

ANNUAL REPORT 2020-21



futurearth
Research. Innovation. Sustainability

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Directors' Note

The Future Earth community values science, facts and knowledge. Scientists have long predicted changes underway, the new challenges that societies have to face, and have devised solutions with which to address them. Even more so during this unprecedented time of global systemic risk, loss of biodiversity and increasing inequalities. During 2020-21, public health, environmental and socio-economic shockwaves from the COVID-19 crisis extended to every corner of the globe. Leaving a vast and unequal recovery and mitigation effort in its wake.

Much of our work within Future Earth focuses on understanding and exploring how to respond to global systemic challenges. Our community recognizes how interdependent humanity and nature are. The need to work across boundaries and communities in this endeavour is critical. Our many national and regional networks exchange best practices to help inform rapid societal change on a global scale. Future Earth's expert networks researching topics like health, infectious disease and emergent risk continue to produce timely, relevant science to guide decision makers towards informed, resilient outcomes. The work of Future Earth is important, not only to anticipate planetary risks, but also to forge collaborations towards meaningful responses and solutions.

Meeting these needs in an inclusive and equitable manner requires input from a breadth of actors and perspectives. In early 2020, we began transitioning to a new management structure with an expanded global Secretariat, a more representative Assembly and Governing Council, and shared leadership opportunities that allow new voices to not just participate but shape the narrative and workflow. This new integration and structure better positions Future Earth as a leading organization capable of delivering on its global sustainability mission.

At Future Earth, we believe that research, innovation, and collaboration can transform the world toward sustainability, but deep societal transformation is a critical next step. Some parts of society are moving to adaptation strategies, however integrated mitigation action must also be ramped up, as it is crucial to deal with the immediate impacts of the climate crisis. In this mission, Future Earth will continue to pursue our collaborative work, build bridges between disciplines and actors and scale up efforts to urgently deliver what is needed to address the climate crisis and the planetary emergency we are facing. To do this, we harness the experience and reach of thousands of scientists and innovators from across the globe. Together, this global community facilitates research, mobilises networks, sparks innovation, and turns knowledge into action.

The next decade will be the true test, determining whether we meet the Sustainable Development Goals, adopt measurable adaptation and mitigation strategies to achieve the Paris Agreement targets, and increase our commitment to the new post-2020 Global Biodiversity Framework. Future Earth has the connectivity, capacity, and sectoral span to not just inform but influence and accelerate these processes. We look forward to working with our networks to concretely address the sustainability of our planet and population by all means possible. Thank you for your continued partnership and dedication to the global goals.

Science has enabled humanity to understand past changes and current realities, both in the environment and in society. Future Earth's scientific networks run the models, we tell the stories. We work with decision makers to identify solutions that protect for example, from catastrophic effects that the multiple and interacting forces of a changing climate, loss of biodiversity, and the rise of inequity, will have on global society.

A global network
of researchers
and innovators

19 Global
Research
Projects

5 Global Hubs

3 Regional Centers
and Partners

18 National
& Local
Networks

8 Knowledge-Action
Networks



Sweden

Japan

France

Canada

United States

- Global Hub
- National and Local Committees
- Knowledge-Action Network
- Global Research Project
- Regional Center

Future Earth is a global network focused on advancing sustainability science

Future Earth's vision is a sustainable and equitable world for all, founded on openly-accessible and shared knowledge

Future Earth's mission is to advance research in support of transformations to global sustainability

Future Earth Transition

In June 2012, the formation of Future Earth was officially announced at the UN Conference on Sustainable Development (Rio+20) to strengthen the interface between policy and science. A Transition Team of more than 30 international experts representing the natural sciences, social sciences, humanities, international policy, research funding, and business set to work designing a new international organization from the ground up that could meet this critical charge. By 2014, a five-country consortium had created an interim Future Earth Secretariat, becoming fully operational with a permanent Secretariat at the end of 2015.

Over five years in operation, Future Earth served an array of Global Research Projects and Knowledge-Action-Networks working to further humanity's understanding of global change. Future Earth also established a growing global network of policy-aware scientists in various nations and regions, now called Regional Offices and National Committees and Structures. These groups are the engines that Future Earth supports to accelerate transformations to sustainability around the globe.

This deep commitment to advancing systems-focused science as well as to its vision of societies that provide good and fair lives for all within a stable and resilient Earth system, led to an extensive fifth-year external review process to create an institutional roadmap to make Future Earth more responsive to the networks it supports, more adaptive to the regional and national contexts its work is embedded in, and more effective at catalyzing the deep structural change needed for humanity to thrive in the Anthropocene.

Future Earth's mid-term review, which was prepared by an external review committee and submitted to the Future Earth Governing Council in early 2020, sparked off the most far-reaching transition process in the organization's history. Crucially, the transition was a deeply collaborative effort that brought together members from all segments of the Future Earth community to co-design a more effective and inclusive organization. As a major milestone, the three-day Future Earth Summit in June 2020 provided an opportunity for the Future Earth community to embark on a discussion regarding future directions of Future Earth. In addition

to showcasing the ambition, drive, and rich diversity of the global Future Earth community, this online summit, developed by a community-led Summit Planning Committee, highlighted the power of cross-network engagement and paved the way for an inclusive and bottom-up transition process.

The Summit was followed by a community-led Post-Summit Committee, which evolved into the Future Earth Implementation Team responsible for resolving differences in inputs from the different Future Earth entities to the Future Earth transition process and providing detailed mechanisms, processes, and policies needed to move Future Earth forward. The Implementation Team efficiently built on the work of the Future Earth Task Force, which the Governing Council had established as a temporary group to develop proposals based on the mid-term review report. With representatives from all Future Earth entities, the Implementation Team formed an inclusive and dynamic group that during fall and winter 2020-21 produced several documents that outlined the next chapter for Future Earth and that were adopted by the Governing Council. Divided



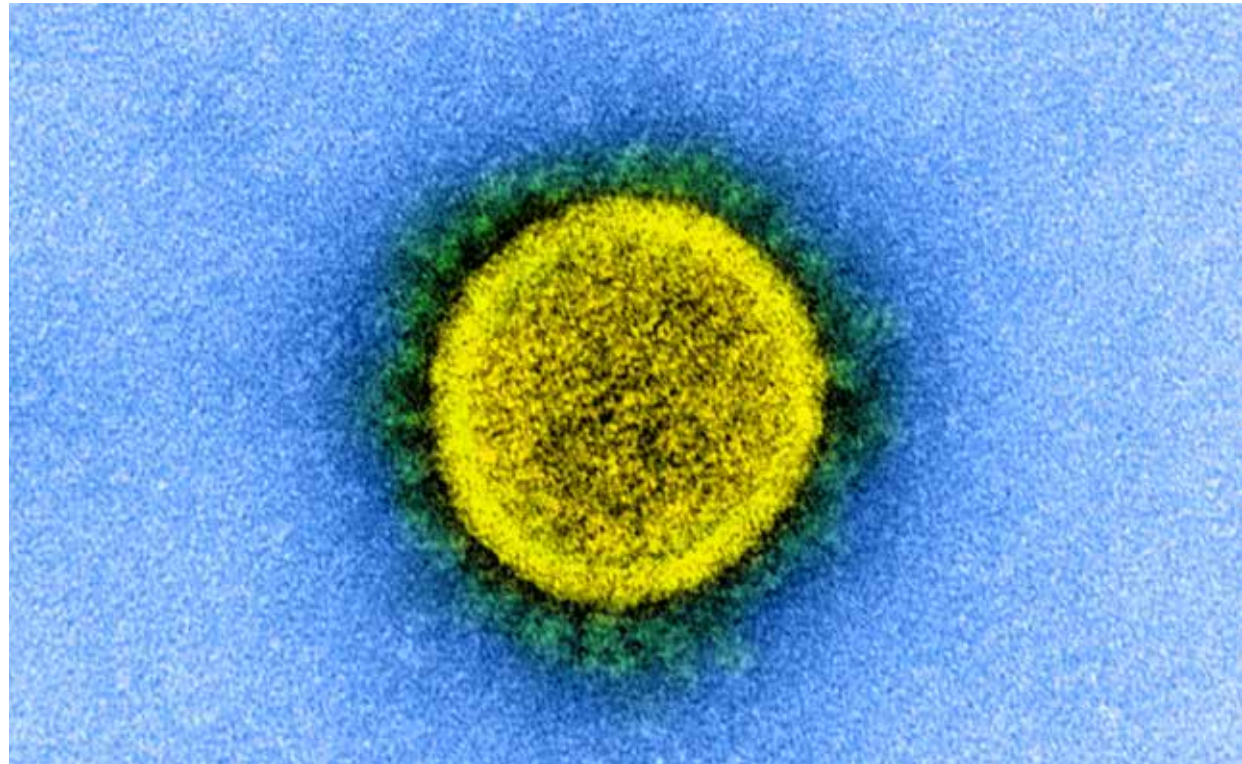
in four working groups (Global Secretariat, Mission and Objectives, Governance, and Global Research Networks), the Implementation Team conducted its work in close consultation with the wider Future Earth community. Besides a revision of Future Earth's mission and objectives, this work resulted in an expansion of the Secretariat, to include more global hubs which will be coordinated by a hub dedicated to coordinating and hosting the executive director. An open call for expressions of interest to host a Global Secretariat Hub or a Global Coordination Hub was launched in February 2021. Changes to our governance are also underway, replacing the Advisory Committee with a new Assembly, representing all of the networks and entities of Future Earth and a new elected Governing Council.

Future Earth and COVID-19

The COVID-19 crisis has and continues to devastate communities and economies around the world. Alarming, this pandemic is a symptom of a much larger systemic crisis, one in which the relationship between human activities and the natural environment is rapidly destabilizing. At Future Earth, we believe that sustainability research can and must support a systems-based approach to managing global public health risks. Various groups within the Future Earth network were not only affected but also directed their focus on understanding and sharing the most up-to-date scientific information available. The Health Knowledge-Action Network came out with an early report that discussed some of the drivers and early prevention measures of COVID-19 for governments, organizations, and individuals to take. The Secretariat organized a successful Webinar to celebrate Earth Day 2020, titled *“Earth Day 2020 and COVID-19: How Are Environmental and Health Crises Linked?”* where the critical linkages between the current public health crisis and ongoing environmental crises were discussed. It is the most viewed Webinar to date organized by Future Earth, with nearly 450 participants globally. Members of the Future Earth community further contributed to various milestone reports such as the IPBES Report on Escaping the Pandemic Era, key

publications such as *“Cities: build networks and share plans to emerge stronger from COVID-19”* led by the Urban Knowledge-Action Network, and several blog posts and webinars organized by the Systems of Sustainable Consumption

and Production Knowledge-Action Network, just to name a few. It is against this backdrop that the secretariat prepared a dedicated [page](#) to highlight this valuable work from the community and from our partners.



