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FUTURE EARTH - OVERVIEW

Note by the Executive Secretary

INTRODUCTION

1. The Executive Secretary is circulating herewith, for the information of participants in the nineteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, a note received from the Future Earth Secretariat. The information is provided in the form and language in which it was received by the Secretariat.

* UNEP/CBD/SBSTTA/19/1.

Future Earth - overview

Future Earth is an international research programme for global sustainability. It supports and coordinates research worldwide to generate new knowledge and solutions, by focusing on three research themes – dynamic planet, global sustainable development and transformations to sustainability. The vision of Future Earth is for people to thrive in a sustainable and equitable world.

Future Earth arose from the integration of the International Council for Science (ICSU)-sponsored Global Environmental Change (GEC) programmes DIVERSITAS, the International Geo-Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP), and projects of the Earth System Science Partnership (ESSP). Future Earth was launched at the United Nations Rio+20 Summit in 2012. It became fully operational in 2015 with the launch of five global hubs in Montreal, Paris, Stockholm, Tokyo and Boulder and the appointment of its first executive director Paul Shrivastava. Future Earth will run for ten years from 2015.

Future Earth is a partnership between the research community and society, aiming to create an agile global knowledge generation and innovation system around an international research agenda. It brings into a single network the world's leading centres and experts in biodiversity, land-use, climate, oceans, energy, food security, urbanisation, transformations, governance, resilience, economics, and more. This requires contributions from a new type of science that links disciplines, knowledge systems and societal partners, building on the achievements of the programmes that came before it.

Future Earth will work with partners in society to co-develop the knowledge needed to support decision-makers and societal change at all scales and in diverse contexts. With these partnerships, Future Earth can contribute to generating the information and tools necessary to address the scientific and technical needs to achieve the Aichi Biodiversity Targets, the 2050 Vision of the Strategic Plan for Biodiversity, and the Sustainable Development Goals (SDGs). Future Earth's international networks of scientific experts and stakeholders are able to support work under the Convention on Biological Diversity, as well as IPBES and IPCC.

Governance structure

The governance structure of Future Earth embraces the concepts of co-design and co-production. Future Earth is led by a Governing Council, and supported by two advisory bodies: a Science Committee and an Engagement Committee.

The Governing Council of Future Earth is composed of members of the Science and Technology Alliance for Global Sustainability (the Alliance), an informal international partnership that is committed to making full use of science and technology to inform equitable, sustainable solutions to the most pressing issues currently confronting humankind. The Governing Council comprises:

- The International Council for Science (ICSU)
- International Social Science Council (ISSC)
- Science and Technology in Society (STS) forum
- The Belmont Forum of funding agencies
- The Sustainable Development Solutions Network (SDSN)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- United Nations Environment Programme (UNEP)

- United Nations University (UNU)
- The World Meteorological Organization (WMO)

The Governing Council is the ultimate decision-making body and is responsible for setting Future Earth's strategic direction and policies. The Science Committee, which contains leading natural and social scientists from a broad range of relevant disciplines, is responsible for providing scientific leadership and guiding the development of new projects. The Engagement Committee, which comprises thought-leaders from stakeholder groups including business, policy and civil society, provides leadership and strategic guidance on involving stakeholders throughout the entire research process from co-design to dissemination, ensuring that Future Earth produces the knowledge society needs. The Engagement Committee and Science Committee are balanced in terms of disciplinary research background, geographical location, nationality and gender.

The Future Earth Secretariat performs the day-to-day management of Future Earth, ensuring the coordination across themes, projects, regions and committees, and liaising with key stakeholders. The Secretariat has hubs in Montreal (Canada), Paris (France), Stockholm (Sweden), Colorado (US) and Tokyo (Japan), and regional centres which today cover the Middle East and North Africa, Latin America, Europe and Asia. A regional hub for Africa is being developed. The creation of National Future Earth Committees is also actively encouraged, with around 20 committees established worldwide and many more in development.

Research

Research within Future Earth links disciplines and knowledge systems to connect science to society. It is guided by the *Future Earth 2025 Vision*, and informed by the regular creation of a Strategic Research Agenda, co-designed by scientists and societal partners. The 2025 Vision sets out an ambitious agenda for Future Earth, which aims to 1) inspire and create ground-breaking interdisciplinary science relevant to major global sustainability challenges, 2) deliver products and services that societal partners need to meet these challenges, 3) pioneer approaches to co-design and co-produce solutions-oriented science, knowledge and innovation for global sustainable development, and 4) enable and mobilise capacities to co-produce knowledge, across cultural and social differences, geographies and generations.

