GROUP ON EARTH OBSERVATIONS



# Implementation Boards
# Considerations and Lessons Learned

*This document is presented to GEO-XII Plenary for information.*

# Implementation Boards
# Considerations and Lessons Learned

## 1 BACKGROUND

### 1.1 Introduction

The Group on Earth Observations (GEO) was launched in 2005 with a 10-year Implementation Plan with the main objectives of making data and information accessible through the development of the Global Earth Observations Systems of Systems (GEOSS), to achieve comprehensive, coordinated and sustained observations of the Earth to improve monitoring and prediction of the state of the planet. Complementary and objectives of equal importance include building capacity worldwide to enable the actual use of this data and information, interacting with the Users and the Scientific Community in different Societal Benefit Areas (SBAs), advancing the use of Earth observations (EO) in decision-making by developing new EO based applications.

From the beginning GEOSS was conceived as a "system of systems", that is a loose confederation of existing and future Earth observation and data management systems supplementing but not supplanting their own mandates and governance arrangements. Whilst the initial focus of GEOSS was to support benefits in nine Societal Benefit Areas (SBAs) of application, it was recognized that GEOSS should serve a broad range of global user communities including managers, policy makers, researchers, engineers, civil society, governmental and non-governmental organizations in further application areas. The success of GEOSS would depend on building interoperability as a key principle among the different and autonomous systems so that the GEOSS can operate as a whole.

Four Committees (Architecture and Data, Capacity Building, Science and Technology and User Interface) were established in 2005 to address the GEO transverse areas as the complement to the nine GEO SBAs and to oversee and coordinate the associated tasks of the Work Plan.

Following the mid-term assessment of GEOSS in 2011, changes were made to the structure of the Work Plan by streamlining the number of Tasks and activities and introducing some changes in the governance structures. As a result, GEO Plenary established the Implementation Boards in November 2011 to better address GEOSS implementation and to provide a mechanism for GEO Members and Participating Organizations (POs) to improve their engagement in the work of GEO.

Three Implementation Boards were established:

- The Institutions and Development Implementation Board (IDIB);
- The Infrastructure Implementation Board (IIB); and
- The Societal Benefits Implementation Board (SBIB).

The Implementation Boards were intended to provide high-level review, advice, recommendations, and support in the ongoing development and implementation of the GEOSS 10-Year Implementation Plan and actively promote the implementation of GEO activities as described in the annual Work Plans.

### 1.2 Terms of Reference for the Boards

The general Terms of Reference for the three Boards can be characterized as follows:

1) Monitor progress toward achieving the 2015 GEOSS Strategic Targets (each Board had a set of assigned Targets);
2) Annually assess Strategic Targets in terms of the likelihood for their completion by 2015 and support a review of Task performance against the Targets;
3) Identify issues, gaps, and Target objectives that require additional support from GEO Members and POs;
4) Advise on the implementation of Tasks; provide guidance on issues of a technical and non-technical nature (e.g. resources; delivery on commitments of Members and POs);
5) Recommend and, where appropriate, undertake actions for addressing these issues and gaps;
6) Actively coordinate activities across Tasks within a specific part of the Work Plan; and
7) Establish cross-cutting links to the other parts of the Work Plan.

Appendix 1 identifies the Strategic Targets and the group of Tasks under the responsibility of each Board.

## 1.3 Boards Membership, Co-chairs and Secretariat support

### *1.3.1 Institutions and Development Implementation Board (IDIB)*

The Board had approximately 18 individuals serving as Member or Participating Organization representatives, made up of:

- 8 GEO Members or POs to reinforce expertise needed to meet the objectives of the Board;
- 5 GEO Members or Participating Organizations representing the Tasks overseen by the Board;
- Additional GEO Members or POs to fill gaps in expertise, as appropriate.

Since 2012 the following Members and POs have served on the IDI Board: Alan Edwards (EC), Ali Didehvarasl (Iran), Ana Casals Carro (Spain), Carsten Dettmann (Germany), Ellsworth Ledrew (IEEE), Freek Van Der Meer (ITC), Ganiyu Agbaje (Nigeria), Gary Foley (USA), Hilcea Ferreira (Brazil), Imraan Saloojee (South Africa), Mark Noort (Netherlands), Noureddine Filali Boubrahmi (Morocco), Paolo Mazzetti (Italy), Peter Zeil (Austria), Robert Chen (ICSU), Russell Lefevre (IEEE), Sergio Albani (EU SatCen), Stefano Nativi (Italy-IIB), Stuart Marsh (UK), Tierry Ranchin (France), Tim Haigh (EEA), Vesna Bengin (IEEE) and Xu Wen (China).