Future Earth Community

The strength of Future Earth lies within the work of the community comprising 27 Global Research Networks (8 Knowledge Action Networks and 19 long-established Global Research Projects), and National and Regional Networks (National Committees and Structures, Regional Committees and Offices), as well as the Early Career Network.

These networks represent academics, policy-makers, independent scholars, and students, all working across sectors and disciplines. They play a critical role in defining and advancing research and solutions in Earth system science and its component sub-systems and their nexus (land, ocean, food, energy, water etc), including human societies and health. The secretariat works to connect the networks and drives synthesis and engagement across the different networks, including communications products and links to policy communities at a global level.

In 2020, under unprecedented pandemic conditions, the Future Earth community continued to produce world-class research and strengthened research and innovation communities through international open science conferences, technical workshops, training programs, and early career events, as well as many other activities, often moving online at short notice.



Global Research Projects

Each year, Future Earth's Global Research Projects advance cutting-edge Earth systems science. These networks have a long history of generating research at the forefront of sustainability science, in some cases stretching back decades. Our Global Research Projects also helped introduce and shape our understanding of the Anthropocene, a new epoch in the geologic history of Earth marked by the influence of humans on the planet.



Analysis, Integration, and Modeling of the Earth System (AIMES) guides and facilitates the integration of social and natural sciences through innovative approaches to modeling the Earth system. AIMES liaises with the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

Through the COVID-19 pandemic, AIMES fostered interdisciplinary, multinational engagement through the virtual convening of working groups, workshops and webinars.

In January 2021, AIMES together with the International Space Science Institute (ISSI) and European Space Agency (ESA) Climate Office convened modelers and the remote sensing community to discuss how Earth observations can contribute to our understanding of tipping elements in the climate system. This forum focused on the role of Earth observations and necessary satellite data requirements to better understand the climate system's resilience to tipping points, to constrain models, and to build on the ESA Climate Change Initiative program as a foundation for a future abrupt change early warning system. Workshop participants are developing a scientific article and citable report that will provide input to and guide the development of future ESA climate activities.



bioDISCOVERY is a network for international and cross-disciplinary collaboration to advance research on monitoring, observation, and modelling of biodiversity and ecosystems improve our understanding of how biodiversity and ecosystems respond to environmental change, and how to overcome the barriers that impede the use of observations and modelling in management and decision-making. bioDISCOVERY liaises with the Convention on Biological Diversity (CBD) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), and experts from its network contribute to assessments and task forces.

bioDISCOVERY is also one of the convenors of the World Biodiversity Forum, a platform that brings together researchers across all disciplines of biodiversity science with practitioners and societal actors in conversations and exchanges that offer inspiration and examples for actions and solutions to conserve biodiversity and set us on a path towards transformation for sustainability. In 2021, bioDISCOVERY organized a series of virtual events that were intended as calls to action, offering inspiration and positive examples for solutions to create an impact action agenda for biodiversity. Participants shared case studies and told about success stories and highlighting synergies. As part of the Future Earth Natural Assets KAN, bioDISCOVERY contributed to the further development of the Pathways to Sustainability initiative.



EvolvES

EvolvES (Evolution for Earth Sustainability) aims at providing an evolutionary framework for sustainability science. For EvolvES, this year was dominated by a number of internal changes: the team replaced the name bioGENESIS with EvolvES to more clearly designate community values, initiated bimonthly online SSC meetings, and attracted a new IPO (Sibylle Schroer, to start in October 2021). EvolvES was also heavily involved in the discussions on setting targets for biodiversity designed to advise the CBD. In addition to the policy document, this resulted in a publication led by Sandra Diaz (Diaz et al. 2020, Science). The contribution of EvolvES mainly involved setting targets for genetic diversity.

Earth System Governance

The Earth System Governance Project is a longstanding global research alliance focused on the politics and governance of earth system transformations, across local to global scales. It brings together a highly interdisciplinary research community, spanning disciplines such

as international relations, political science, human geography, urban studies, development studies, and sustainability science, among others. Highlights in 2020 included hosting a widely accessible and free global Virtual Forum in September 2020 which had 1148 registrations across 85 countries. The project welcomed a new Paris Research Centre hosted by The Institute for Sustainable Development and International Relations (IDDRI). Active task forces have pursued ongoing work including on Ocean Governance, Earth System Law, New Technologies, Anticipatory Governance, and Planetary Justice. Several vibrant new Working Groups emerged including the Economic Downturn and Climate Action and Urban Governance Working Groups. The project also experienced a steady growth in network membership among research fellows and senior research fellows who bring further energy and diversity to the project. There is growing momentum for the Earth System Governance journal as well as frequent releases of various earth system governance publication series. Finally, the project's new Mentoring Initiative was launched, which connects less experienced scholars to the guidance of project lead faculty. 2020 was a year where the network found its footing in digital ground, explored new arenas of interaction and connected in novel ways.



Future Earth Coasts

Future Earth Coasts (FEC) is an interdisciplinary program combining biophysical models with studies of ecosystems, governance, and human behavior to map pathways for sustainable development in coastal zones. In 2021, Tim Smith and Purvaja Ramachandran took over as FEC co-chairs from Valerie Cummins and Bruce Glavovic, and Mike Elliott replaced Donald Forbes as vice chair. FEC's network grew further by welcoming additional distinguished scholars into the FEC Academy, as well as new Fellows and new affiliated activities such as the 'Pathways Of Dispersal for Cholera And Solution Tools DEMONstrator' or 'Nunataryuk – Permafrost thaw and the changing Arctic coast, science for socio-economic adaptation'. Working groups led by the FEC IPO in Yantai made remarkable progress in the field of source identification and biofilm formation of marine microplastics (published among others in Nature Sustainability and selected as one of the Top 10 Scientific and Technological Progresses in Ecology and Environment in China in 2020), and provided important insights into Blue Carbon sink mechanism and sequestration capacities (published among others in Global Change Biology). Further notable activities of FEC included a

new working group of the German Committee Future Earth (DKN) and the Belmont Pathways to Sustainability project PACPATH.



Global Carbon Project

The Global Carbon Project (GCP) is an international research project that aims to develop a complete picture of the global carbon cycle. In the reporting period, the GCP produced budgets for three major greenhouse gases; carbon dioxide, methane, and nitrous oxide. Three public forums were organized digitally in English and Japanese to raise awareness and discuss the implications of these budgets. Additionally, GCP contributed a chapter to the United in Science report for the UN Climate Action Summit in September 2020. Finally, in response to the COVID-19 outbreak, GCP researchers examined the effects of coronavirus lockdowns on global fossil CO2 emission and published the first peer-reviewed article on the subject. Other contributions from GCP include, methane estimation, city-level emission estimation, and international workshops on smart city projects contributions to climate resilience and urban decarbonization in the post covid-19 era.



Global Land Programme

The Global Land Programme (glp.earth) is an interdisciplinary community of science and practice fostering the study of land systems and the co-design of solutions for global sustainability. As a global network of over 2000 researcher-members, guided by a Scientific Steering Committee (SSC) and coordinated by the International Programme Office (IPO), GLP's mission is to catalyze research for sustainable development of coupled human-environmental land systems. This entails bridging scientific innovation (specialization) with societal relevance (transformation) and employs place-based research (contextualization) to feed synthesis-understandings of the patterns and processes of global change and related debates in global policy settings (generalization). In 2020, GLP pivoted towards building global engagement through virtual means, launching several new webinar series including the GLP Young Speakers, and GLP



working group series, the latter featuring our new working groups on shifting cultivation, remittance dynamics and land change, global drylands, socio-ecological land systems in Latin America, and agricultural land abandonment and global land use change. GLP continued to link scientific advancement to societal relevance by participating in Future Earth's Science-Based Pathways to Sustainability Initiative. Together with the International Land Coalition, GLP jointly launched the Science for Action Series, which brings together key findings from research networks relevant to ILC'S ten commitments to People-Centered Land Governance. Twenty-seven GLP Members appeared on Clarivate's Highly-Cited Researchers 2020 list.

Global Mountain Biodiversity Assessment

The Global Mountain Biodiversity Assessment (GMBA) is a platform for international and cross-disciplinary collaboration on the assessment, conservation, and sustainable management of mountain biodiversity. It serves as an advisory body with regard to mountain biodiversity-related policy- and

decision-making and liaises with international bodies including the Convention on Biological Diversity, the UN Environmental Programme, and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. In 2020, GMBA achieved an important milestone in developing a new, highly detailed hierarchical inventory of the world's mountains for use across the natural and social mountain sciences. Via its working groups, it has further initiated major syntheses of the state-of-knowledge in mountain soil and aquatic biodiversity and is pursuing its efforts in support of Long-Term Social-Ecological mountain Research through inter- and trans-disciplinary workshops and projects. Collaborative outreach products include a new contribution to the Post-2020 Global Biodiversity



Framework negotiations in the form of a selective list of indicators considered important for safeguarding mountain biodiversity and ecosystems. As an active member of the Future Earth Natural Assets KAN it further co-authored a factsheet on the importance of biodiversity for sustainable development, which represents one research area to which its community actively contributes with projects and publications.



The International Global Atmospheric Chemistry (IGAC) Project has the goal of advancing atmospheric chemistry towards a sustainable world by advancing knowledge, fostering community, building capacity, and engaging society. From 1 April 2020 – 31 March 2021, IGAC sponsored a GEIA Open Science Conference, launched a new activity (Tropospheric Ozone Assessment Report-II, a continuation of the successful TOAR), and held a virtual workshop on air quality and COVID-19 through the AMIGO activity. The joint SOLAS-IGAC activity, CATCH, hosted a webinar series beginning in early 2021. COVID-19 delayed the in-person IGAC2020 conference, scheduled to take place in Manchester, to a virtual conference scheduled for 2021. The IGAC director changed in September of 2020, with Dr. Megan Melamed

taking a new position and Dr. Langley DeWitt taking on the role of IGAC director.



