

Vision for GEO 2025

PART A: THE CASE FOR A RENEWED GEO

1 ADDRESSING SOCIETAL CHALLENGES

Food security - water security - energy security - resilience to natural hazards - mitigation of, and adaptation to, climate change - developing a sustainable economy: these are among our greatest global challenges. These challenges are driven by Earth's changing, interconnected, environmental conditions, in concert with human activities and policy decisions made at every level of a global society. To address these challenges wisely, Ministers, decision-makers and citizens around the world require comprehensive, integrated observations, data and information about the Earth's changing conditions. The intergovernmental Group on Earth Observations (GEO) was launched in 2005 to assemble a fuller picture of our planet, and to enable the science-informed decision-making needed to drive sound policy for the benefit of society. A renewed GEO will expand its commitment to sharing, discovery, access and use of Earth observations in its second decade.

2 VISION

GEO is a partnership of governments and organizations that envisions “a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations, and information.” At the time of GEO's creation in 2005, Ministers endorsed a 10-Year Implementation Plan containing specific actions designed to promote full and open access to Earth observations, data and information, and work towards building a Global Earth Observation System of Systems (GEOSS) to meet the need for “timely, quality, long-term, global information as the basis for sound decision-making.”¹

Between 2005 and 2010, GEO began laying the foundation for achieving GEOSS by establishing and refining its diverse program of work, which encompasses a broad array of societal challenges. Key gaps were identified, and Ministers met twice in Cape Town (2007) and Beijing (2010) to renew their commitment to the process. Between 2010 and 2013, GEO's Membership grew to 90 governments and more than 60 Participating Organizations. Examples of new value to society have begun to emerge from the creation of GEO, and steady progress toward the broad GEOSS vision is being realized.

As GEO approaches the end of its first 10-year mandate, the Government of Switzerland has invited Ministers from all GEO Member governments and leaders from all GEO Participating Organizations to Geneva in early 2014 to extend their political commitment to the GEO vision through 2025. The goal is to further leverage GEO's substantial accomplishments to improve Earth observations, as well as to increase the availability of Earth observations, data, and information (see Section 3 below) for the purposes of:

- a) Achieving national and international objectives for a resilient society, sustainable economy and healthy environment worldwide;

¹ *The Global Earth Observation System of Systems 10-Year Implementation Plan, 2005, p.1*

- b) Addressing global and regional challenges by deepening understanding of Earth system processes and improving the link between scientific understanding and policymaking at these levels; and
- c) Sustainably growing economies, reducing redundancy and reducing costs to public sector budgets through innovation and shared collaborations.

The representatives of GEO's Members and Participating Organizations assembled in the GEO Plenary, having assessed GEO's progress to date and the continuing global need for integrated, comprehensive Earth observations, recommend that Ministers renew GEO's mandate through 2025.

3 MAINTAINING GEO'S FRAMEWORK FOR SUCCESS

GEO's value rests in its unique capability to connect Earth observation data to societal needs in high-impact ways. GEO's achievements to date can be characterized broadly in five areas:

- **Data sharing** - GEO has significantly advanced international sharing of Earth observation and environmental data through the world-wide release and exchange of thousands of data sets of universal value, previously available for only limited use. This has proven particularly valuable for both global water research and land and natural resource management, contributing to sustainable economies and environments;
- **Data access and integration** - To advance data interoperability, GEO has effectively promoted the adoption of common standards, and developed pilot phase infrastructure and information architectures. This has been critical to improving the discovery, access, integration and use of Earth observations, with resulting progress in GEO projects concerning global drought and flood information, and the link between air quality and the influence of climate variables on human health, among other areas;
- **Major new global monitoring initiatives** - GEO has fostered substantial collaboration among governments and international organizations by creating four new global Earth observation initiatives: 1) monitoring biodiversity; 2) understanding the stock and flow of carbon at the global level with specific attention given to the world's forests; 3) improving global crop yield forecasts; and 4) coordinating the monitoring of major seismic and volcanic zones. For each, GEO identified specific observation gaps and – often with substantial support from Members and Participating Organizations – launched targeted initiatives, harmonized *in situ* and satellite observations, developed technical tools, communities of practice and, as appropriate, the formal agreements required to begin closing the gaps. These initiatives enable decision-makers to address global challenges such as food security, human health and safety, and maintaining a healthy environment, globally and in each country and region;
- **Regional coordination, research and innovation** - GEO has supported vital regional initiatives focused on the safety and security of the most vulnerable populations, such as water management in Asia and Africa; disaster response in Central America; and environmental monitoring in East Africa and the Himalayas; and
- **User-driven networks and projects** - GEO has advanced new Earth observation efforts by working to close critical information gaps via the creation and development of new, user-driven networks and projects. Examples include the monitoring of mercury compounds and assessing global solar and wind resources, among other efforts to address specific societal needs.

In addition, GEO's open, welcoming and voluntary approach has brought 90 Member governments and 67 international Participating Organizations together to coordinate and integrate data across essential socio-economic sectors, scientific and technical disciplines, and geographic

borders. No other organization holds GEO's distinctly critical mandate and flexible governance and management arrangements.