In addition to the above-nominated Members, ID Task Coordinators also served on the Board: ID-01 Michel Schouppe (EC), ID-02 Andiswa Mlisa (South Africa) replaced in 2014 by Gregory Giuliani in 2014 (Switzerland / UNEP), ID-03 Hans-Peter Plag (IEEE), ID-04 Kathleen Fontaine (USA, now RDA-USA) and ID-05 Bente Bye (Norway).

At its first teleconference in January 2012, the Board nominated three co-chairs, each representing the former Committees to ensure smooth transition: Mark Noort (Netherlands) for Capacity Building, Stuart Marsh (UK) for Science and Technology and Gary Foley (USA) for User Interface / Engagement. The three members have served the Board as co-chairs, with annual renewals to date. In addition at its first meeting the Board recommended additional expertise be added to the Board to include geographical representation.

The IDIB has over the years received support from the following GEO Secretariat staff: Andiswa Mlisa, Douglas Cripe, Georgios Sarantakos, João Soares, Masami Onoda, Seonkyun Baek and Tomoko Mano.

### *1.3.2 Infrastructure Implementation Board (IIB)*

The initial composition of the IIB included 15 people representing 5 member countries, the EC, and 5 Participating Organizations.

Board members have included:

Nominated members: Alessandro Annoni (EC), Yuqi Bai (China), Thorsten Buesselberg (Germany) Ivan DeLoatch (USA), Siri Jodha Khalsa (IEEE), Joan Masó Pau (Spain), Stefano Nativi (Italy), Ivan Petiteville (CEOS), Frédéric Joël Ramarolhahivonjitiana (Madagascar), Bernd Richter (Germany), Ryosuke Shibasaki (Japan), Rainer Stowasser (Austria), Lixin Wu (China), Lee Annamalai (South Africa), Kathy Fontaine (USA), Jean-Jacques Serrano (EuroGeoSurveys).

In addition to the above nominated Members, IN Task Coordinators served in the Board: Brian Killough (CEOS), Koki Iwao (Japan), Mirko Algani (ESA), Yana Gevorgyan (USA), George Percivall (OGC), Doug Nebert (USA).

At its first meeting, the Board nominated two co-chairs, ensuring a smooth transition from the Architecture and Data Committee: Alessandro Annoni (EC) and Ivan DeLoatch (USA). The two members have served the Board as co-chairs, with annual renewals to date.

The IIB has, over the years, received support from the following GEO Secretariat staff: Mike Tanner, Espen Volden, Osamu Ochiai.

### *1.3.3 Societal Benefits Implementation Board (SBIB)*

The SBIB was initially intended to include approximately 20 individuals from the community of GEO Members or PO representatives. In practice, the SBAs were represented by the Points-of-Contact (POCs) for the Tasks and by representatives from Communities of Practice (COPs), recognizing that these participants were also representatives of GEO Member countries and POs. However, their engagement was based primarily on the work related to the Task and hence on their Task affiliation. At the time of its dissolution (GEO Plenary 2015), the SBIB had 23 participants. These included a POC for each SBA, members from the Communities of Practice related to the SBAs, and representatives from related projects such as the Blue Planet initiative and the Coastal Zone COP.

Although the terms of reference called for the SBIB to annually rotate its leadership, only one change occurred: when Richard Lawford replaced Guy Seguin. A one-year term did not seem to be sufficient for a new appointee to fully learn the program and influence the development of the Board's activities. Members of the GEO Secretariat who supported the SBIB over the four-year period included Francesco Gaetani, Gary Geller, Alexia Massacand, Andre Obregon, Bradley Reed, Giovanni Rum, Georgios Sarantakos, João Soares, and Espen Volden. Gary Geller and Andre Obregon of the GEO Secretariat were supporting the Board at the time of its dissolution.