The Integrated History And Future Of People On Earth (IHOPE) is a global network of researchers and research projects using integrative frameworks to provide long-term, human-scale perspectives combining Earth system science with the social sciences and the humanities. As the BRIDGES Coalition in the UNESCO Management of Social Transformations Programme has gotten underway, IHOPE's ties, in both research and personnel, have been greatly strengthened. This new global coalition follows IHOPE's vision closely, integrating diverse perspectives into research, education, and action for global sustainability. IHOPE's pioneering work in the combined cultural, historical, ecological, and environmental aspects of heritage management now has a global home. Over the past accounting year IHOPE's SSC has published 300 articles and chapters and 15 books. In the March meeting the SSC welcomed five new members whose work (in Madagascar, Nigeria, SE Asia, Iceland, the Caribbean, the Peloponnese, and the Philippines) will strengthen both IHOPE's diversity and its global coverage.



iLEAPS – the Integrated Land Ecosystem Atmosphere Processes Study – is a Future Earth Global Research Project (GRP) to coordinate and promote world-wide scientific research in the field of ecosystem-atmosphere exchanges and their impact on society. iLEAPS promotes scientific activities at the land-atmosphere interface and its impact on society, and provides essential science that links biological, chemical and physical processes



from local to global scales in the changing Earth system. iLEAPS accomplishes this through capacity building globally and preparing the next generation of leaders through Early Career Science networks. iLEAPS held a virtual conference in March 2021, consisting of four half-day sessions. GoToWebinar was used as the platform for this and the sessions were recorded. The conference had an appreciable attendance and the session topics covered a wide range of Atmospheric Land Ecosystem studies and the Early Career Scientists Networks (ECSN) organised a webinar series in November 2020 for African scientists. Further, SSC member Sebastian Leuzinger contributed to the activity *Ten New Insights in Climate Science 2020*, co-sponsored by Future Earth.



Integrated Marine Biosphere Research (IMBeR) is a large global research project that focuses on ocean sustainability in the context of global change. It aims to understand past, present, and future changes to the ocean; in particular, how a sustainable ocean for the benefit of society can be achieved. In August 2020, IMBeR's Interdisciplinary Marine Early Career Network (IMECaN) held a virtual *Marine Spatial Planning Workshop: Balancing*

social, economic, cultural, and ecological objectives; attended by almost 700 early career researchers and ocean science professionals from 82 countries. Stephenson et al. published *'The quilt of sustainable ocean governance: patterns for practitioners'* which addresses the challenge of full-spectrum sustainability. The authors identified 13 objectives from the literature, Sustainable Development Goals and international agreements, and evaluated how these diverse considerations are included in six sustainability-related concepts. Marsec et al. used the Walters Shoal seamount in the South West Indian Ocean as a case study to discuss how it could become a fully protected space within a new legal framework under the United Nations Convention on the Law of the Sea. Cavanagh et al. demonstrated that IPCC assessments can be used to support the ecosystem approach to fisheries management within a warming Southern Ocean.



Integrated Risk Governance

The mission of Integrated Risk Governance (IRG) is coordinating international risk science community group activities to better understand adverse impacts of extreme natural events in order to safely protect human society and to achieve the UN Sustainable Development Goals. IRG has transferred most of its activities to online due to the COVID-19 since early 2020. IRG has been working with other international research communities, such as IRDR and Risk KAN, to explore the impacts and possible solutions to deal with COVID-19 for the whole human society. The group has identified that the most urgent task is to regain the trust among all stakeholders in order to deal with emerging risks such as COVID-19 at global scale effectively and coordinated. Science in nature is an adaptive system in that it is constantly evolving in light of new challenges and its dynamic processes provide new opportunities for governments, businesses, scientists, and civil society in dealing with the impacts of natural disasters.

MAIRS Monsoon Asia Integrated Research For Sustainability

MAIRS-FE and WCRP-CORDEX co-organized a conference themed on climate change and regional research collaboration in November 2020, with over 50 participants working on climate extremes/risks, impacts, and air quality on health and water resources involving more than 20 universities, research institutions, funding organizations, and science alliances. The MAIRS-FE Scientific Steering Committee meeting was held in conjunction with the Workshop on Air-Climate-Health Integrated Study supported by Energy Foundation China and co-hosted by the Chinese National Committee for Future Earth. The environmental health team of Peking University initiated Air-Climate-Health (ARCH) Integrated Study and Exchange Platform to build a non-profit and voluntary partnership composed of academic research institutions, policymaking supporting institutions, think tanks, and NGOs. Professor Tong Zhu, Chair of Scientific Steering Committee of MAIRS led the research groups and MAIRS-FE International Project Office to jointly work on a series of activities to boost the development of health-oriented National Ambient Air Quality

Standards in China. The MAIRS-FE Regional Project Office at Divecha Centre for Climate Change, Indian Institute of Science organized an online workshop on Climate Resilient Agriculture on 3-4 December 2020, with speakers from India, Bhutan, and France. Dr. H. Paramesh gave a number of talks and TV interviews in various online events on COVID-19 and the consequences of air pollution and climate change on human health.



oneHEALTH explores the links between global environmental change and health for the planet and society. This year, SSC members and researchers were heavily called on to provide technical guidance in response to the COVID-19 crisis and in the design of pandemic recovery efforts to build back better and greener to prevent and prepare for future threats. Relevant activities ranged from coordination of animal and environment aspects under the WHO R&D Blueprint, advising development and technical agencies on wildlife health system needs, and serving on the International Panel of Experts to the Global Health Security Index. A key activity involved coordination of the IPBES Pandemics workshop and report, plus participation in the IPBES invasive alien species



thematic assessment. The GRP represented Future Earth in the CBD-WHO Interagency Liaison Group on Biodiversity and Health, which was instrumental in shaping the Global Plan of Action on Biodiversity and Health. In collaboration with IUCN, oneHEALTH GRP early career scientists have also been examining Nature-based Solutions (NbS) important for health and wellbeing. This initial work catalyzed a manuscript now underway (“Integrated Nature-based Solutions to Reduce Zoonotic Risks”), involving a systematic literature review (n=259 articles) to inform management and policy actions.

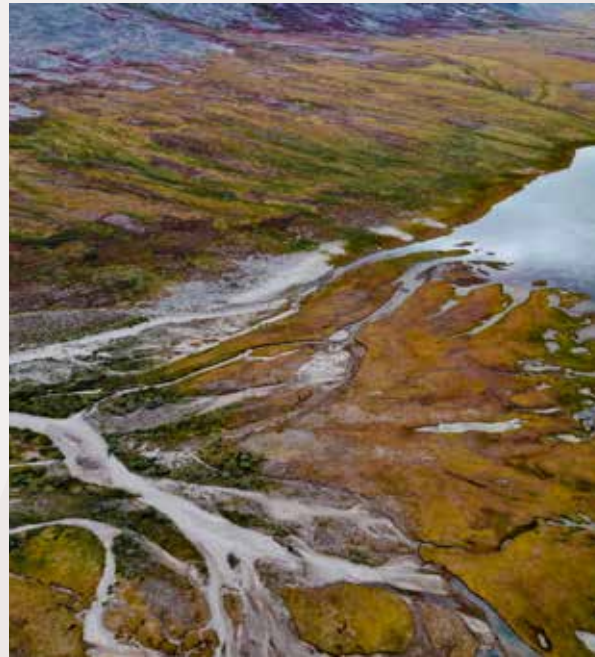


The Surface Ocean-Lower Atmosphere Study (SOLAS) is dedicated to achieve quantitative understanding of the key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere, and of how this coupled system affects and is affected by climate and environmental change. SOLAS launched two new initiatives during the reporting period. The Air-Sea Integrated Observation Network was launched in June 2020, and three time series stations have been endorsed since then. The second new initiative on the Indian Ocean as an integrated topic, was launched during two online events in September 2020 and a subsequent implementation plan was developed. SOLAS has been contributing to the United Nations Decade of Ocean Science for Sustainable Development (hereafter the Ocean Decade), including sponsoring a special forum of the Fifth Xiamen Symposium on Marine Environmental Sciences in January 2021; joining the proposal on Coastal Zones Under Intensifying Human Activities and Changing Climate: A Regional Programme Integrating Science, Management and Society to Support Ocean Sustainability (Coastal-SOS), which was submitted for the Ocean Decade endorsement by Xiamen University; and planning proposals

with other international programs for the Ocean Decade endorsement. Since January 2021, SOLAS has co-chairs and a dual-IPO for the first time in its history.

Past Global Changes

The Past Global Changes (PAGES) project aims to improve our understanding of past changes in the Earth system in order to improve projections of future climate and environment, and inform strategies for sustainability. PAGES' science structure addresses the key components of the Earth system through the themes climate, environment, and humans, and their interactions. In 2020, PAGES launched two new working groups, DiverseK and Human Traces, respectively focusing on integrating diverse knowledge systems for environmental policy and on synthesizing human traces in the stratigraphic record. Also, Past Global Changes Magazine, aiming to communicate paleoscience in an accessible and informative style, published two issues on "*Past Plant Diversity and Conservation and Climate Reconstruction*" and "*Impacts from the Archives of Societies*". Additionally, the Carbon in Peat on Earth through Time (C-PEAT) working group published



a review on the main agents of change of peatland carbon stocks and fluxes to define and quantify the leading drivers of change that have impacted peatland carbon stocks during the Holocene and predict their effect during this century and in the far future. This review has been mentioned in both The Carbon Brief and The Conversation. Finally, despite limitations imposed by the pandemic, several virtual events organized by PAGES' working groups and IPO were held this year.

PECS

The Programme on Ecosystem Change and Society (PECS) is the coordinating body for an exciting network of social-ecological systems scientists working on place-based research in a variety of locations and scales around the world. Ten years since its inception, PECS is now reflecting on the last decade, and revising the science plan. For the former, there is an ongoing Special Issue in the journal *Ecosystems & People*, which reflects on the growth of social-ecological research, methods, and the program itself. For the science plan, new themes were developed with the scientific committee, and now there is an active call for working groups to invite the wider social-ecological systems research community to both widen the community and form new collaboration, and to synthesize new learnings as they emerge in the next decade.



Water Future

The Sustainable Water Future Programme (Water Future) of Future Earth is a global platform facilitating international scientific collaboration to drive solutions to water problems. Due to restrictions for COVID 19 situation, most of the on-ground action plans of Water Future were hampered. However, in 2020 Water Future community focused mostly on the development of research papers, reports and scoping exercises. One of the significant

collective publications from the Water Future community is the Handbook of Water Resources Management: Discourses, Concepts and Examples. With 25 chapters and 800 pages, this book provides an overview of facts, theories and methods from hydrology, geology, geophysics, law, ethics, economics, ecology, engineering, sociology, diplomacy, and many other disciplines with relevance for concepts and practice of water resources management. It provides comprehensive but also critical reading material for all communities involved in the ongoing water discourses and debates. The book was launched at several global events in 2021. In 2021, Water Future also signed a major MoU with UNESCO. UNESCO and Water Future agree to carry out common projects to contribute to sustainable water management consistent with the broad objectives of the Sustainable Development Goal for Water. Water Future agrees to support UNESCO as one of the principal science knowledge partners.



Knowledge-Action Networks

As society grows ever more connected, Future Earth is capitalizing on the power of networks – linking science, policy, business, and civil leaders – to bring about collaborative solutions for complex environmental problems. Much of the strength of Future Earth lies within our community of Knowledge-Action Networks (KANs), national and regional entities, and ongoing collaborations with science funders and early career scientists.