The *Strategic Research Agenda 2014* is structured around three research themes – dynamic planet, global sustainable development and transformations to sustainability, all contributing to address eight societal challenges, namely 1) food water energy nexus, 2) decarbonisation of the economy, 3) natural assets, 4) cities, 5) rural futures, 6) health, 7) sustainable consumption and 8) governance. To encourage and facilitate integrated, challenge-driven approaches, researchers from different disciplinary backgrounds will work together with stakeholders in Knowledge Action Networks that address challenges in integrated, solutions-oriented way. With this approach, Future Earth will both build on and move beyond the research and knowledge generation activities of the former core projects of the GEC programmes.

The Strategic Plan for Biodiversity 2011 – 2020 (Annex to Decision UNEP/CBD/COP/DEC/X/2) notes that ongoing research on biodiversity and ecosystem function and services and their relationship to human well-being will be facilitated by DIVERSITAS, the Programme on Ecosystem Change and Society (PECS), one of projects that has transitioned into Future Earth, and other global change

research programmes of ICSU, among others. In light of this, DIVERSITAS developed a research agenda on biodiversity and ecosystem services: the DIVERSITAS vision 2012 – 2020 (Larigauderie et al., 2012). This vision has been integrated into the Future Earth Strategic Research Agenda, and a number of ongoing research programmes that were initiated under DIVERSITAS have transitioned into Future Earth, among them the former DIVERSITAS core programmes bioGENESIS, bioDISCOVERY, ecoSERVICES, ecoHEALTH and Global Mountain Biodiversity Assessment (GMBA). In addition, new initiatives launched under Future Earth in 2014 include work on global biodiversity monitoring, prediction and reporting, and on linking earth system and socio-economic models to predict and manage changes in land use and biodiversity.

Recent Research highlights and initiatives:

Understanding critical challenges at the intersection of ecosystems and society

- Recent high-profile outbreaks of infectious diseases such as Ebola, avian influenza and severe acute respiratory syndrome (SARS) pose fundamental questions about the drivers of disease spillover from animals to humans. The emergence of such diseases involves many factors, and interdisciplinary research offers a way to better understand and solve the complex problems zoonotic diseases pose to human and animal well-being. The recent research paper 'Interdisciplinarity and Infectious Diseases: An Ebola Case Study' (Ezenwa VO, et al., 2015)[1] uses the recent outbreak of Ebola in West Africa as a case study to highlight how integrated research and approaches across scales from the molecular to the environmental can contribute to solving such complex problems.

Advancing scientific knowledge

- The inclusion and elaboration of the biosphere integrity boundary which features in the 2015 update of the planetary boundaries framework (Steffen et al., 2015)[2] uses examples developed by the DIVERSITAS community after the publication of the first set of planetary boundaries in 2009. A workshop convened by the DIVERSITAS community together with the International Geosphere-Biosphere Programme (IGBP) brought the biodiversity scientists from around the world together with researchers on planetary boundaries to assess the possibility of global-scale thresholds. The resulting paper concluded that "biodiversity's role in supporting a safe operating space for humanity may lie primarily in its interactions with other boundaries". Managing the biodiversity boundary can play a role in slowing or preventing crossing of the other planetary boundaries, suggesting an immediate area for research and policy focus. Conversely, the biosphere risks being pushed closer to its boundary by changes in other planetary processes. The updated planetary boundaries framework published in 2015 makes clearer the interactive nature of the boundaries,

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1 Ezenwa VO, Prieur-Richard AH, Roche B, Bailly X, Becquart P, García-Peña GE, Hosseini PR, Keesing F, Rizzoli A, Suzán G, Vignuzzi M, Vittecoq M, Mills JN, Guégan JF (2015) Interdisciplinarity and infectious diseases: an Ebola case study. PLoS Pathogens 11: e100499

2 Steffen, W., Richardson, K., Rockstrom, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., Sorlin, S.. (2015). Planetary boundaries: Guiding human development on a changing planet. Science, 3, 47(6223), 1259855–. doi:10.1126/science.1259855

recognizing the 'core' role of biosphere integrity and climate change through their interactions and feedbacks with the other seven boundaries.

Contribution to policy processes

- In partnership with ICSU, ISSC, UNU and SDSN, Future Earth has established a task force on SDGs, led by the Earth System Governance project. This will be implemented into the overall Future Earth architecture in order to establish efficient and effective engagement of Future Earth with the SDG implementation process. In 2015, Future Earth has been active in providing a scientific perspective on the definition of the SDGs, targets and implementation. Further work foreseen will include contributions to the development of indicators for some targets and goals, and to the monitoring framework to regular assess progress towards the SDGs.