Board members have included Stephan Bojinski (Climate, WMO), Antonio Bombelli (Climate, Italy), Jim Caughey (Weather, WMO), Jun Chen (China), Paul di Giacomo (Coastal COP, USA), Joerg Freyhof (Biodiversity, Germany), Rifat Hossain (WHO, Switzerland), Iphigenia Keramitsog (Greece), Richard Lawford (Water SBA, Japan/USA), Olivier Leo (Environment Canada), Michael Nyenhuis (Water, Germany), Nicola Pirrone (Health, Italy), Hans Peter Plag (Disasters, USA), Trevor Platt (Blue Planet, UK), Antonello Provenzale (Ecosystems, Italy), Thierry Ranchin (Energy, France), Glenn Rutledge (Climate, USA), Kerry Sawyer (CEOS, USA), Manuela Schlummer (Water, Germany), Guy Seguin (Disaster, CEOS), Adrian Strauch (Water, Germany), Michele Walters (Biodiversity, South Africa), and Bing Fang Wu (Agriculture, China). Observers include Martine Herold (Netherlands) and Victoria Cheung (POGO, UK).

# 2 ACHIEVEMENTS

## 2.1 Institutions and Development Implementation Board (IDIB)

Over its term the Board undertook Strategic Target Assessment which was presented annually to the GEO Plenary. The process started with the development of a methodology to assess and monitor progress towards achieving the 2015 strategic targets, the methodology was refined every year. This resulted in:

- Identified the hindering issues as – lack of clarity (measurable) in Targets and indicators, and up-to-date availability of information. The Board identified required additional support from the GEO community to address gaps however it failed to design and conduct effective actions for addressing the issue and gaps. GEO lacked an organisational mechanism to track and follow-up on recommendations;
- Actively coordinated activities and increased awareness across ID Tasks, including hosting Task events during the Board meetings, for example, Capacity Building event, in Enschede, during the 7th IDIB meeting;
- Provided guidance and recommendations on the implementation of Tasks and supported the Tasks by providing regular reports to the Executive Committee, engaging and providing comments to established Working Group, the latest of these being the Implementation Plan Working Group (IPWG).

## 2.2 Infrastructure Implementation Board (IIB)

### *2.2.1 General*

Beyond the annual assessment of the two Targets under its responsibility, there were three main achievements that the IIB contributed to during this period:

- advancing the GEOSS Common Infrastructure (GCI);
- supporting the GEOSS Data Sharing Principles; and
- developing, with the Data Sharing Working Group (DSWG),the GEOSS Data Management Principles.

### *2.2.2 GEOSS Common Infrastructure (GCI)*

The GEOSS Common Infrastructure (GCI) underpins and serves as the primary delivery mechanism for the GEO mission. The GCI has now been in operation for over five years after an initial stage of experimentation and development. It provides search and discovery, and to a lesser extent access to, a very large body of over 190 million EO assets. The GEOSS Architecture Principles of openness, effectiveness, flexibility, sustainability and reliability serve as the basis for the evolution of the GCI, and ensure its interoperability. Under these principles the GCI has evolved from its initial architecture that replicated those of many national spatial data infrastructures based on relatively few standards and protocols, to a more flexible brokered architecture that acknowledges the diversity of the scientific and thematic communities GEOSS connects to, and hence mediates across their multiple standards and protocols. The GCI has also evolved by moving its search engine into the cloud, thus exploiting the evolution of new technology. The IIB has been fully responsible for supervising its development and integration.

### *2.2.3 Data Sharing Principles*

The success of GEOSS rests on the willingness and ability to share EO for the benefit of humanity. The GEOSS Data Sharing Principles were adopted in the first GEOSS 10-Year Implementation Plan. A GEOSS Data Sharing Task Force elaborated guidelines, and an action plan for implementing the principles which were adopted in 2009 and 2010 respectively. The creation of the GEOSS Data-

CORE, a distributed pool of documented datasets with full, open and unrestricted access at no more than the cost of reproduction and distribution, enabled to leverage the voluntary nature of GEOSS and overcome the complexity of data policies at the global level. The GEOSS Data Sharing Principles and Data-CORE have anticipated and contributed to the development of Open Data policies in many countries of the world, and to the opening up of archives of EO that were previously restricted. The adoption of these principles in the new Copernicus programme of the European Union is evidence of the benefits of participating in GEO. The IIB has supported the Data Sharing Working Group (DSWG) in particular by making the GEOSS Data-CORE available through the GCI.