Emergent Risks and Extreme Events

Extreme climate and weather events as well as associated disasters and systemic risks are becoming increasingly critical in the context of global environmental change. They are an important threat to reaching the SDGs and one of the most pressing challenges for future human well-being. The Risk KAN (www.risk-kan.org), a joint initiative of the Future Earth, IRDR, WCRP and WRRP programs, provides an open platform for scientific communities from multiple disciplines and engineering working on extreme events, systemic risks, disaster risk reduction and governance to exchange information, knowledge and data and engage in collaborative research activities. Working Groups (WGs) are a core element of the Risk KAN. They span a wide

range of topics such as e.g. Compound Events, Critical infrastructures, Early Warning, Learning from the past, Metabolic Risks on Islands and Modelling and Insurance (further information available at www.risk-kan.org/workinggroups/). New WGs can be proposed at any time. Key Highlights in 2020/2021 include a Systemic Risk Workshop organized by UNDRR, ISC and Risk KAN, a series of high-level webinars organized by Risk KAN Working Groups, and multiple sessions organized at SRI2021, EGU 2020 & 2021 and other congresses.

Finance and Economics

The Finance and Economics Knowledge-Action Network completed the formation of its Development Team after a global call for members. Further, with the establishment of the governance and leadership, there was an

agreement to operate based on four working groups, of which each group has its own team running operations. The approved Working Groups are: 1) Sustainable Finance, 2) Agent-based macroeconomics, 3) Complexity, economics and global change, and 4) Natural resources and local sustainable development. The Finance and Economics Knowledge-Action Network further discussed its activities to begin in April 2021. The discussion led to planning within the Working Groups on collaborative projects such as workshops, a webinar series, and other outreach activities for the broader community interested in sustainable Finance and Economics.

Health

Health Knowledge-Action network members developed boundary-spanning work on

the pandemic, providing the best possible synthesis on the prevention of COVID-19 for governments, organizations, and individuals through peer-reviewed publications, various science-communication activities, and a policy brief on *“COVID-19, A Global Health Concern Requiring Science-Based Solutions”* amidst global distress. The work on COVID-19 led the Committee to play a key role in the development of Future Earth’s most viewed Webinar to date, sparking over 4400 views, on the topic: *“Earth Day 2020 and COVID-19. How Are Environmental and Health Crises Linked?”* Further, members played a pivotal role in the IPBES workshop on Biodiversity and Pandemics and published several articles. They also co-organized and contributed to the international virtual symposium and related outputs on Climatological, Meteorological, and Environmental factors in the COVID-19 pandemic in partnership with WMO and other renowned organizations. Apart from its pandemic research, members developed a chapter on mental health in the 10 New Insights in Climate Science 2020, which was published as a peer-reviewed publication, policy report, and launched at COP26 with UNFCCC Executive Secretary, Patricia Espinosa. Members also published a list of transdisciplinary research priorities for human and planetary health in the context of the 2030 agenda for sustainable development. The publication was further discussed and brought into the context of global environmental change at its launch webinar that is freely available for the public.

Ocean

During the pandemic year, the Ocean KAN nevertheless advanced several projects. Members contributed to a special issue of Coastal Management Journal on networked knowledge to action in support of sustainability published in July. In addition, members published on marine-related learning networks for coastal governance and on using the UN Decade of Ocean Science for Sustainable Development to promote science, policy, and action. The Ocean KAN continued to contribute to the Decade, with members serving on the Executive Working Group and participating in national committee meetings in the U.S., Germany, France, and Japan, as well as in a number of other regional Decade meetings and Laboratories. The Ocean KAN also contributed to a successful submission by the Global Ecosystem for Ocean Solutions to become a Decade program. The Ocean KAN continues to support the Virtual Blue Decade project, the need for which became increasingly evident, with both the pandemic and climate disasters showing why we need new ways of conducting conferences and sharing multi-disciplinary and multi-sectoral. In that spirit, Ocean KAN members also participated in a number of virtual events, including the Ocean Visions Summit, held completely online this year, with contributions to sessions on climate adaptation and ocean solutions.

Systems of Sustainable Consumption and Production

The Systems of Sustainable Consumption and Production (SSCP) KAN emphasizes the need to address whole provisioning systems, including consumption practices and production conditions, as well as lifecycle impacts and the economic, political, social, and cultural imperatives that impel consumerist lifestyles. The “COVID-19 and Sustainability Transitions” initiative that started last year, continued with a virtual mini-conference in May 2020 that brought together more than 150 participants. This initiative has attracted the support of the Social Science Extreme Events Research (SSEER) Network administered by the CONVERGE facility at the University of Colorado Boulder and became affiliated with the World Pandemic Research Network. SSCP KAN also developed a Collaborative Research Action (CRA) proposal for a Systems of Sustainable Consumption and Production theme for funding. This was successfully adopted by the Belmont Forum and is currently in the scoping phase to finalize the details of the grant call. The network’s six Working Groups (WGs) focused on political economy, SCP in cities, social change, communicating SCP, global value chains, and circular economies, have also been actively publishing joint papers/book chapters, developing policy briefs, organizing webinars and writing project proposals for funding. Some

highlights of WG activities include an open letter and consultation meeting with EU Commission on Green Deal, circular economy and upskilling, higher education needs; empowering youth for global eco-leadership through a Sustainability Adventure course; and organizing a professional development workshop during the Academy of Management Annual Meeting.

Urban

Urban Knowledge-Action Network Steering Committee members contributed to urban sustainability through high-level publications and engagement in high-level science work (e.g. Earth Commission, British Ecological Society's Festival of Ecology, The Nature of Cities Festival) and science-policy activities (IPCC-IPBES cosponsored workshop "*Biodiversity and Climate Change*"). For example, members led a Nature Comment "*Cities: build networks and share plans to emerge stronger from COVID-19*", exploring what lessons cities can learn from the pandemic and emphasizing the importance of building resilience through networks within and across cities. Members also published a short correspondence in Nature on the combined risk of COVID19 and extreme heat and wrote a paper published in Nature Food, "*Urbanization can benefit agricultural production with large-scale farming in China*", which assessed comprehensive impacts of urbanization on agriculture in China through modeling and scenario analysis. Members were also heavily involved in the launch of a new journal, npj Urban Sustainability, where the



co-chairs authored "*Urbanization in and for the Anthropocene*". Members also contribute to the Nature-based Solutions for Urban Resilience in the Anthropocene (NATURA) project. Finally, Timon McPhearson received a U.S. National Science Foundation RAPID award to study how impacts of shifting behavior and shelter-in-place policies in response to COVID-19 interact with weather-related extremes.

Water-Food-Energy Nexus

In the framework of Future Earth, Knowledge-Action Networks (KANs) are networks of people and organizations, collaborating to build the knowledge and tools needed to tackle the greatest sustainability challenges of our time. The Nexus KAN does so in the context of sustainably and equitably delivering water, energy and food for all. This is achieved through better understanding of the interactions between water, energy and food systems and managing their trade-offs and synergies. The Nexus KAN acts as a liaison between Earth system science, social science, humanities, and society to explore and promote science-based solutions to address pressing water, energy and food system challenges. The Nexus

KAN facilitates collaboration between existing projects, networks and individuals involved with nexus issues and builds on their knowledge, expertise and experience. The Future Earth Nexus KAN steering committee was established in 2018 and currently has eight members chaired by Prof. Jiaguo Qi. The Steering Committee initiates and stimulates activities in the Nexus Knowledge-Action Network. These activities aim to enhance collaboration and interaction among the research and practice communities working on nexus issues, spurring the co-creation of new knowledge and the application of knowledge in practice. Among the group activities, there are the promotion of water-energy-food nexus approach to address challenges and tradeoffs of hydropower dams and water/food security in Botswana, through a collaborative project "*Long-term impacts of land-use/land-cover dynamics on surface water quality in Botswana's reservoirs using satellite data and artificial intelligence methods: case study of the Botswana's Limpopo River Basin (1984-2019)*" funded by USAID. (PI: YashonOuma, University of Botswana and US Partner: Jiaguo Qi, Michigan State University). In addition to this scientific engagement, the NEXUS KAN also formally established a collaborative partnership with the EO4WEF.

National and Regional Networks: Updates from around the Globe

Future Earth Local, National and Regional Structures forge a bridge between local, national and regional sustainability science and research and the global sustainability community, aggregating knowledge and inspiration from the ground to the global and back. Below are a few examples of this critical work:

Asia and the Pacific

This year the **Asia Regional Center** in collaboration with the Research Institute for Humanities and Nature, organized a virtual TERRA (Transdisciplinarity for Early Career Researchers in Asia) School, a capacity-building short course on transdisciplinary research for early-career researchers in the Asian region. Despite being online, the participants engaged in interactive workshops, dynamic discussions and were able to interact with local stakeholders of a transdisciplinary project in Kyoto. The Regional Center also organized webinars to introduce the Science-Based Pathways for Sustainability Initiative to the Asian network of Future Earth, and have supported Pathways-related work in the Philippines and Mongolia.

The **Chinese National Committee for Future Earth (CNC-FE)** is another active network in the region with 14 working groups and an information center. In 2020-2021, the committee participated in the Earth Committee, development of the Sixth IPCC report, and introduction of new concepts into China's National Assessment Report on China Climate and Environmental Evolution. CNC-FE further engaged with the international sustainability community through the Research Cooperation Project of the Aral Sea, and the steering committee of Monsoon Asia Integrated Research for Sustainability - Future Earth (MAIRS-FE). The **Future Earth Japan National Committee** supports and promotes networking among societal partners in Japan towards truly transdisciplinary research that will have a transformative impact on global issues facing us. This year, the Committee cooperated in the establishment of the new Global Secretariat Hub in Japan, and welcomed new leadership. The **Korean National Committee for Future Earth (FE-K)** provides various platforms for visioning and networking in the pursuit of improving epidemiological surveillance and response mechanisms in line with SDGs #3 and #17 in the Mekong sub-region. In this pursuit, FE-K initiated a two-year (2021-2023) transdisciplinary project in February 2021, Sharing of experiences, best practices and lessons learned in controlling COVID -19 outbreaks between ROK and Mekong countries. Future Earth Taipei and its 11 working groups organized 42 events, including scientific symposiums, capacity-building workshops, and promotion and networking, with various themes during March 2020 and April 2021. **Future Earth Taipei** also connected or engaged in Health KAN, Finance and Economics KAN, Risks KAN, SSCP KAN, ECR Network, and Sustainability in the Digital Age initiative. In addition, Future Earth Taipei organized three sessions and supported 70 Asian researchers and stakeholders to join the 2021 SRI online congress.