Global coordinated and integrated biodiversity monitoring, prediction and reporting

- This cluster activity, led by the GMBA, brings together the observational, remote sensing and modelling communities (in Future Earth and beyond) that are collecting and using spatio-temporally explicit biodiversity or environmental data. In a workshop in March 2015, the initiative provided a common platform for expertise from observational, remote sensing and modelling communities to interact and to discuss ways to integrate data collections and more effectively use spatio-temporally explicit biodiversity or environmental data for synthesis efforts. Discussions included ways to facilitate and create standards and infrastructure for collaborative global spatio-temporal biodiversity and ecosystem function monitoring, data harmonization and integration, prediction, reporting and visualization.

  The workshop identified several working groups to further develop action plans for the cluster. These include:
    - WG 1: Demonstrating the value and need for multi-species (inventory) data for assessing biodiversity change.
    - WG 2: Monitoring globally distributed but readily delineated systems.
    - WG 3: Linking traits and spatiotemporal species data and remote sensing to address community/ecosystem function and service
    - WG 4: Vision paper/report: Toward a best-possible representative global biodiversity monitoring – research and data needs
    - WG 5: Toward a digital platform for global biodiversity monitoring, prediction and reporting – issues, audiences, science

  The activity will further involve several smaller workshops to develop online data-and-reporting infrastructure prototypes, to address focal research activities, and to combine biodiversity and environmental monitoring and informatics, with the goal of publishing the outcomes in several articles.

Linking Earth System and Socio-economic models to predict and manage changes in land use and biodiversity - "Modelling Sustainable Futures"

- The goals of the cluster activity, led by AIMES (Analysis, Integration and Modelling of the Earth System), and co-led by bioDISCOVERY, are to bring together the modelling communities in the Earth system-, Biodiversity- and Socio-economic sciences in order to significantly advance the capabilities and approaches used to modelling human-environment systems, and to develop an integrated socio-environmental modelling framework. A focus is placed on the interactions between societal and environmental dynamics on one hand, and land use, biodiversity and ecosystem functions and services on the other, with the aim of identifying chances to create new opportunities for societies to develop. Thus, within the activity, there is an intent to move away from the prediction of negative consequences to the development of positive futures.
- Two workshops will bring together experts of different disciplines working on socio-environmental scenarios and models of land use change around selected case study regions. Potential case study regions include:
    - Mediterranean basin - Abandonment of land due to urbanization, different forms of agricultural management
    - Satoyama - Changes in land use and values
    - Life Stock Herding systems in Southern Africa - Change to common land to individual land ownership
    - Mexico - Land fragmentation in the EHIDO system
    - São Paulo - Atlantic Forest
    - Land Grabbing - Palm oil system in Borneo/Sumatra
    - UK and Europe - CAP reform

Scientific Support for IPBES Knowledge Generation

- The objectives of this cluster activity, led by bioDISCOVERY are to: 1) build and coordinate tasks of a community of practice that can support IPBES activities, 2) identify gaps in knowledge in collaboration with IPBES task forces, and 3) stimulate the community to find funding to fill those gaps. Activities of this initiative are closely coordinated with the IPBES Bureau and Multidisciplinary Expert Panel (MEP) and scientists engaged in IPBES activities. The activity collaborates with the IPBES task force on Data and Knowledge, and will link to other task forces once they are established. The activity also collaborates with the Intergovernmental Panel on Climate Change (IPCC) and Convention on Biological Diversity (CBD), in order to better integrate the scientific work for the Conventions, as well as other Multilateral Environmental Agreements (MEAs). The focus will be placed on the following gaps in assessments associated with:
    - Indicators, in particular in relation to Aichi Targets
    - Disconnect and lack of integration between monitoring and assessment of biodiversity and assessment of ecosystem services
    - Sustainable use of biodiversity across systems and realms

Seeds of a Good Anthropocene

- This project aims to solicit, explore, and develop a suite of alternative, plausible visions of "Good Anthropocenes" – positive visions of futures that are socially and ecologically desirable, just, and sustainable. In addition to global visions, the project also identifies and analyses 'bright spots' – real places that demonstrate one or more elements of a positive future that might serve as seeds of a Good Anthropocene. The main achievements of the projects to date are:
    - A Game (which currently can be played with cards, and later will be developed into an online version) to both solicit Bright Spots and to explore how various Bright Spots might interact if they existed together in the world.
    - Database of over 100 seeds (https://goodanthropocenes.wordpress.com/). Data collected on each seed includes its location, pathway of impact, global relevance, Anthropocene challenges addressed, enhancing factors, limiting factors, actors involved, number of people involved, and current state of the seed.
    - Website/Blog to capture storylines.
    - International network of researchers interested in Bright Spots/Seeds.