### *2.2.4 Data Management Principles*

To further maximize the value and benefit from data sharing, it is necessary for GEO to promote also the use of key Data Management Principles, including the need for common standards and interoperability arrangements. This will ensure that data and information of different origins and types are comparable and compatible, facilitate their integration into models and the development of applications including decision support tools. In 2014-15 the GEO Data Management Principles Task Force (DMP-TF) identified a key set of data management principles for GEOSS under five headings: Discoverability, Accessibility, Usability, Preservation, and Curation. They will be presented at the GEO-XII Plenary and Mexico City Ministerial, with an initial set of guidelines, clarifying concepts, and implications for the organisations that need to implement such principles. The adoption of the Data Management Principles will be an important additional step in the advancement of GEO's vision. The IIB has supported the establishment of the DMP-TF and contributed to the development of the principles.

## 2.3 Societal Benefits Implementation Board

### *2.3.1 General*

The SBIB has been functional from 2012 to 2015. During this period there has been an approximately 20% turnover rate in Board membership, while the number of Secretariat personnel supporting the Board has had a 100% turnover. Rifat Hossain (Health SBA/WHO) and Guy Seguin (Disaster SBA/CEOS) were the initial co-chairs for the Board. In 2013, Richard Lawford (Water SBA/JAXA) replaced Guy Seguin when he retired from the Canadian Space Agency. The Board has undertaken four target assessments and stimulated cross-sector activities in a number of areas. These assessments and other aspects of the Board's activities are described in the following paragraphs.

### *2.3.2 Strategic Targets Assessment*

Over the past four years the SBIB has undertaken four assessments of the nine Targets for which it is responsible. This process has involved the review of materials documented in the Work Plan, consultations with individual investigators and comparative analysis. These actions were necessary to arrive at realistic and balanced assessments of the Targets and to propose recommendations that addressed the key issues and ensure they were formulated in an appropriate and actionable way,

### *2.3.3 Participation to the GEO Work Plan Symposia*

SBIB representatives have been active at all of the GEO Work Plan Symposiums held between 2012 and 2015. These events proved beneficial because they facilitated interaction and provided perspective for GEO's goals and developments. The symposia also gave the SBAs an opportunity for their needs to be made known to the other Boards and, in several cases, led to joint projects. At the 2015 GEO Work Plan Symposium, Rifat Hossain organized discussions in a café format where different groups expressed their views on how GEO and Earth observations could contribute to the SDGs.

### *2.3.4 Cross cutting activities*

#### 2.3.4.1 SBA links with Infrastructure and Institution and Development activities

The SBIB discussed links between the SBAs and the Infrastructure and Institution and Development Boards (IIB and IDB). For example, Water had links with ID-05 (mobilizing resources) and ID-02 (building capacity). The collaboration between WA-01 and ID-05 led to a science session in Beijing and a workshop in Bonn, Germany. In terms of cross-Board activities, GEO BON is trying to better engagement with the Capacity Building (CB) Task by encouraging countries to institute biodiversity observation networks to report to the Convention on Biological Diversity (20 Aichi Targets). In fact, all of the SBAs had links with ID-02 and with S&T and User Engagement Tasks.

#### 2.3.4.2 Cross-SBAs collaboration

The SBIB has encouraged cross-SBA collaborations by promoting interactions between the SBAs and Sustainable Development and other high-profile, potentially beneficial initiatives.

Sustainable Development:

With respect to the Sustainable Development Goals (SDGs), all of the SBAs have specific SDGs to which they can contribute under the current SDG structure. Several informal SBIB meetings have been held to clarify the role of Earth observations in meeting the needs for monitoring SDGs (particularly for Water). In the case of Water, GEO experts made a significant contribution to the design of GEMI, a UN initiative developed to facilitate data services in support of the Water SDG initially and subsequently other SDGs.

Trilateral and Bilateral Cross-SBA Collaborations

The SBIB coordinated activities across Tasks within a specific part of the Work Plan (e.g., across the SBAs), while also establishing crosscutting links to the other Implementation Boards. For these collaborative activities the SBIB developed advice on the implementation of Tasks and guidance including both technical and non-technical advice (e.g., resources; delivery on commitments of Members and Participating Organizations). Areas of collaboration continue to be identified among the SBAs. Cross-SBA activities are emerging in Biodiversity, Ecosystems, and Water; between Water, Energy, and Food; and among a number of bilateral initiatives such as health and renewable energy. Strong linkages have developed for specific activities such as the Coastal Waters COP and the Water Quality sub-task. Some of these activities were presented as new initiatives at the recent GEO Work Planning Symposium.