In Oceania and the Pacific, **Future Earth Australia** worked closely with Future Earth and the Belmont Forum throughout 2020 and 2021 to plan the inaugural SRI Congress, which was hosted in Australia in June 2021. In addition, the National Committee has served Australian policymakers by creating national strategies for the uplift and implementation of the SDGs, which focused on cities and oceans in 2020 and 2021, respectively. A third report targeting climate adaptation and resilience is planned for 2022. Meanwhile, the **Future Earth Philippines (FEP) Program** participated in the Belmont Forum project on Coastal and Oceans Assessment for Sustainability and Transformation (COAST), with PhilCOAST as a component project, and partnered with the Future Earth Asia Regional Centre at RIHN to offer a series of online activities. These activities built upon Knowledge-to-Action projects for Sustainability (KAPS) drafted by FEP in collaboration with local stakeholders in 2018-2019, and engaged scientists and key stakeholders in the formation of Science-Based Pathways to sustainability through the KAPS. Following their formation, these were validated and contextualized in partnership with SDG-oriented local stakeholders in the Philippines.

Europe

In Europe, the **French National Committee on Global Change** was involved in the organization of the 3rd edition of the National Conference on Adaptation and Mitigation, Climate actions for the territories, from 25 January - 3 February 2021. Targeted at sharing knowledge, experiences and solutions, this symposium aimed to bring together a wide variety of actors working at the national or local level to address adaptation and mitigation issues in the face of climate change. To follow up from three regional conferences it engaged in, the CNFCG is supporting the development of a network of French regional initiatives in sustainability. The **German Committee Future Earth (DKN)** served as a national contact point and platform for developments within Future Earth and the World Climate Research Program (WCRP), and established three new working groups to strengthen sustainability research in Germany, which aim to initiate research activities in the context of Future Earth and WCRP: Modelling Human-Environmental Interactions In the Anthropocene (HERMITAN), Anticipating and Transforming Coastal Futures, and Sustainable, Transformative and Circular Bioeconomy. In April 2020, **Future Earth Ireland National Committee** curated a series of videos to mark 50 years since the first Earth Day in 1970.

In spring 2021, Future Earth Ireland collaborated with a number of Irish higher education institutions to organize a series of three online webinars addressing the question, 'How can higher education "build forward better"?' in the post Covid-19 context. In late 2020, the host institution of **Future Earth Switzerland**, the Sustainability Research Initiative (SRI) at the Swiss Academy of Sciences, published the white paper *Priority Themes for Swiss Sustainability Research*, which outlines Switzerland's six most urgent overarching research needs in order to support meeting the UN Sustainable Development Goals. SRI also engaged in a research project of the University of Bern on how international networks can effectively support transformative research for sustainability, along with the four Future Earth Global Research Projects based in Switzerland, amongst others. A final scientific article on the project outcomes was published in spring 2021. In the **United Kingdom**, the National Committee has continued to develop its Early Career Researcher and Practitioner Network, which held three online workshops to explore a new research paradigm post-Covid. Between April 2020 and March 2021, UK Future Earth also prepared a forum on Just Transitions for the SRI Congress that would take place in June 2021. The **Romanian National Committee for Future Earth** continues to organize an annual workshop on environment and sustainable development topics and a biennial international summer school for PhD students and young researchers on issues related to environmental risks in mountain areas. Members of the Romanian National Committee also gave presentations about climate-related impacts, risk and policy at scientific events and meetings throughout 2021. In **Russia**, members of the National Committee published *For the coming day. Scientists unite for the future of the planet* in the science information portal "Poisk". The National Committee also continues to involve young scientists in global change research through an annual youth conference Global processes and their regional aspects at the Kursk Biosphere Station of the Institute of Geography at the Russian Academy of Sciences.

South Asia

The South Asia Regional Office of Future Earth, in collaboration with the Divecha Centre for Climate Change (DCCC) and the Indian Institute of Science (IISc), jointly carried out various outreach activities, organized workshops and conferences, engaged with stakeholders including government bodies and legislatures, and partnered with many national and international institutions in 2020-2021. The current National Committee of Future Earth in India was appointed in November 2020 during an orientation program, and has since met twice more to discuss its working structure and plans of action. The Indian National Committee jointly organized a webinar with the Future Earth South Asia Office in March 2021 on 'Best Practices and Deliberating on a Way Forward' for Future Earth in India. The event had a total of 452 registrants spanning various sectors and groups. The Indian National Committee is divided into four Working Groups focusing on Climate Change, Ecology and Biodiversity, Water and Health and they will begin various activities shortly.

Southern Africa

On 23 March 2021, the Future Earth Regional Office of South Africa (FEROSA) hosted the 2nd FEROSA stakeholder platform. The virtual stakeholder platform was attended by over 60 delegates from 10 African countries, namely: Botswana, Ghana, Madagascar, Mauritius, Mozambique, Namibia, Tanzania, South Africa, Zambia and Zimbabwe. There were also international participants from the United States and France. Participants included representatives from national governments, regional organizations, universities, private sector, non-profit organizations, the Africa SDG Labs and the Future Earth Global Secretariat. The outcomes of the stakeholder platform included the validation of the FEROSA situational and needs analysis report, the unanimous support for FEROSA to consider bidding for the Future Earth Global Secretariat Hub. The draft FEROSA strategic plan was also endorsed.

All National Committees and Regional entities also engage collaboratively and with the Future Earth Secretariat to connect local, national and regional work globally.

Integrative Activities and Collaborations



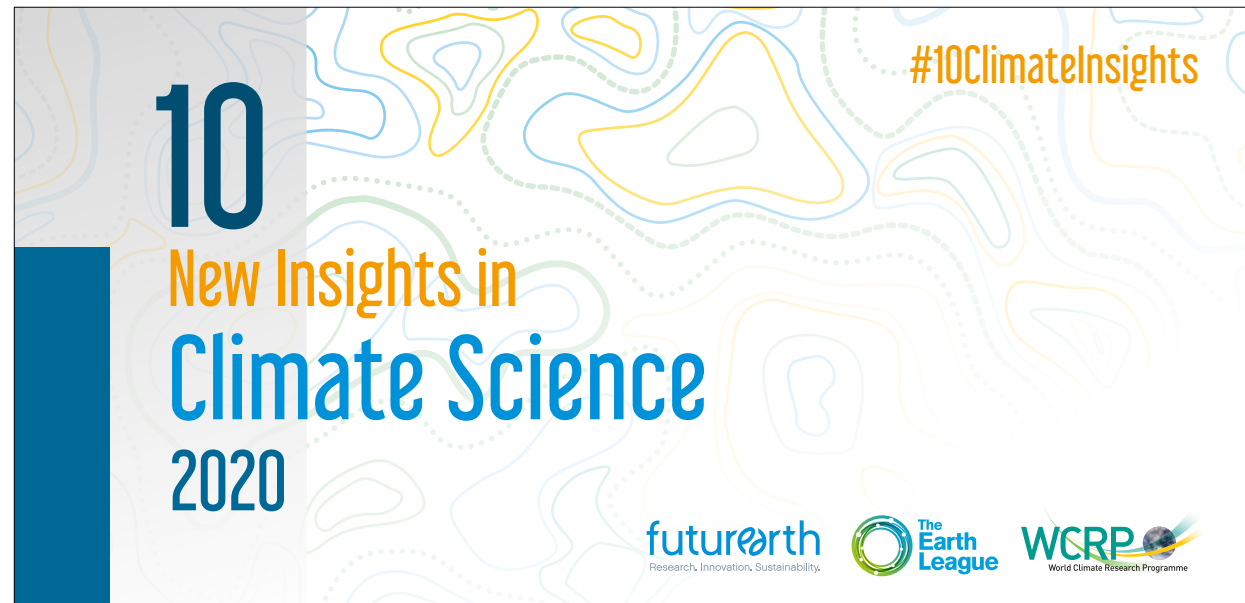
10 New Insights in Climate Science

Published each year since 2017, the 10 New Insights in Climate Science series aims to synthesize and communicate the latest and most essential scientific findings on climate change to the policy community. It is prepared in collaboration with the Earth League and the World Climate Research Program, and it is delivered as two self-standing products: a policy report underpinned by a peer-reviewed academic article published in the Journal of Global Sustainability.

The policy report is a climate science year-in-review for journalists, policy makers, and the general public, while the peer-reviewed article is targeted to a scholarly audience, and crucially strengthens the credibility of the policy report. The 2020 edition touched on topics from thawing permafrost and the degradation of the tropical carbon sink, to the impacts of climate change on mental health and the (not yet seized) opportunity for a green recovery from the COVID-19 pandemic, reflecting an intentional balance of insights from natural and social sciences.

The report is launched annually at the UN Framework Convention on Climate Change (UNFCCC) Conference of the Parties in collaboration with the UNFCCC Executive

Secretary, Patricia Espinosa. In 2020, as the UNFCCC COP was postponed, the report was launched in an online event involving Patricia Espinosa and the report authors.



Anthropocene Magazine

Anthropocene, Future Earth's premier independent magazine, is changing the game plan. Where traditional environmental reporting has focused on the crisis, *Anthropocene* focuses on solutions – convening, across multiple media outlets, the world's most creative writers, designers, scientists, and entrepreneurs to explore how we can create a sustainable Human Age we actually want to live in.

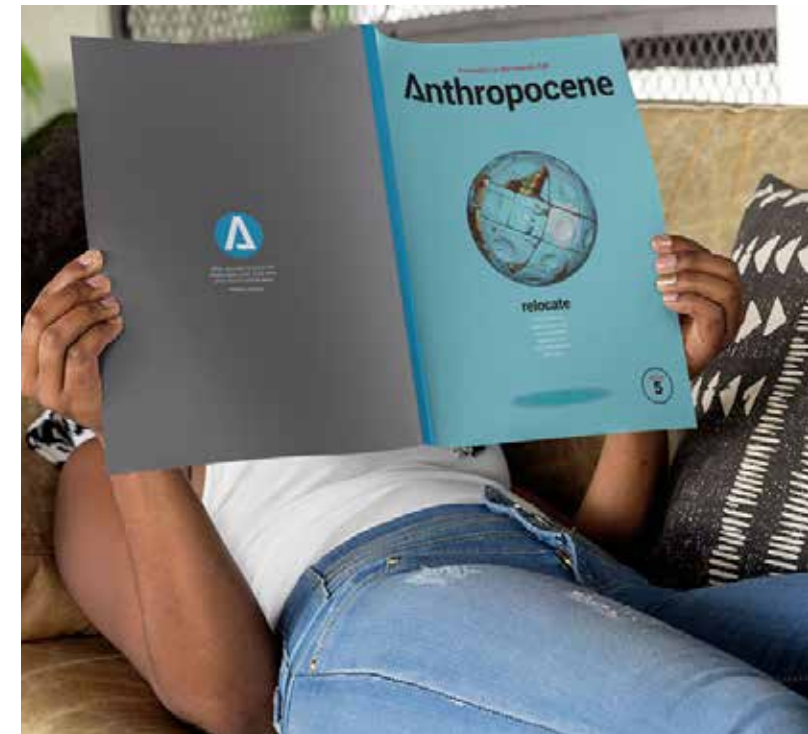
Anthropocene's goal is not to make people feel better; nor is it to scare them into paralysis. Rather it is forging a sophisticated middle ground: evidence-based journalism that puts the best science and innovations into the hands of those who can do the most with them. In other words, balancing urgency with efficacy.

