss implications of developed pathways for decision-making, agenda-setting and society.

The core methodology for developing pathways is grounded in two key elements:

- **Backcasting.** Pathways are co-designed using a backcasting methodology in which a set of targets is chosen for a future date in order to co-design pathways towards achieving them. Backcasting includes the identification of policy priorities, societal transformations and innovations and steps needed to reach the target. The methodology is grounded in scientific and practitioner expertise and involves key stakeholders from academia, policy arenas, civil society and the private sector, fostering societal debate and stakeholder buy-in. Backcasting scenarios are normative; they are not meant to predict the future but rather to explore the implications of alternative development paths (Bibri, 2018; Robinson, 1990).
- **SDG and cross-scale interactions.** Interactions between the chosen target(s) and the entire SDG framework are systematically analysed, i.e. to assess synergies and tradeoffs and to identify the most significant interactions (see Nilsson et al., 2018). In addition, local, regional or national pathways are part of larger, interconnected global systems, and take into account their possible impacts on other countries or regions (Friis et al., 2016; Liu et al., 2013; Seto et al., 2012).

Outputs

The outputs of the Initiative aim to inspire research agendas, further encourage transdisciplinary research efforts, and inform policy and decision-making at various scales (Figure 3). For each national and regional process, the output dissemination will be defined with the actors involved to ensure that the products respond to the needs to the stakeholder and scientific communities. Examples of these outputs include:

- **Policy briefs** on how to reach specific SDG-related goals in an integrated way in a country or a region (e.g. pathways for zero plastic pollution in France, pathways for reversing trends of pesticide use or land take for housing and infrastructure in Europe and implications for global food security, priority SDG related research needs for UN Decade of Ocean Science, discussion papers on the establishment of post-2020 biodiversity targets at national or regional levels)
- **Scientific publications** (e.g. synthesis of priority research needs to better assess interactions between the SDGs at different scales)

- **Methodological toolbox and guides** on how to build pathways for the SDGs so that the Initiative can be replicated elsewhere
- **Informal networks of scientists and stakeholders** around the Initiative's key themes (e.g. ocean, or water)
- **Newly formed interdisciplinary research groups** with capacity to respond to research funding opportunities related to the SDGs
- **Dissemination of results** in major sustainability conferences (e.g. Sustainability Research and Innovation 2020)

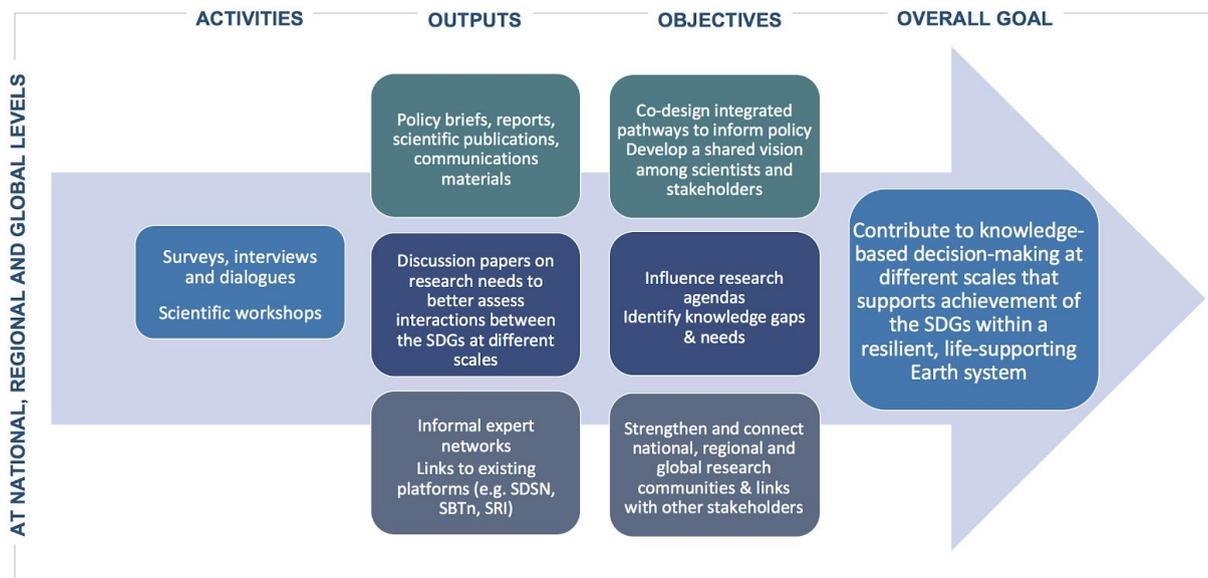


Figure 3: The Science-Based Pathways for Sustainability Initiative's Theory of Change (Future Earth)

About Future Earth

[Future Earth](#) is a global research platform that develops the knowledge and tools that government, communities, and companies need to meet the United Nations' 17 Sustainable Development Goals. By understanding connections among environmental, social and economic systems, Future Earth works to facilitate research and innovation, build and mobilise networks and shape the narrative, turning knowledge into action.

This international programme was established in 2015 and is governed by a council representing major international organizations in science, sustainability and policy including: The United Nations Educational, Scientific and Cultural Organization (UNESCO), UN Environment Programme (UNEP), UN University, the World Meteorological Organization (WMO), International Science Council (ISC) and the Belmont Forum.

Future Earth harnesses the experience and reach of thousands of scientists and innovators from across the globe. This community is spread over a series of scientific networks ([Global Research Projects](#), [Regional Centers and Offices](#) and [National Committees](#)) and [Knowledge-Action Networks](#)) and governing and advisory bodies ([Future Earth Governing Council](#), [Future Earth Advisory Committee](#)) and is coordinated by a [Global Secretariat](#).

Scientific Core Team

The Science-Based Pathways for Sustainability Initiative has been co-designed with members of the Future Earth community, including:

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Complementary initiative: the Earth Commission

The Science-Based Pathways for Sustainability Initiative links with the [Earth Commission](#). Convened by Future Earth with support from the Potsdam Institute for Climate Impact Research (PIK) and the International Institute for Applied Systems Analysis (IIASA), and part of the Alliance for the Global Commons, the Earth Commission will provide several scientific synthesis reports to underpin the development of science-based targets. Interactions between the Science-Based Pathways for Sustainability Initiative and the Alliance for the Global Commons is key to ensure consistency between the two networks' various efforts (e.g. insight from pathways could feed into relevant target-setting efforts; stakeholders from the Alliance for the Global Commons could be mobilised for the design of a specific pathway etc.).

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