### *2.3.5 Coordination with other Boards/Working Groups, Meetings and Reports*

The SBIB coordinated some inputs with the Monitoring and Evaluation Working Group and Evaluation Team, although the majority of the interactions with this working group came through the GEO Secretariat and individual SBAs as they were being evaluated.

The SBIB provided reports to the GEO Plenary and delivered progress reports to the GEO Executive Committee as appropriate. Given Rifat Hossain's location at the WHO in Geneva, he was able to frequently brief the GEO Executive Committee on the progress of the SBIB when they met in person. In addition, written reports were also submitted. In 2012 the Executive Committee decided that rather than individual IB reports, the Joint Board would make a single presentation. The SBIB contributed to the Joint Board's assessment report and to the Joint Board presentations to the Plenary. In 2014, the SBIB made the presentation on behalf of the Joint Board to the GEO Plenary. In addition, individual SBAs have organized side events.

The SBIB held meetings in conjunction with each GEO Plenary meeting and the GEO Work Plan Symposium. Numerous teleconference calls and email exchanges took place to deal with issues and assessments. The teleconference calls took place between the whole Implementation Board, among the

POCs and the co-chairs, among the co-chairs and GEO Secretariat experts, and among the co-chairs themselves. The GEO Secretariat assisted in preparing minutes of meetings and ensuring they were finalized and posted on the web. The Secretariat also supported follow-up actions to these exchanges.

Participation in Board meetings and activities was supported by the agencies and/or the GEO members they each represent. For the most part the SBIB worked by consensus, although it was not clear that a quorum of members expressed their views on every issue. In general, it was a consensus of those who spoke up regarding a particular issue and it was assumed that silence (or non-response) was an indication of agreement.

# 3 CHALLENGES AND LESSONS LEARNED

## 3.1 Introduction

Below, a summary of lessons learned resulting from discussions within each Board is presented, with the aim to improve the functioning of the GEO process in the next 10-year implementation phase. The lessons could sometimes lead to contradicting conclusions, showing the importance of striking a balance in implementing such a difficult undertaking as the GEO process. The terminology used is often not very exact. The reason being is that the lessons learned also describe the less tangible aspects that play a role in motivations and decisions of people and organizations to contribute to the work of GEO. The lessons are reported Board by Board and reflect their different domains of action

## 3.2 Institutions and Development Implementation Board (IDIB)

### *3.2.1 General*

The GEO-approach works, because the common goal of GEO is shared by the Earth observation community: after 10 years, people still provide voluntary contributions and work together to achieve the GEO targets.

### *3.2.2 Coordination*

Effective coordination mechanisms are needed at all levels. The current structure with Boards and the previous structure with Committees can both be improved upon. Some complexities are built in the system (on purpose or accidentally). As an example: the Data Sharing Working Group reports to the IDIB and reports to the IIB for targets. This is a clear mismatch and should be avoided in the future. Overlaps between and among the groups should be minimized as much as possible. The coordination structure is also heavy with a lot of administration and physical meetings: this may be acceptable to government institutions, but is less well suited to active participation of the private sector.

### *3.2.3 Focus on measurable results*

The GEO Targets are (in) conveniently vague: it is therefore neither conducive nor easy to apply metrics for assessing progress towards Targets. This leads to endless discussion, was confusing and reduced work satisfaction for Board members. Indicators for the next 10-years should not only be relevant, but also measurable. As a minimum requirement, it should be made clear (for the next 10 years) what constitutes a good, average or bad result for each activity and what weight each activity has in impacting an indicator or Target.

### *3.2.4 Involvement*

People need to remain involved. The focus on Targets instead of Tasks led to less involvement and exchange of experiences. The Boards did not assume the same role as the Committees, as some expected them to do. The Boards also provided fewer networking opportunities than the Committees. As contributions to GEO are voluntary, this could compromise reaching the objectives (see also

'active participation'). The new 10-year implementation plan should include a mechanism that guarantees the long-term involvement of volunteers.

#### *3.2.5 Recognition*

Related to the aspect of involvement is the issue of recognition: efforts must be recognized in some way or another. Although (or exactly because) contributions are voluntary, they should not be taken for granted. A distinction should be made between those who actually contribute and those whose name only figures on the list. In practice, people know who is active, how they can find each other and work together, but this should also be reflected in reporting, and at GEO events.