Readership is global. *Anthropocene* reaches over 116,000 unique web visitors every month, with the largest readership in the US, UK, Canada, Australia, India, the Philippines, Mexico, Spain, Germany, and South Africa. In addition, *Anthropocene* now has over 34,000 subscribers who have signed up to receive our two weekly newsletters: “The Weekly Science Dispatch” and “Fixing Carbon: Dispatches from An Emerging Future.”

Alongside government and philanthropic support, *Anthropocene* business model is based on the belief that people pay for what they value. *Anthropocene's* base of donating members is international, robust, and growing. In 2020 we raised over 110,000 USD from 1,600



individuals in 72 nations. In 2022, look for the rollout of *Anthropocene's* innovative new fiction series called “The Climate Parables” which will commission, publish, and perform (on stage) climate reporting from the future.



Belmont Forum Collaboration

Future Earth works collaboratively with the Belmont Forum to help scope and shape its Collaborative Research Actions (CRAs), which are major funding opportunities for multinational, interdisciplinary research teams to address the world's greatest sustainability challenges. Future Earth is the only institutional entity invited to directly propose new topics annually.

During fiscal year 2020, two CRA themes were proposed and moved forward into scoping stages: a new collaborative research action on Systems of Sustainable Consumption and Production, driven by the SSCP Knowledge Action Network, and a new theme based on broad discussions with the scientific community under the theme of Human Migration and Global Change. Furthermore, the Future Earth Global Research Networks also participated in furthering the scoping processes for a new opportunity under the Climate, Environment and Health program that launched in 2019. Scoping workshops were held in the Americas in collaboration with IAI and in the Asia-Pacific region led by the Health KAN. Science officers worked closely with the US Global Change Research Program's Climate and Health Working Group and the International Working Group to align priorities among researchers and funders around the world.



Early Career Researchers

Future Earth seeks to engage diverse Early Career professionals from all regions in order to strengthen global environmental change and sustainability science. Future Earth is supporting and encouraging innovative and influential Early Career Professionals to undertake inter- and transdisciplinary research addressing the physical, biogeochemical and human dimensions of global environmental change. The growing Future Earth Early Career Professionals Network entails numerous benefits, such as funding opportunities and relevant vacancies, call for papers, dissemination of events, capacity building events, conferences and workshops etc. The continuous support of Future Earth to the ECR community is pivotal for the long term advancement of Future Earth's goal and mission.

In 2020, we ensured early career representation on the Task Force, the Implementation Team, the Summit preparation, and the committee strategizing on the creation of the Future Earth Society, while there was a continuous collaboration and support to the Early Career Researchers Network of Networks. Moreover, in September 2020 we designed and implemented a virtual capacity building workshop for 110 early career researchers from 29 countries in Africa on the Belmont Forum Collaborative Research

Action (CRA) on Pathways. The Nairobi-based company Well Made Strategy delivered training in science communication and storytelling. ECRs were given the opportunity to learn about the Pathways CRA and network with senior scientists from GLP, ILEAPS, IGAC, and other organizations. The event was organized in collaboration with the Office for Southern Africa (FEROSA), the Program for Early-stage Grants Advancing Sustainability Science (PEGASuS),

the Belmont Forum, the National Research Foundation of South Africa (NRF), the African Future Earth Committee (AFEC), and the Institut de Recherche pour le Développement (IRD).

Last but not least, discussions and preparations for the Early Career Researcher's activities at the Sustainability Research and Innovation Congress, SRI2021 took place during March 2021.



Earth Commission

In the Anthropocene we need to redefine our relationship with the Global Commons of the Earth system and critical biomes - the life support systems that underpin a stable and resilient planet. Future Earth is host to the [Earth Commission](#), an international team of leading natural and social scientists working collaboratively to provide an independent assessment and define guardrails for these essential planetary systems, as a 'safe and just corridor for people and planet'.

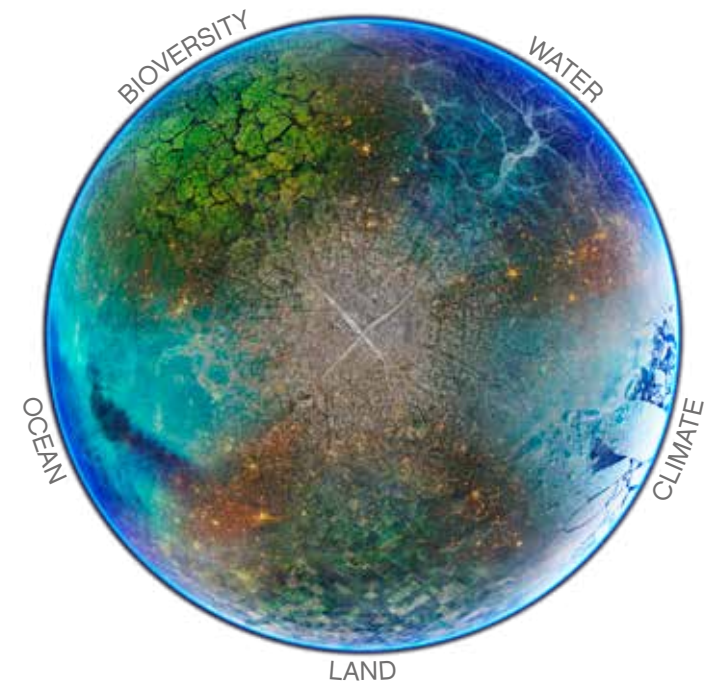
The Earth Commission was established in 2019 and forms the scientific foundation of the Global Commons Alliance (GCA), a unique coalition poised to create science-based targets for companies, cities and countries based on the Commission's peer reviewed findings. The GCA will mainstream the implementation of the Commission's findings through its network of organizations that focus on stewardship of the global commons, including the Science Based Targets Network.

Five working groups (WGs) have been established to undertake specific aspects of the Commission's analysis, with contributions from additional experts including many from the broader Future Earth network. WG1 focuses on climate, cryosphere and interconnected

tipping elements), WG2 on biodiversity, WG3 on nutrients, pollution, and freshwater, and WG4 on justice and transformations. WG5 synthesises the science on cross-scale translation of the planetary guardrails to scales at which key actors, such as cities and companies, operate.

In early 2020 Earth Commission members convened a biodiversity workshop in collaboration with the secretariat of the Convention on Biological Diversity (CBD), and Future Earth Global Research Networks, to support the development of the post-2020 global biodiversity framework. The workshop resulted in a report to CBD and [a paper published in Science](#) in October 2020. These outputs influenced the draft goals to be agreed upon by the CBD in 2022.

During 2021 the Earth Commission published its [conceptual framework in Earth's Future](#).



Science-Based Pathways for Sustainability

The Science-based Pathways for Sustainability (Pathways) Initiative, aims to serve as an 'incubator for engagement' to build understanding of : a) How complex human-environment systems produce trade-offs or synergies within a context of competing development agendas and claims on resources; b) How transformations can be mobilized to enable expansion of integrated pathways to sustainability in diverse concrete contexts; and c) How pathways and processes of transformation interact across locations and scales, and 'add up' to outcomes at the regional and global levels. To play this role of incubator, the initiative supports the development of an open Community of Practice convening researchers from diverse disciplines who engage with societal actors (e.g. civil society, governments, private sector) in processes of adaptive learning to design, implement and evaluate pathways to sustainability. Continuing the series of pilot workshops initiated in 2019, a workshop exploring pathways related to land was held in France in October 2020 convening national stakeholders and researchers. The outcomes of the three French Pathways workshops were presented in various international conferences and a report synthesizing the outcomes of the Biodiversity workshop was released (<https://futureearth.org/>)



[wp-content/uploads/2020/11/Biodiversity-and-the-2030-Agenda-Report-EN.pdf](https://futureearth.org/wp-content/uploads/2020/11/Biodiversity-and-the-2030-Agenda-Report-EN.pdf)).

A national workshop was organized by the Future Earth Philippines Programme in February 2020 where national scientists formulated knowledge-into-action scenarios and roadmaps. These scenarios have been

shared back with the participants of the regional workshops the following year via online conferences to explore and share problem-solving initiatives that can be undertaken at the national and local levels. Also, the Canadian contingent, focusing on biodiversity pathways, completed their project this year to conduct a retrospective

assessment of Canada's progress against the Aichi Targets. Results were presented to government and academia at a forum hosted by the national Social Sciences and Humanities Research Council (SSHRC) and an evidence brief was published for the Canadian government.

Science-Policy

Future Earth is an accredited observer organization in various international science policy interface processes such as UNFCCC, CBD, UNEP, IPCC, IPBES etc.

Through its extensive scientific community, Future Earth participates in framing sustainability research, research agendas, advising decision makers and more. By engaging its community into opportunities from international processes, Future Earth participated in the following events / reports from April 2020 to March 2021:

- The **UNFCCC SBSTA in June 2020** where a Future Earth representative highlighted the necessity of interdisciplinarity and strengthening the links with humanities and social sciences in climate sciences in the post COVID context
- The **UNFCCC Earth Information Day** in November 2020 at which we presented 2 posters ("10 New Insights in Climate Science 2020" and "The future of Arctic sea-ice biogeochemistry and ice-associated ecosystems" and gave one presentation about the 10 New Insights in Climate Science 2020
- The **IPBES report on Biodiversity And Pandemics** in which an expert we nominated participated
- We successfully nominated an expert to participate in the IPBES scoping of the methodological assessment of business and biodiversity
- The **10 New Insights in Climate Science** report in which experts carried out a horizon scan in fields related to climate change on what the latest findings and most important new emerging fields are. We summarize this in 10 important scientific insights, which was published as an academic paper and policy report which was delivered to Ms. Patricia Espinosa, UNFCCC Executive Secretary.
- The Earth Commission, in collaboration the global research projects BioDISCOVERY and Global Mountain Biodiversity Assessment, and representatives of the UN Convention of Biological Diversity (CBD) convened a workshop in Davos to synthesise the science informing biodiversity goals. A report was submitted to the CBD and was reflected in the draft goals prepared for COP15. There was follow up in 2021 with a statement into the OEWG.
- Future Earth is working to influence the the UN high-level meeting Stockholm+50, to be held in June 2022 with science from the Future Earth community.
- Alongside these efforts, the Future Earth Secretariat worked with representatives from all these international processes to ensure visibility of the community, and participation in future events and works, such as the UN Decade on Ocean Science in which the Ocean KAN will become a collaboration center, the Convention on Biological Diversity COP15 process in which Future Earth will have a delegation. Several articles were also prepared and fed into the UNFCCC COP26.