4 NEW GEO ACTIVITIES THROUGH 2025

To continue leveraging these successes through 2025, GEO will engage more deeply with its Participating Organizations, and strengthen GEO's role as a partner for major multilateral agreements and conventions, and as a mechanism for regional capacity building and proactive engagement with developing countries. Through sector-specific, public-private fora and other platforms for dialogue, GEO will further seek to sustain public sector investment in Earth observations while also increasing engagement with the private sector to spur innovations in the exchange and dissemination of, as well as closing gaps in, Earth observations, data and information for the benefit of society.

The GEO Work Plan adopted each year by the GEO Plenary, contains a number of ideas currently in development that, if successful, will mark success for GEO's second decade. Examples of the voluntary, exploratory projects of the current work plan include:

- a global operational ocean forecasting and information system to contribute to healthy oceans;
- a suite of globally agreed land cover data sets;
- a global urban observation system;
- a global wildfire information system to better manage forest fire threats;
- a global drought information system to contribute to sustainable agriculture and food security;
- a global carbon analysis system to better understand climate change;
- a global mountain observation and information network; and
- an information service for cold regions to contribute to the protection of these fragile and unique global ecosystems, in collaboration, where appropriate, with existing international coordination mechanisms, particularly in the Arctic.

To support the development of these and other potential activities highlighted in the annual GEO Work Plan, Part B below outlines consensus recommendations of the GEO Plenary for specific GEO process and activity goals for the decade ahead.

New elements include:

- sustaining an information system that provides access to the data and products of its Member governments and Participating Organizations;
- fostering global initiatives that address identified gaps in Earth observation information including, where appropriate, facilitating the development of partnerships to identify relevant stake-holders (end-users), as well as development of associated services and arranging for their subsequent uptake by relevant entities;
- mobilizing appropriate resources for Earth observation capacity building with a specific emphasis on developing countries through partnerships with relevant governmental, non-governmental and multilateral development institutions;
- allowing for the possibility of modifications to GEO's current Societal Benefit Area structure, exploring linkages to sustainable development themes;
- making a renewed effort, where possible, to collaborate with the private sector while remaining an intergovernmental partnership; and
- developing a specific and strengthened framework or mechanism for steady resource commitments to GEOSS, from both public and non-public sources, while relying on the principle of voluntary contributions.

Part B below outlines initial consensus recommendations of the GEO Plenary for specific GEO process and activity goals for the decade ahead. By the end of 2015, GEO will document the completion of activities under its first 10-year Implementation Plan and substantially elaborate on the below recommendations in the form of a new Implementation Plan for endorsement by Ministers.

PART B: RECOMMENDATIONS FOR GEO THROUGH 2025 (for ADOPTION by GEO-X Plenary)

In the 2010 Beijing Ministerial Declaration, the GEO community resolved to review recommendations for the governance, role and future work of GEO through 2025, and to take the necessary decisions, at the next Ministerial Summit. In response to this action, and building on the results of the first ten years of GEO, the GEO-X Plenary is requested to first adopt the following recommendations. Ministers assembled at the Geneva Ministerial Summit will then be invited to endorse these recommendations as referenced in the Geneva Ministerial Declaration.

Recommendation 1: Renew GEO and GEOSS for Greater Societal Impacts

The Group on Earth Observations (GEO):

- is a unique global initiative mandated to coordinate and facilitate the integration of, and access to the data from atmosphere, land and ocean observing networks (both *in situ* and remote sensing) and their associated information systems;
- occupies a key, strategic, upstream coordination position in the international community with respect to observations, data and information about the Earth system in support of other major initiatives; and
- brings together Governments and all relevant intergovernmental, international and regional organizations with an interest in Earth observations under a flexible, voluntary framework for coordinating strategies and investments, as well as developing new initiatives, through the on-going implementation of the Global Earth Observation System of Systems (GEOSS).

To develop and fully utilise a global observing system is a challenge beyond the ability of any single nation, organisation or academic discipline acting independently. GEO is making significant progress towards achieving this goal and should be given a renewed mandate to further implement GEOSS through 2025.

Therefore, GEO and the implementation of the GEOSS will be renewed through 2025.

Recommendation 2: GEO Strategic Objectives

Considering the increasing demand for Earth observations required to address sustainable development needs and future challenges, and inform decision-makers, GEO will focus on the following three Strategic Objectives through 2025:

- Coordinating strategies for acquiring Earth observations, seeking active collaboration with relevant existing and emerging global initiatives with complementary mandates to both ***promote full and open access to Earth observation data, and strengthen Earth observing networks, strategic planning and identification of the needs for applications and services***²;
- Facilitating enhanced access to: 1) ***national, regional and global Earth observation data and information*** (including “big data”³) by implementing a robust and user friendly GEOSS information system that links available systems, also taking advantage of repositories of “big

²Note: In the context of this paper, the term “service” is defined as the delivery of products based on Earth observation data and information addressing user needs through the coordinated use of the infrastructure and assets of the Members and Participation Organizations.

³Note: in the context of this paper, the term “big data” is defined as collections of data sets so large and complex that it becomes difficult to process them using on-hand database management tools or traditional data processing applications. The challenges include capture, curation, storage, search, sharing, transfer, analysis and visualization.

data"; and 2) *tools to transform the data and information into useable formats for resource management and decision-making*;

- Fostering *global initiatives* that address identified gaps in Earth observation information including, where appropriate, facilitating the development of associated services and arranging for their subsequent uptake by relevant entities.