Assessment of the contribution of biodiversity to climate change mitigation and adaptation

- In this follow-up activity to the analyses conducted for the Global Biodiversity Outlook 4, a team of experts under the leadership of Paul Leadley, and coordinated by bioDISCOVERY, is carrying out an assessment of how the conservation and sustainable use of biodiversity and the restoration of ecosystems, under the Convention on Biological Diversity (CBD), in particular the Strategic Plan for Biodiversity 2011 – 2020 and relevant Aichi Biodiversity Targets, has contributed, is contributing and could contribute to climate change mitigation and adaptation. As part of the assessment, possible scenarios are explored, that are likely to keep climate change within a 1.5 or 3 degree limit, and at the same time reduce and ultimately halt biodiversity loss in line with the Vision of the Strategic Plan for Biodiversity and meet other agreed goals for sustainable development and to examine the feasibility of pathways and response options in line with these scenarios.

Earlier contributions of DIVERSITAS to CBD

The technical reports underpinning the Global Biodiversity Outlook 3 (GBO-3, TS 50)[3] and Global Biodiversity Outlook 4 (GBO-4, TS78) were co-led or led by bioDISCOVERY, a core project of DIVERSITAS. In the GBO-3, the synthesis focused on estimates of biodiversity change as projected for the 21 st century by models or extrapolations based on experiments and observed trends, and paid particular attention to the interactions between biodiversity and ecosystem services. Experts

3 Leadley, P., Pereira, H. M., Alkemade, R., Fernandez-Manjarres, J. F., Proenca, V., Scharlemann, J. P. W., & Walpole, M. J. (2010). Biodiversity scenarios: projections of 21st change in biodiversity and associated ecosystem services. Global Biodiversity (Technical .). Montreal: Secretariat of the Convention on Biological Diversity, Montreal, Canada, Technical Series 50, 132 pages

Leadley, P.W., Krug, C.B., Alkemade, R., Pereira, H.M., Sumaila U.R., Walpole, M., Marques, A., Newbold, T., Teh, L.S.L, van Kolck, J., Bellard, C., Januchowski-Hartley, S.R. and Mumby, P.J. (2014): Progress towards the Aichi Biodiversity Targets: An Assessment of Biodiversity Trends, Policy Scenarios and Key Actions. Secretariat of the Convention on Biological Diversity, Montreal, Canada. Technical Series 78, 500 pages

highlighted a number of critical "tipping points" that could lead to large, rapid and potentially irreversible changes. Furthermore, possible actions at the local, national and international levels were identified that could be taken to conserve biodiversity.

In the GBO-4, and building on the methods and approaches used for the GBO-3, the team of experts assessed biodiversity trends, policy scenarios and key actions to determine the progress towards the Aichi Biodiversity Targets. The approach to scenario analysis was much broader than in previous assessments, as the "storyline" approaches to socioeconomic scenarios (e.g., IPCC SRES scenarios, MA scenarios) were complemented with other types of scenarios and extrapolations of current trends. Marrying this with an examination of the National Biodiversity Strategy and Action Plan reports available allowed to provide clearer input into policy, and to open the door to a stronger dialogue with stakeholders concerning desirable endpoints, identify actions needed to reach these endpoints and examine a broad range of socioeconomic development pathways and their impacts on the environment.

ecoHEALTH has established links with the CBD, and in recent years has supported the work of the CBD on the relationships between biodiversity and health. In particular, it supported the development of the joint WHO-CBD publication "Connecting global priorities: a state of knowledge review on the interlinkages between biodiversity and human health"4. ecoHEALTH is also a partner of a synthesis report undertaken by CBD on the underlying drivers of disease emergence and biodiversity loss.

Future Earth – a strong scientific partner

Building on established relationships, and having access to the world's leading centres and experts from a broad range of biodiversity and ecosystem related disciplines, and a wide range of societal partners, Future Earth can be a strong scientific partner to the CBD, supporting it in achieving its 2020 Strategic Plan and 2050 Vision. Experts involved in Future Earth can continue to contribute to various AHTEGs, such as the AHTEG on indicators. Other experts are contributing to various IPBES assessments, and activities are underway to prepare the scientific community for the upcoming IPBES global assessment, which will, among others, assess the progress towards achieving the Aichi Targets. Activities include the identification of indicators necessary for the assessment, as well as the development of integrative scenarios.

Opportunities for interactions between the Convention and Future Earth are manifold. A Future Earth delegation will be present at SBSTTA meetings; side events and workshops informing SBSTTA delegates on latest scientific development surrounding topics of relevance can be held before and during SBSTTA meetings. Future Earth has already 20 National committees established, with many more expected to follow. These National Committees are natural interaction points for SBSTTA national focal points, as are the secretarial hubs, regional offices and project offices.

4 Romanelli C, Cooper D, Campbell-Lendrum D, Maiero M, Karesh WB, Hunter D and Golden CD. 2015. Connecting Global Priorities: Biodiversity and Human Health A State of Knowledge Review. World Health Organization and Secretariat of the Convention on Biological Diversity