Earth Leadership Program

After 20 years of success in training over 200 sustainability leaders in North America, the Leopold Leadership Program re-launched as the Earth Leadership Program (ELP) in March 2020. The ELP focuses on training mid-career academic researchers based in Canada, Mexico, and the US to conduct transdisciplinary research for sustainability. Through a robust recruitment and selection process in Spring 2020, 22 North American Fellows were chosen that include diverse identities, disciplines, and types of institutions. Due to the COVID-19 pandemic, the 2021 training retreat was postponed to June 2022. This pause in the schedule provided an opportunity to conduct a formal evaluation of the impact of the program over the past 20 years and 200+ Fellows. Surveys and interviews conducted with past fellows provide a rich source of information to assess the impact of the program on leadership development, as well as shifts in attitudes, behaviors, and skills that Fellows use to successfully engage a wide range of participants in transdisciplinary research for sustainability.

The Earth Leadership Program is led by Dr. Sharon Collinge, a 2004 Leopold Leadership Fellow and full professor in the Environmental Studies Program at the University of Colorado

Boulder. By connecting with Early Career training programs and with Future Earth global partners, the Earth Leadership Program aims to support regional networks of collaborative sustainability leaders around the world and to connect these networks under a common purpose. Conversations are underway for formal connections with early career fellowship

programs in North America and globally, and for additional cohort training opportunities in Latin America, Europe, and South Asia. Over the next year, the structure of the Earth Leadership Program will continue to evolve as it seeks to build greater connections among existing fellows, bring new fellows into the program, and build new programs around the world.



European Space Agency Partnership Program

Future Earth partners with the European Space Agency (ESA) to facilitate links between Future Earth's projects and ESA programs, helping to guide ESA's strategic direction and support the networks. There is a [seed fund](#) to foster innovative use of Earth observation in the research activities of the Global Research Networks, which supports collaboration.

In 2021 the partnership program funded four small research demonstration projects led by Earth career researchers. These projects focused on deriving useful information from Earth observations to help with climate adaptation. They co-developed online tools with key users that will be demonstrated at UNFCCC COP26 for tackling the threats posed by increasingly [frequent storm damage](#), [coastal hazards](#), [cholera outbreaks](#), and to improve [urban planning](#).

In January 2021 the program supported an [online forum](#) to discuss how Earth observations can contribute to the understanding of tipping elements in the climate system and help with early warning of change. The meeting was convened by AIMES and the ESA Climate Office, and hosted by the International Space Science Institute. It also co-organized a session at SRI2021 in June with bioDISCOVERY on Earth observations for biodiversity and ecosystem monitoring.

Future Earth Members Platform

The Future Earth members platform is a digital space for the global sustainability science community, where individuals can connect with colleagues through our growing database of international researchers, search for new job

openings and upcoming events from around the world, and discover useful tools and resources.

- Over 1900 members have joined in the past year
- Current membership is at 3300 from 70 countries



Future of Washing Initiative

The Future of Washing Initiative was launched in December 2018 together with Future Earth, Kao Corporation, and The University of Tokyo Institute for Future Initiatives. The initiative aims to create a discussion platform where various stakeholders from the private, academic and public sectors collaboratively explore innovative and sustainable ways of washing. Since its launch, the Initiative has been hosting events and workshops providing participants with learning opportunities to connect people's washing behavior with their impacts on the environment. The Initiative divided the concept of washing into various themes and selected clothes washing as the first discussion topic. In 2020, working with various stakeholders, events, and workshops topics have included: 1) life cycle assessment of clothes washing; 2) the water and energy used by clothes washing, including new energy efficient technologies installed in washing machines; and 3) the impacts caused by microplastics and exploring developments in new fibers that may decrease environmental impacts. The Initiative has also been disseminating blog posts regarding the various environmental impacts of washing.

By discussing the environmental impacts of washing with various stakeholders, the Initiative aims to facilitate a behavioral transformation in society towards sustainable washing. The Initiative is currently engaging a wide range of

Japanese stakeholders and it plans to expand its activities throughout Asia and other regions. The Initiative also plans to consider the cultural and religious diversity of washing methods based upon habits and local knowledge.



Global Risks Perceptions Initiative

The increasing frequency and intensity of global risks (like climate change, public health threats, and social inequity) pose major obstacles to the wellbeing of all humanity. Finding solutions to these global systemic challenges will require dialogues that engage a diversity of perspectives and experiences. Over the past 15 years, the framing of global

risks has been strongly shaped by the World Economic Forum's annual Global Risks Report, which surveys the perceptions of world leaders from business, academic, and policy spheres. While this framing is valuable, Future Earth's Global Risks Perceptions Initiative strives to complement this perspective by capturing and analyzing the perceptions on global risk of

different scientific communities. In 2021, for the second edition, the initiative surveyed over 200 scientists in 65 countries in collaboration with a global advisory committee and in partnership with the International Science Council. Results are currently being analyzed. A peer-reviewed publication and public-facing report will be released in the coming months.



Grants for Collaborative Sustainability Research Projects

The Program for Early-stage Grants Advancing Sustainability Science (PEGASuS) was established to provide \$2 million in direct support over a five-year period for Future Earth Global Research Projects, Knowledge-Action Networks, and new partners to collaborate, increase knowledge, promote innovation, and establish evidence-based solutions to the world's sustainability challenges. PEGASuS aims to generate self-sustaining research projects that have real impacts on the health and well-being of human societies and the natural world.

PEGASuS II: Ocean Sustainability, a partnership between Future Earth and the National Center for Ecological Analysis and Synthesis (NCEAS) launched in early 2019. The Program provides support for two NCEAS working groups focusing on ocean-related sustainability challenges: establishing and monitoring the Palau National Marine Sanctuary, and facilitating the implementation of a globally coordinated and sustained ocean observing system to assess the status and trends in ocean biodiversity around the world. PEGASuS II also supported two postdoctoral researchers, Drs. Erin

Satterthwaite and Alfredo Giron, working in collaboration with both NCEAS working groups and the OCEAN Knowledge-Action Network. The postdoctoral researchers also actively engaged in science-policy through the United Nations Decade of the Oceans for Sustainable Development, and established the Early Career Ocean Professionals (ECOP) group. Due to the unprecedented pandemic conditions the program reassessed their remaining resources and developed a self-guided data visualization training program that was already delivered in Palau and will be shared widely in the next year.

PEGASuS III and IV both launched in 2020. In PEGASuS III, Future Earth established a "take it further" grants program, providing an opportunity to the 15 international research teams funded through the Belmont Forum Sustainable Urban Global Initiative Food-Water-Energy Nexus program. Four new transdisciplinary research teams received funding for delivering and implementing new innovative ideas that increase the impact of their original proposed projects. For PEGASuS IV, Future Earth partnered with FEROSA and

the Belmont Forum to support integrated research focused on establishing international transdisciplinary research teams focused on the development of new networks and communities of practice addressing multiple sustainable development goals and pathways. PEGASuS IV provided funding for African researchers to participate in the collaborative research actions and their work kicked off in March 2021.



Sustainability in the Digital Age

Humanity today is interconnected through, and dependent on, the digital and natural worlds. Thus, tackling the UN Sustainable Development Goals, while working towards a just digital future, are intertwined ventures. Sustainability in the Digital Age works to build a global network of collaborators at this nexus, to drive the transformative systems changes needed to build a sustainable, climate-safe, and equitable world.

This initiative is a formal partnership with Future Earth, Mila – Quebec Artificial Intelligence Institute, the International Science Council (ISC), and the German Environment Agency.

A key milestone in 2020-2021 was the release of a special issue of IEEE Technology and Society Magazine (vol. 30, Issue 2) on Sustainability in the Digital Age. It gathers commentaries, opinion pieces, and analyses from thought leaders, building on insights from the [Digital Disruptions for Global Sustainability \(D²S\) Research Agenda](#) produced in collaboration with over 250 experts from around the world.

Other major highlights this year include the following:
Reimagining Climate Governance in the Digital Age: An ongoing project in partnership with ClimateWorks Foundation to develop a strategic

framework for philanthropic investments. We built a database of nearly 200 examples of digitally-empowered climate governance strategies in action, convened a series of Co-Working Sprints engaging experts from four continents and two high-level workshops with key actors from philanthropy and finance, and launched [a video and web article](#).

[Coalition for Digital Environmental Sustainability \(CODES\)](#): This is an open multi-stakeholder community of change makers and practitioners that seek to collaborate in accelerating a digital planet for sustainability. It is co-championed by UNEP, UNDP, the International Science Council, the German Environment Agency, the Kenyan Ministry of Environment and Forestry, Future Earth, and Sustainability in the Digital Age.

[Canada's Sustainable Future: Creating a Digital Action Plan](#): We held a series of virtual town halls, and invited consultations, in partnership with the Canadian Science Policy Centre, in sum reaching over 250 people, to raise Canadian awareness on the topic of sustainability and digitization.

[The Leadership in Environmental and Digital innovation for Sustainability \(LEADS\)](#) graduate training program in partnership with several Quebec Universities welcomed its first cohort



of students in 2020. Eight LEADS interns were hosted by the Future Earth Canada Hub over the reporting period. We also co-organized three speaker events, co-organized two Leadership Training sessions, and helped co-organize a LEADS summer school (May 2021).

Sustainability Research and Innovation Congress

Future Earth and the Belmont Forum have partnered to establish a global congress series focused on Sustainability Research and Innovation. By March 2021, the preparations for the first Sustainability Research and Innovation Congress, SRI2021, were in full swing, and SRI was emerging as a central global platform for transdisciplinary research and innovation in sustainability. Initially planned for June 2020, the global outbreak of COVID-19 and concerns over the health and safety of participants led

conveners to postpone the Congress to June 12-15, 2021. Travel restrictions and safety concerns also led to a dramatic pivot from a mostly in-person meeting in Brisbane, Australia, to a hybrid gathering, bringing together more than 2000 participants from all over the world via the SRI online Congress platform. Onsite events at the Brisbane Convention and Exhibition Center were designed to bring local flavor to the meeting and offer an in-person venue for the Australian sustainability science community.

The hybrid format enabled innovation in engaging the growing SRI audience. By March, the first SRI pre-event had already been organized, and the following months would feature three more SRI Talks - high-level and open access conversations on sustainability - as well as online training sessions, workshops and webinars. These events prepared the ground for the SRI2021 Congress program featuring over 700 diverse speakers from multiple countries, academic disciplines, and sectors of society - and many from the Future Earth community.