Recommendation 3: Societal Challenges to be addressed through GEO post-2015

GEO will maintain its current working structure organized around coordinating acquisition of, and providing access to, the Earth observations needed to address societal challenges, initially referred to as Societal Benefit Areas, which currently include the following:

- Reducing risks and loss of life and property from natural and human-induced disasters;
- Understanding environmental factors affecting human health and well-being;
- Improving management of energy resources;
- Understanding, assessing, predicting, mitigating and adapting to climate variability and change;
- Improving water-resource management through better understanding of the water cycle;
- Improving weather information, forecasting and warning;
- Improving the management and protection of terrestrial, coastal and marine ecosystems;
- Supporting sustainable agriculture and combating desertification; and
- Understanding, monitoring and conserving biodiversity.

At the same time, GEO will also allow for the possibility of modifications, recognizing the cross-cutting and inter-related nature of these challenges and exploring linkages to sustainable development themes. GEO and GEOSS will build stronger relationships, both upstream and downstream, with complementary global Earth observations organizations, including those UN Agencies that are already Participating Organizations, as well other national, regional and global entities.

Recommendation 4: New Implementation Plan for GEOSS through 2025

During the period 2014-2015 a new Implementation Plan for GEOSS through 2025 will be developed, fully endorsing and extending the concepts in the current GEOSS 10-Year Implementation Plan for 2005-2015, while drawing upon lessons learned. The new Plan will also take into account the GEOSS Strategic Targets agreed at GEO-VI in 2009, as well as update them, and will include the following elements:

4.1 GEO Core Functions:

To advance the Strategic Objectives of GEO while building upon on its current activities, the resources and activities of GEO will continue to be dedicated to the following Core Functions, in close cooperation with user communities:

- Strengthening observation systems (space-based, airborne and particularly *in situ*) and networks among observation systems;
- Advancing interoperability and integration of Earth observation data;
- Promoting and implementing the GEOSS Data Sharing Principles;
- Building and sustaining an information system that provides access to the data and products of its Members and Participating Organizations;
- Developing capacity to collect and use Earth observations, and promoting regional GEOSS implementation;

- Supporting research and development of integrated applications of Earth observations; and
- Engaging with users and decision-makers, to ensure a user-driven GEOSS.

4.2 Governance

In the interest of preserving GEO as a flexible, agile and inclusive intergovernmental partnership, GEO will retain its present general governance structure: a regionally-based Executive Committee comprised of Member nations reporting to a full Plenary. However, to maximize the efficiency, effectiveness and success of GEO through 2025, GEO will explore options for modifications to governance including, possibilities for a strengthened role for Participating Organizations, based on the experiences of other international organizations, and for a strengthened Secretariat.

4.3 Engagement with Developing Countries

GEO will strengthen and incentivize its engagement with developing countries in relation to using Earth observations efficiently for addressing sustainable development, as well as fostering regional cooperation. In particular, capacity building is critical for developing Members' active engagement in the implementation of GEOSS. Thus, GEO will assist countries and regions in increasing their capacity to acquire, share, store, maintain and utilize space-based, airborne and *in situ* Earth observation data that is available on a full and open basis in connection with GEO Data Sharing Principles. To promote the advancement of Earth observation technologies and the further development of national and regional capacity to absorb and use these technologies, GEO will take the lead in mobilizing appropriate resources through partnerships with relevant governmental, non-governmental and multilateral development institutions.

4.4 Engagement with the Private Sector

While remaining an intergovernmental partnership, GEO will make a renewed effort, where possible, to collaborate with the private sector in achieving the GEO Strategic Objectives (Recommendation 2 above).