#### *3.2.6 Active participation*

Changing the organizational structure from Committees to Boards led to a reduction in active participation. For comparison: 30 – 50 people participated in Committee meetings, while the average for Board meetings was 10 – 15. Although redundancy in Tasks was avoided in the Work Plan, quite a number of non-active participants still figured as Task contributors (and there was no mechanism to acknowledge the true contributors). There were also 'sleeping' Board members, designated for a particular region or expertise, but never participating or contributing. See also the section on 'recognition'.

#### *3.2.7 Communication*

Difficulties in communication between the Committees were transferred to difficulties in communications between Boards. Joint Board members were supposed to help solve this problem, but physical meetings of the Boards were scheduled simultaneously and therefore the liaison members only participated in the Board to which they were closely aligned. Joint Board meetings partly addressed this, but the focus was very much on Targets and sharing of experiences was left to events such as the Work Plan Symposium. Improving the visibility of the outcomes of the work of all groups, such as the Data Sharing Working Group, (indicating where to find documents and dissemination of best practices) could help overcome this problem.

#### *3.2.8 Extending the community*

It is important to show how the data sharing principles and use of the GEOSS Portal can be translated to an institutional or national policy. Development of guidelines and case studies for this purpose would be useful. To reach and involve new groups of users in GEO, they will have to be presented with an attractive proposition. At this point it seems that the GEO process itself (recognizing the convening power of GEO) seems more attractive to outsiders than the power of the GEOSS Portal. Even those inside the GEO community struggle with the GEOSS Portal and resort to getting data from other sources. A good and reliable functioning of the GEOSS Portal, including simplification and acceptance of the Portal as **the** source of information for Earth observations, should be a first priority.

### 3.3 Infrastructure Implementation Board

#### *3.3.1 Introduction*

While the GEOSS Common Infrastructure (GCI) is the main focus of this Section, as the most important element of GEOSS, there are other Infrastructure Tasks such as In-situ, GEONETCast, Earth Data Sets, Communication Networks, Radio Frequency Protection and others which are also important but less often discussed.

#### *3.3.2 Developing and Operating GEOSS*

Developing GEOSS continues to be a formidable challenge because in the global context it requires working with a very wide range of cultures, institutional arrangements, methods of work, capabilities,

and data structures. The process relies entirely on a voluntary best-effort basis and in-kind resources, without specific funding beyond the operations of the contributors and the GEO Secretariat. Moreover the speed of technological development is such that building a System of Systems on components that are autonomous, and move at different speeds and in different directions requires thinking in terms of adaptive systems with ”emerging” properties rather than traditional system design. Yet, in spite of these challenges, we have managed to work together in an excellent spirit of collaboration, and develop a system of systems that has evolved and matured over the best part of 10 years. Of course it is far from perfect, and there is ample room for improvement, but the process of building and evolving GEOSS has been as important as the outcome, because it has provided a focus for collaborative working and learning across many nations and cultures.

### *3.3.3 Collaboration and Continuity*

The need to accept and work with the diversity of the GEO community has been an essential lesson learned. In a voluntary, global, and discipline-varied environment such as GEO it is not possible to impose technical solutions and protocols; it is necessary instead to work through consensus building, evolution, and co-design. Continuity in the core membership between the ADC and the IIB, even if significant change has also taken place, has helped retain historical knowledge and build on the lessons learned. The pace of technological change surrounding GEO makes such continuity all the more important.

### *3.3.4 User Requirements*

One limitation we have identified is the gap between the work done by the data providers, technologists, and engineers developing the GCI, and the scientific community working on the more thematic tasks aligned to the SBAs. Looking back at the early documents in 2005-06 there was always a high degree of awareness of the importance of GEOSS being user-driven, but the reality is that the processes put in place to foster these links have not worked as well as needed. For this reason the IIB makes recommendations for a more structured approach in the following section.

While the GCI has been the main focus of this Section, as the most important element of GEOSS, there are other Infrastructure Tasks such as In-situ, GEONETCast, Earth Data Sets, Communication Networks, Radio Frequency Protection and others which are also important but less often discussed.

## 3.4 Social Benefits Implementation Board

### *3.4.1 Participation to SBIB activities*

One of the main challenges in the SBIB revolved around getting people to attend the meetings and to participate in the teleconference calls. It appeared that some SBAs were quite active and encouraged participation, while others engaged only at the level required to fulfil assessment obligations. In general, there appeared to be two classes of SBAs represented on the SBIB: active SBAs, which were quite “hands-on” in the implementation of the SBIB, and passive SBAs, which relied strongly on the GEO Secretariat liaison colleagues to provide necessary input to the SBIB. To be fully effective, the SBIB needed all SBAs to be in the active category. Contributions for the Communities of Practices helped to strengthen the contributions of the SBIB.