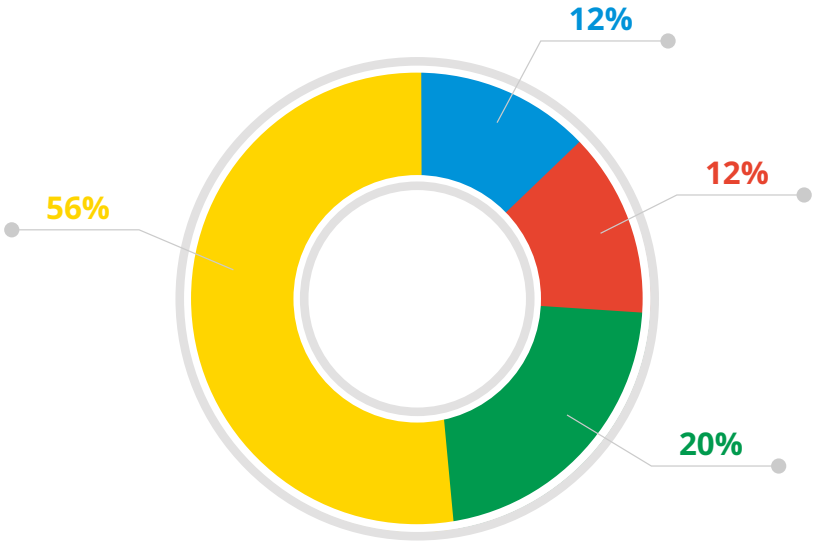


Financial summary

During the financial year April 2020 - March 2021, the consolidated revenue of Future Earth's Global Hubs consisted of 56% public source funds, including national contributions, and 44% private-sector funding. This is a shift from previous years when public sources accounted for approximately 80% of annual revenues.

Total expenses were 5.6 million EUR. This is an increase from last year's 4.8 million EUR, primarily in the Research and Innovation function.

Expenses by function 2020-2021	thousand EUR
Operations	646
Communications	1137
Networks	688
Research & Innovation	3117
Total	5588



Who we are

Secretariat

Executive Leadership

Amy Luers, Executive Director (until August 2020)

Fumiko Kasuga, Global Hub Director, Japan

Hein Mallee, Director, Asia Regional Center

Josh Tewksbury, Interim Executive Director (starting September 2020); Global Hub Director, USA

Manfred A. Lange, Director, MENA Regional Center

Michael Nxumalo, Director, Southern Africa Regional Office

Sandrine Paillard, Global Hub Director, France

S.K. Satheesh, Director, South Asia Regional Office

Veera Mitzner, Global Hub Associate Director and Networks Co-Lead, USA

Wendy Broadgate, Global Hub Director, Sweden

USA

Josh Tewksbury, Global Hub Director, USA

Craig Starger, Research Enabling Lead (until September 2020)

Hannah Moench, Network Associate

Jon Walton, Communications Lead

Apurva Dave, Research and Innovation Lead and Earth Commission Lead (until June 2020)

Judit Ungvari, Co-lead, Research & Innovation

Kathy Kohm, Editor-In-Chief, Anthropocene Magazine

Lakshmi Muralidharan, Finance Manager (until December 2020)

Laurel Milliken, Information Technology Officer

Margaret Krebs, Program Director, Earth Leadership Program

Maria Fernanda Enriquez, Administrative Officer

Sharon Collinge, Executive Director, Earth Leadership Program

Veera Mitzner, Associate Director, Network Lead

Japan

Fumiko Kasuga, Global Hub Director, Japan

Giles Sioen, Co-lead, Research & Innovation

Junya Tani, Senior Advisor

Kyoko Shiota MacAulay, Program Manager

Noriko Kawata, Communications Officer

Marcin Jarzebski, Science Officer

Yuki Hashimoto, Communications Officer

Ria Lambino, Science Officer

Masami Oka, Communications Officer

Takako Okamoto, Administrative Officer

Canada

Amy Luers, Executive Director (until October 2020)

Eliane Ubalijoro, Global Hub Director, Canada

Andréa Ventimiglia, Staff Writer

Jennifer Garard, Science Officer

Sylvia Wood, Science Officer (until August 2020)

Marie d'Acremont, Administrative Officer

Nilufar Sabet-Kassouf, Executive Assistant

Rachelle Fox, Digital Content and Communications Officer

Paula Monroy, Communications Coordinator (until November 2020)

Sylvia Wood, Science Officer (until August 2020)

France

Sandrine Paillard, Global Hub Director, France

Cosma Cazé, Science Officer

Fanny Boudet, Science Office (until February 2021)

Clément Brousse, Science Officer

Cristian Passarello, Science Officer

Hannah Moersberger, Deputy Director

Mariela Antonakopoulou, Senior Science Officer

Vincent Virat, Science Officer (until August 2020)

Xavier Peres, Coordinator

Sweden

Wendy Broadgate, Global Hub Director, Sweden

Erik Pihl, Science Officer

IngMarie Alström, Finance Director (until September 2020)

Juan Rocha, Research Scientist, Earth Commission

Lisa Jacobson, Science Officer

Sophie Hebden, Research Coordinator - Earth Observations

Steven Lade, Research Scientist, Earth Commission

Susanna Dobrota, Coordinator and Administrative Officer

Therese Öreteg, Communications and Administrative Officer

Governing Council Members

Dirk Messner, United Nations University (UNU) (Co-Chair), Germany

Maria Uhle, Belmont Forum (Co-Chair), USA

Asako Omi, STS Forum, Japan

Hartwig Kremer, United Nations Environment Programme, Denmark

Heide Hackmann, International Science Council, France

Jean-Marie Flaud, Ministère de l'enseignement supérieur, de la recherche et de l'innovation, France

Juichi Yamagiwa and Kazuhiko Takeuchi, (until October 2020) Science Council of Japan, Japan

Takaaki Kajita and Yukari Takamura, (from October 2020) Science Council of Japan, Japan

Shamila Nair-Bedouelle and Meriem

Bouamrane, UNESCO, France

Pavel Kabat, World Meteorological Organization (WMO), Switzerland

Rémi Quirion, Fonds de recherche du Québec (FRQ), Canada

Stefan Claesson, Royal Swedish Academy of Sciences, Sweden

Advisory Committee Members

Johan Rockström, Potsdam Institute for Climate Impact Research (PIK) (Co-Chair), Germany

Leena Srivastava, International Institute for Applied Systems Analysis (IIASA) (Co-Chair), Austria

Anny Cazenave, International Space Science Institute, France

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Braulio Ferreira de Souza Dias, University of Brasilia, Brazil

Fatima Denton, United Nations Economic Commission for Africa, Ethiopia

Jim Balsillie, Research In Motion (BlackBerry), Canada

Joy Shumake-Guillemot, WHO/WMO Climate and Health Office, Switzerland

Naoko Ishii, Global Environment Facility (GEF), USA

Oyun Sanjaasuren, Green Climate Fund, Mongolia

Pamela Matson, Stanford University, USA

Peng Gong, Tsinghua University, China

Tetsuzo Yasunari, Research Institute for Humanity and Nature (RIHN), Japan

Tolullah Oni, University of Cape Town, South Africa; University of Cambridge, UK

Funders

National and Local Contributors

- Austria (Federal Ministry for Science, Research & Economy)
- Taipei (Academia Sinica)
- Finland (Council of Finnish Academies)
- Germany (German Research Foundation)
- India (Indian National Science Academy)
- Israel Academy of Sciences and Humanities
- Japan (Ministry of Education, Culture, Sports, Science and Technology, MEXT)
- Philippines (Philippine Council for Industry, Energy and Emerging Technology Research and Development)

U.S. Global Hub

- Belmont Forum
- Colorado State University
- Cynthia and George Mitchell Foundation
- George Mason University
- Gordon and Betty Moore Foundation
- NASA
- NOMIS Foundation
- University of Colorado Boulder
- US Global Change Research Program
- US National Science Foundation
- V Kann Rasmussen Foundation

Japan Global Hub

- AEON Environmental Foundation
- KAO Corporation
- Keio University
- National Institute for Environmental Studies
- Remote Sensing Technology Center of Japan
- Research Institute for Humanity and Nature
- Science Council of Japan
- The University of Tokyo/Institute for Future Initiatives

Canadian Global Hub

- Canadian Institutes of Health Research
- ClimateWorks Foundation
- Fond de Recherche du Québec (FRQ)
- Laval University
- Montréal International
- Polytechnique Montréal
- Quebec's Ministry of International Relations
- Social Sciences and Humanities Research Council
- United Nations Environment Programme

French Global Hub

- Alliance Nationale pour la Recherche en Environnement (AllEnvi)
- Agence Nationale de la Recherche (ANR)
- Centre National de la Recherche Scientifique (CNRS)
- Ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation (MESRI)
- Institut de Recherche pour le Développement (IRD)
- Sorbonne Université

Swedish Global Hub

- European Space Agency
- MAVA
- Oak Foundation
- Porticus Foundation
- The Global Environment Facility
- Global Challenges Foundation
- Herlin Foundation
- Gordon and Betty Moore Foundation

Selected publications

For a full list of Future Earth community-led publications, visit: <https://futureearth.org/ar2021publicatons>

Future Earth-wide integrative publications

Earth Commission

- Rockström, J., Gupta, J., Lenton, T. M., Qin, D., Lade, S. J., Abrams, J. F., ... & Winkelmann, R. (2021). Identifying a safe and just corridor for people and the planet. *Earth's Future*, 9(4), e2020EF001866. <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020EF001866>
- Díaz, S., Zafra-Calvo, N., Purvis, A., Verburg, P. H., Obura, D., Leadley, P., ... & Zanne, A. E. (2020). Set ambitious goals for biodiversity and sustainability. *Science*, 370(6515), 411-413

10 New Insights on Climate Science

- Future Earth, The Earth League, WCRP (2021). 10 New Insights in Climate Science 2020. Stockholm. URL: <https://futureearth.org/10-insights-2020>
- Pihl et al., (2021). 10 New Insights in Climate Science 2020 – a Horizon Scan, *Global Sustainability*, 4. <https://doi.org/10.1017/sus.2021.2>

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- Future Earth (2020) Digital Disruptions for Sustainability (D²S) Agenda– Cross-Cutting Actions Agenda, *Environment: Science and Policy for Sustainable Development*, 62:3, 30-41, DOI: 10.1080/00139157.2020.1750924
- Luers, A., Garard, J., St. Clair, A. et. al. Leveraging Digital Disruptions for a Climate-Safe and Equitable World: The D²S Agenda: (2020). *IEEE Technology and Society Magazine, Special Issue*, vol. 30. Issue 2.
- Garshagen, M., Wood, S., Garard, J., Ivanova, M., Luers, A. Too Big to Ignore: Global Risk Perception Gaps Between Scientists and Business Leaders. (2020). *Earth's Futures Vol 8 (3)* <https://doi.org/10.1029/2020EF001498>
- Wood, S., Luers, A., Garard, J., Gambhir, A., Chaudhari, K., Ivanova, M., & Cronin, C. (2021). *Collective foresight and intelligence for sustainability*. *Global Sustainability*, 4, E3. [doi:10.1017/sus.2021.3](https://doi.org/10.1017/sus.2021.3)



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