4.5 Resources for GEO and GEOSS through 2025

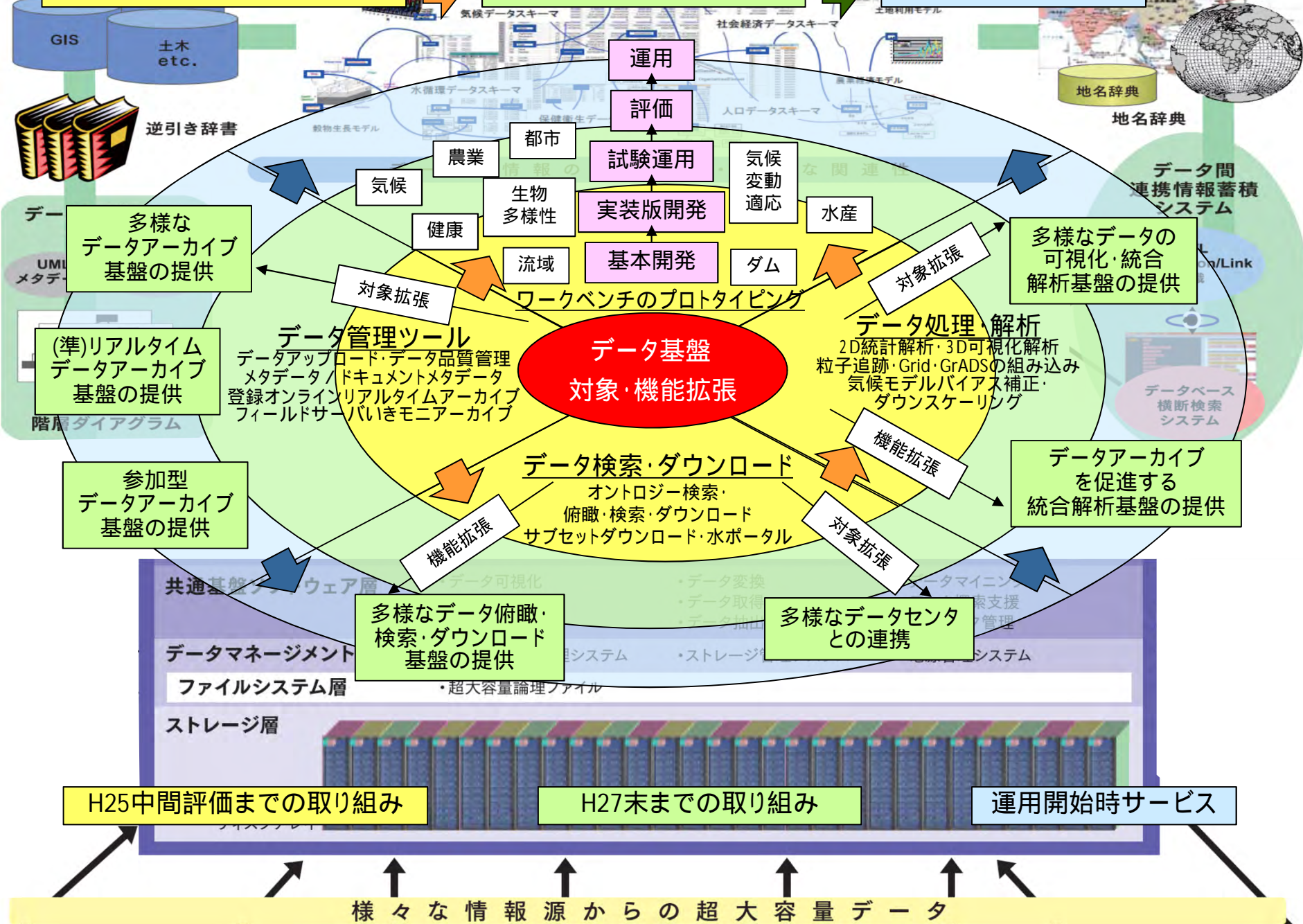
The resourcing mechanisms for the implementation of GEOSS through 2025 will continue to rely on voluntary contributions. With the aim of more active membership and engagement, and based on this voluntary contribution principle, a specific and strengthened framework or mechanism for steady resource commitments to GEOSS, from both public and non-public sources, will be developed by 2016. This framework will enable GEO to sustain the essential technical and administrative components of GEOSS through 2025 (GEO Secretariat and GEOSS Information System). Additionally, this framework will include support mechanisms for improving the participation of developing countries in GEO, and for the development, as appropriate, of global initiatives. In order to document global support to GEO and its added value, a dedicated registration system will be established to record resource contributions to the GEO Work Plan.

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GIS 土木 etc.

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機能拡張

対象拡張

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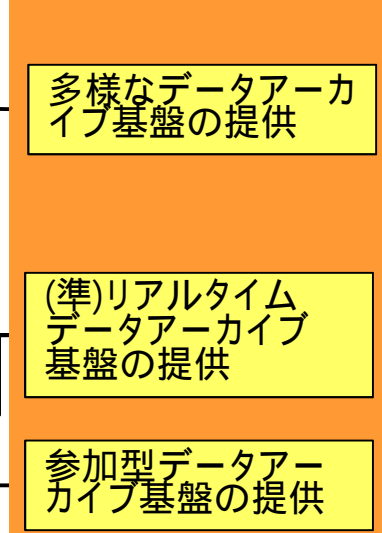
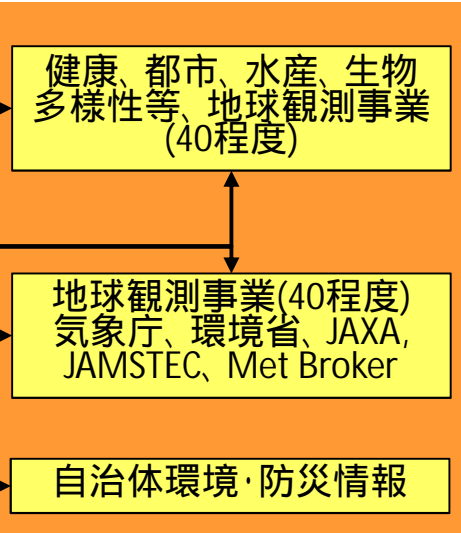
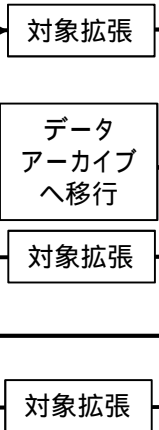
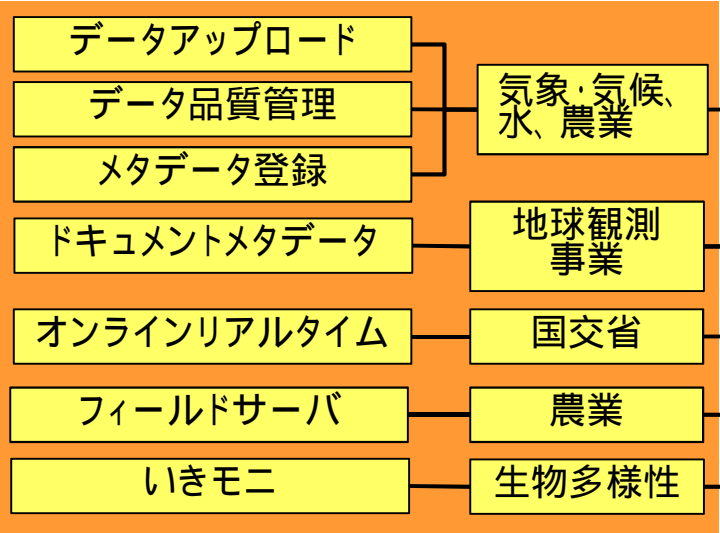
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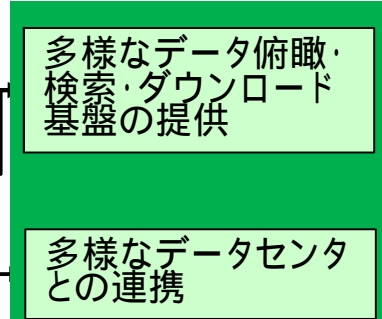
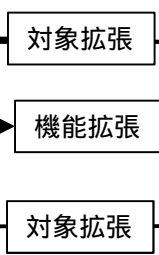
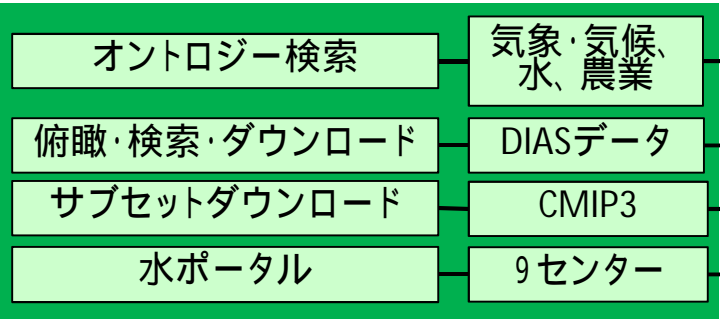
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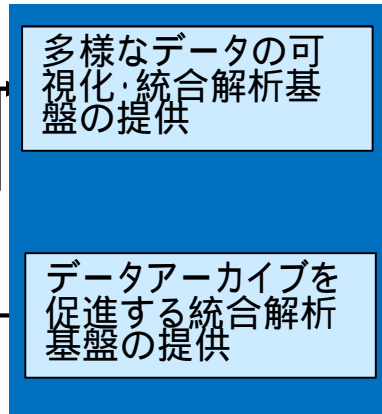
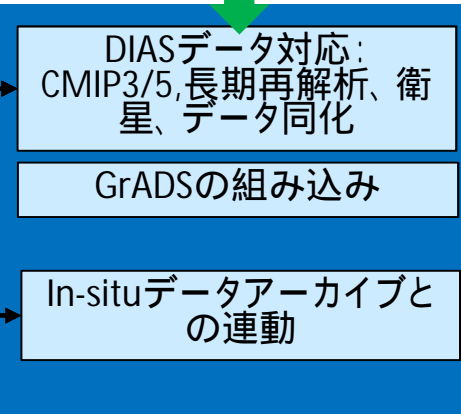
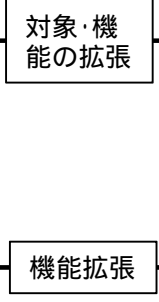
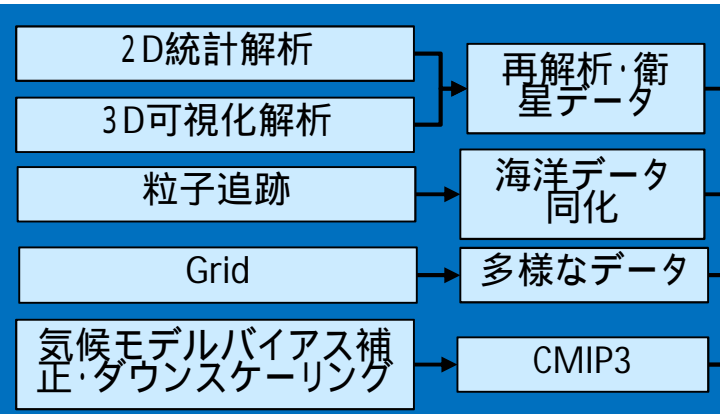
データアーカイブ



データ抽出



データ解析



Towards defining success for Future Earth by 2025

DRAFT: December 2013 (SC→EC→CPs)

The logic of this document proceeds from (A) Future Earth's stated role in relation to humanity's expressed global objectives, to (B) identify some relevant advances that the global community would need to aspire to by 2025 for these objectives to be met, to then (C) propose what Future Earth should achieve by 2025 to contribute to these outcomes.

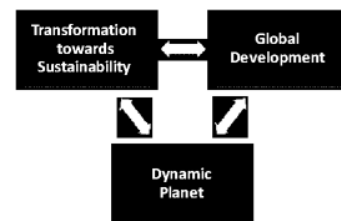
A. Background

We draw on two primary sources to frame this document: first, as a definition of our role, the stated intent of the Future Earth Initial Design Document¹:

“Future Earth will address issues critical to poverty alleviation and development such as food, water, energy, health and human security, and the nexus between these areas and the overarching imperative of achieving global sustainability. It will provide and integrate new insights in areas such as governance, tipping points, natural capital, the sustainable use and conservation of biodiversity, lifestyles, ethics and values. It will explore the economic implications of inaction and action and options for technological and social transformations towards a low-carbon future. Future Earth will explore new research frontiers and establish new ways to produce research in a more integrated and solutions-oriented way.”

We also note the three Research Themes defined as an organizing framework for Future Earth:

1. **Dynamic planet**
2. **Global development**
3. **Transformations towards sustainability**



Second, as a global policy statement of intended outcomes, the definitional (4) and resolution (12) clauses regarding sustainable development in the opening of the UN General Assembly's resolution 66/288² that adopted *The Future We Want* outcomes document from Rio+20 in 2012:

*“4. We recognize that poverty eradication, changing unsustainable and promoting sustainable patterns of consumption and production and protecting and managing the natural resource base of economic and social development **are the overarching objectives of and essential requirements for sustainable development**. We also reaffirm the need to achieve sustainable development by promoting sustained, inclusive and equitable economic growth, creating greater opportunities for all, reducing inequalities, raising basic standards of living, fostering equitable social development and inclusion, and promoting the integrated and sustainable management of natural resources and ecosystems that supports, inter alia, economic, social and human development while facilitating ecosystem conservation, regeneration and restoration and resilience in the face of new and emerging challenges.*

*“12. **We resolve to take urgent action to achieve sustainable development**. We therefore renew our commitment to sustainable development, assessing the progress to date and the remaining gaps in the implementation of the outcomes of the major summits on sustainable development and addressing new and emerging challenges. We express our determination to address the themes of the United Nations Conference on Sustainable Development, namely, a green economy in the context of sustainable development and poverty eradication, and the institutional framework for sustainable development.”*

¹ http://www.icsu.org/future-earth/media-centre/relevant_publications/future-earth-initial-design-report

² <http://sustainabledevelopment.un.org/futurewewant.html>

B. Global aspirations

The global community thus aspires to achieve the high level outcome of significant progress towards the UN's expressed goal of poverty eradication, changes to sustainable patterns of consumption and production, and protective management of the natural resource base, through the mechanisms noted in Clause 4 above, with all their related implications. Systems thinking suggests that the following, more specific, achievements would need to be key contributors:

- All Sustainable Development Goal targets agreed in 2015 will be on track, and no new transgressions of our safe and just operating space will have occurred, with a good and equitable handling of interactions among goals and their implementation at national and regional scales. In particular:
 - Global emissions of greenhouse gases will be declining
 - The rate of loss of biodiversity and all natural habitats is brought close to zero, and the role of biodiversity in providing benefits to all people is secured;
 - All nations will be trending towards more equality, and national GDP per capita will be converging for nations globally
 - Nutritious food will be available for all from sustainable land and marine food systems which are using water, nutrients and land/sea more efficiently than today
 - Negotiations will have begun on a new and more challenging set of SDGs post-2030
- Major transitions to sustainable patterns of consumption and production will be in train, with all nations playing their role
 - Half the nations of the world will use inclusive wealth indicators as the main approach to assessing national well-being
 - The trend towards increased consumption will have reversed in those people with above median consumption per capita globally
 - A new sustainable narrative of urban identity is spreading through the world's cities, recognizing rural-urban interactions, and leading to urban planning which delivers health and well-being with declining net resource waste and resource flows per capita
- Governance systems at national and international levels will have changed to facilitate agreement on the foregoing outcomes.
 - Critical regions for environmental change are well-monitored and regularly discussed in high level international economic sustainability fora as indicators of change that drive transparent adaptive decision-making about planetary stewardship

What should have been the contribution of Future Earth research towards these outcomes?

C. In the light of this context, Future Earth will judge its progress in terms of whether, by 2025, we have developed [can we make these more measurable?]:

1. Groundbreaking science linked to sustainable solutions in key problem areas, which will have:

Transformations towards sustainability

- Identified new governance and institutions, which governments, businesses and civil society have adopted for transformational innovation
- Provided transparent and accessible information and a suite of indicators (e.g., inclusive wealth, social-ecological footprints, trade-offs) useful for policy decisions and to provide feedback to individuals, businesses and communities about the impact of their actions, which are in use in policy and daily life
- Identified a range of innovations and experiments in technology, social practices and cultural perspectives, which are in use to promote transformative social change
- Developed methods and tools that support collaborative solutions for sustainable development with a wide range of stakeholders, who have diverse worldviews, values, interests, levels of power and marginalisation, and visions for the future

Global development

- Provided the understanding of and options for managing the interactions between and among identified social and biophysical targets of the Sustainable Development Goals, at global and sub-global levels
- Identified planning, management and governance structures for human settlements that deliver human health and well-being whilst supporting global sustainability outcomes, with narratives of urban identity that are not dependent on consumption
- Delivered understanding of the interactions across scales of food, water and energy, so that needs can be met sustainably without detrimental effects on other biodiversity and ecosystem values
- Provided decision-makers with information about the implications of alternative development trajectories and choices for human identity, standards of living, equity, opportunities and happiness
- Delivered the knowledge base for societies to adapt sustainably to changing environmental conditions, including climate variability and extremes, in a manner that recognizes the dynamic relationships among social and biophysical processes

Dynamic planet

- Produced a new generation of coupled social-ecological models that are able to account for non-linearity, emergent properties, and complex interactions, and are contributing to scenario building at different levels of analysis
- Developed, tested and collaborated to implement integrated observing systems and data infrastructure, which are underpinning the understanding of coupled human-environmental processes and the monitoring of change and sustainability trajectories at different levels of analysis
- Delivered the knowledge base that is in use for assessing, monitoring and policy making in specific critical regions of environmental change, such as oceans, cryosphere, coastal regions, small islands, deltas and estuaries, monsoon regions, and drylands.

DRAFT Success in 2025

2. Proven new ways of working, collaborating, engaging and communicating, that support Future Earth's specific scientific and engagement outcomes and build replicable models for the future. Thus Future Earth will have:

- Conducted and enabled multiple experiments in co-design/co-production/co-implementation for global sustainability issues, have evaluated their effectiveness, and have written "The [metaphorical] Book" on innovative and good practices in co-design.
- Established an ongoing set of interactions and outputs to promote, share and learn from examples of interdisciplinary co-design/co-production, including dynamic web-based fora, and have tracked periodically where and how they are taken up and used
- Established an institutional structure for Future Earth that reflects co-design/co-production/co-implementation, thus serving as an internationally visible model for co-design
- Set up an ongoing Future Earth Fellowship programme for leaders and partners, which - through an ongoing modular training program - (a) builds skills in international collaboration, inter- and transdisciplinarity, communication and leadership; (b) builds the Future Earth "family"; and (3) is widely recognized as a prestigious award
- Changed international research funding practices in ways that support interdisciplinary, transdisciplinary research and engagement
- Established Future Earth for the international policy-making community as the recognized go-to institution for global change and sustainability research and information through a variety of policy/practice-accessible formats

3. People as the central human face of Future Earth's vision, enabled and mobilized to develop sustainable solutions, transformative understandings and new ways of collaborating and engaging, now and into the future. Future Earth will have:

- Engaged and connected a wide diversity of people, through appropriately identified strategies and styles and sensitive response to their interests, including: scientists, policy makers, civil society practitioners, private sector actors, funders, and Friends of Future Earth³.
- Established a multi-tiered Future Earth community (including a broad mailing list, funded projects, Steering Committees, Secretariat...) using varying forms and intensity of communication and engagement
- Regionally contextualised all forms of engagement within the boundaries of FE's global vision
- Mobilized, and where necessary built, capacity (people and their abilities), including through South-North and South-South co-operation
- Helped to integrate existing network hubs of knowledge
- Created a critical mass of scientists, policymakers and civil society leaders who believe in and can serve as ambassadors for Future Earth
- Inspired younger scholars and advocates to carry forward Future Earth's vision and mission.

³ Scientists – those creating knowledge; policy makers – those formulating and implementing policy; civil society practitioners, including NGOs and social movements – those undertaking advocacy, outreaching to communities, critically evaluating government policies and private sector interventions, innovating with institutions; private sector actors – those progressives seeking actively to promote sustainability; funders – those willing to stake their money for the earth's future; and, Friends of Future Earth – individuals or groups with diverse interests who stand behind our vision.

DRAFT: Collaborative Research Action on Data Management and e-Infrastructure

Steering Committee Meeting – Work Package Summary

(Windsor, United Kingdom - 15th October - 17th October 2013)

Context

Following the steering committee presentations a list of trending topics was created and compared with the San Francisco topic list resulting in several alterations and re-groupings to be used as the basis for work package development. Participants then broke into 2 working groups: Governance, and Architecture & Interoperability, with the groups then rejoining for discussion before approving 5 work packages for further investigation, plus an overarching Capacity building activity.

The wealth of on-going activity at local, national and international levels addressing environmental change collaboration was acknowledged, with many who have, to a greater or lesser extent, already begun to address issues of data management and e-infrastructure. It was agreed that coordination and collaboration between established bodies to prevent duplication of effort and facilitating research through improved access to relevant data and partners was of first importance.

Work Package Methodology

It was proposed that a general work methodology be used as a starting point for each work package to begin activities:

1. Establish current Best Practice Use Cases (including solutions to problems, decision making processes and regional coordination) as advisory exemplars for on-going study.
2. Use these exemplars to identify Barriers to integration and collaboration (What is hindering coordination/collaboration at the moment? Possible factors include cultural, cross-discipline and international/national/regional issues. Externalities, constraints, dependencies by funding agencies and government) and;
3. Gaps in current knowledge and activities (What has yet to be solved in terms of effective governance? What have people not found a solution to yet?), leading to the creation and/or development of;

4. Guidelines and Recommendations (Codes of conduct, solutions to overcome barriers) in areas where the Belmont Forum could make a significant contribution through future involvement and intervention.

Working Groups and Work Packages

Participants identified three Architecture & Interoperability and two Governance Work Packages, plus one overarching Advisory Activity to look at Capacity Building, and their associated leaders and Steering Committee participants.

Architecture & Interoperability

Work Programme 1: Standards

- Areas of Focus:
 - Discoverability and annotation
 - Ontologies and semantics
 - Brokering
 - Access to models
 - Data provenance identifiers
 - Minimal standards to be identified for maximum participation
 - Identifying ways to facilitate cooperation between existing groups
 - Identifying and bringing together domain experts from existing bodies (e.g. RDA, GEOSS) to address key community identified gaps in a holistic way
- Work Package Leaders: Roberto Cesar and Françoise Genova/Mustapha Mokrane, supported by Jean-Pierre Vilotte, Christoph Waldmann, Toshio Koike, and Stefano Nativi
- Secretariat Support Person: Kathie Bowden (UK Secretariat), Rachael Black (US Secretariat - additional governance support person)

Work Programme 2: Improved interface between the computation and data infrastructures

- Areas of focus
 - Identification of the interface and existing gaps in synergy between data and computing infrastructure from a user perspective
 - Security Models and Access
 - Bringing together experts on infrastructure and computing
 - Identification of the most immediate barriers and potential funding to support lowering these barriers
 - Measurement of performance and how the difference has been made
 - User community-driven and coming from the data community
- Work Package Leaders: Jean-Pierre Vilotte and Toshio Koike supported by Roberto Cesar and Andrew Treloar
- Secretariat Support Person: Jane Lewis (UK Secretariat), Kate Kretschmann (US Secretariat - additional governance support person)

Work Programme 3: Harmonisation of global data infrastructure for sharing environmental data

- Areas of focus:
 - Defining the minimal interface for cooperation on environmental harmonisation
 - Identifying general requirements of the ecosystem, using user scenarios as the springboard.
 - Building on experiences of the COOPEUS project, adding experiences of other work done internationally
 - Use Japan's experience as a key knowledge source
 - Findings from this Work Group to provide guidance to other Work Packages
- Work Package Leader: Christoph Waldmann supported by Andrew Treloar and Toshio Koike
- Secretariat Support Person: Jane Lewis (UK Secretariat), TBC (US Secretariat - additional governance support person)

Governance

Work Programme 4: Data Sharing

- Areas of focus
 - Investigating data authenticity and quality
 - Investigating data provenance (certification, standards)
 - Investigating incentives to share data
 - Cultural Issues - different disciplines, national/regional
 - Developing trust across spectrum of sources
 - Preservation of data context
 - Legal issues, within and across national jurisdictions, liability (subcommittee)*
 - Long term sustainability and organisational continuity
 - Community approach to standards (community implementation of standards)
- Work Package Leader: Dale Peters supported by Birgit Gemeinholzer
- Secretariat Support Person: Genevieve Pearthree (US Secretariat), Jane Lewis (UK Secretariat - additional technical support person)

Work Programme 5: Open Data

- Areas of Focus:
 - Open access
 - Integration with civil society (Citizen science, crowd-sourcing, policy and the role of appropriate hardware/software)*
 - Development of a strategy to promote/implement open data across groups with an interest in environmental data who are at various stages of technical maturity
 - Development of match-making services linking data providers with suitable repositories to support open data
 - Use of data and liability/uncertainty in decision making
 - Data retention, archiving, preservation
- Work Package Leaders: [Andrew Treloar](#) and Birgit Gemeinholzer supported by Toshio Koike, Stefano Nativi, Robert Samors, Jean-Pierre Vilotte
- Secretariat Support Person: Kim Oakley (UK Secretariat), Genevieve Pearthree (US Secretariat - additional support person)

Work Programme 6: Capacity Building (overarching activity)

- Areas of Focus:
 - Investigation into IT resource gaps
 - Cross-disciplinary education and training
 - Sustainable human resources
 - Data infrastructure
 - Cross-disciplinary education and training
 - The Capacity Building Champion will consider requirements across all work packages to identify possible areas where the Belmont Forum could contribute
- Capacity Building Champions: Lee Allison & Robert Gurney
- Secretariat Support Person: Kathie Bowden (UK Secretariat), TBD (US Secretariat - additional support person)

*Note: It was agreed that it would be worthwhile to investigate legal issues which make be a barrier to international interoperability, however it was at the same time acknowledged that the Belmont Forum was not in a position to influence the legal landscape and that this investigation might not result in any recommendations to the Forum. Instead this activity will influence the scope of activities of the other work packages.

*Note: Present throughout the 3 days of the conference were discussions surrounding integrating wider community involvement not only as benefactors of output from the research community, but also as contributors, providing not only data, but also assisting with requirements analysis and investigation across much wider geographical and cultural landscapes. It was also identified that the drive for development of collaboration international action was actually coming from the general public and willingness to actively participate in this process is high. This led to an agreement that further investigation of current civil society involvement projects specifically questions on policy, incentives and physical resource (e.g. hardware/software) was warranted.