### *3.4.2 Targets assessment*

Discussions about Target Assessments took up the largest proportion of time in SBIB meetings. On the positive side, one POC reported that he found the goals and objectives were more than adequate and that the documentation helped him develop and coordinate Tasks and Outcomes. In other cases, the Target statements were not sufficiently specific to allow for an entirely meaningful assessment. This led to a certain amount of subjectivity in applying the colours used in the assessments (Green – no problem; Yellow – minor problems and delays; Red – major problems that threaten Target

achievement), although a more consistent basis for applying the colours has emerged over the past three years. In general, we have consistency through time in the evaluations for individual SBAs but fine-tuning across SBAs is still required. While the colours indicated at a glance how a particular Target or Task was doing but more information could have been communicated in this framework.

### *3.4.3 Difficult to flag lack of funding as a cause of delay*

The assessment procedure did not allow for a clean distribution between those targets being achieved because of a lack of funding and the Targets not being achieved due to some other, more solvable problems. This is a significant issue because a Task or Target could be progressing but may never be delivered because of the lack of funding. The SBIB identified a need to flag whether or not there are adequate resources to complete a Task/Component. The SBIB recommended that the Joint Board consider a system of symbols that would visually highlight whether a lack of dollars or a lack of personnel was the dominant reason for the delay in a task. Several methods were tried but in the end the routine format was used to conform to the requirements of other Implementation Boards that did not seem to have the same need.

### *3.4.4 Follow-up of Board recommendations*

The impacts of the Target Assessment and the effects of its recommended actions are unclear. Members of the SBIB raised concerns that there was no feedback from the Executive or Plenary on the SBIB recommendations and the ways in which GEO proposed to address them. It was recommended that a mechanism be maintained by the GEO Secretariat to track progress on the implementation of the recommended actions. It does not appear that this was acted upon. The absence of any tracking mechanism was discouraging for some SBIB members who were concerned that their inputs were not leading to any improvements. In spite of this gap, however, some progress was made on some recommendations due to the internal processes within the SBAs and the efforts of the GEO Secretariat.

### *3.4.5 SBIB coordination with other Boards*

There is a concern that there was a disconnect between the SBIB and the other Boards, especially the coordination across SBIB and Infrastructure Implementation Board (IIB). Given the long lead times to successful outcomes and the difficulty in implementing global coordination, there is benefit in coordinating the SBA activities and making sure they are more strongly linked to show success within the infrastructures proposed, or completed within IIB (e.g., the GEO Community Portal work). The GEOSS Architecture Implementation Project (AIP) has been a leading mechanism for advancing some of these connections.

### *3.4.6 Cross-SBAs coordination*

The SBIB has had some benefits in promoting integration between some SBAs. However, the two biggest challenges for the SBIB were time and lack of a mechanism to identify or secure funding. To address this problem, it was suggested that the GEO Secretariat increase its capacity to support cross-SBA integration through regular conference calls/webinars, etc., provided it will be supported by a group of willing Communities of Practice.

### *3.4.7 Resources to support SBIB activities*

Funding projects and workshops is also a major problem for the SBIB. The Board identified the need for Workshops (for example, on floods in order to clarify the roles of the Disaster and Water SBAs). However, this workshop was never held because of insufficient resources. This gap also arose in other contexts. Countries benefiting from these pilot projects would also be expected to provide some contribution. It would be desirable to have some core funding from donor institutions (or GEO Members and POs). Their support could cover some aspect of the overall agenda and be guided by a rigorous application and review process. Support could be provided for Community of Practice

meetings; training on where and how to find and use Earth observations for a particular project; pilot projects; developing capacity for data integration; and delivery of information to address a particular societal challenge. This could also help provide momentum for the many initiatives that were proposed but never moved forward.

#### *3.4.8 Members and POs engagement*

If the goal of the Implementation Board was to engage GEO Members andPOs, the SBIB was only marginally successful. Clearly the involvement of Member countries through experts with interests in a topic was effective but, in most cases, there was no involvement of the GEO Member Principal in the Task because many Principals had no contact with the experts of the SBIB (and vice versa).

The SBIB was intended to provide high-level review advice, recommendations, and support in the on-going development and implementation of the GEOSS 10-Year Implementation Plan. Although the Task Leads developed the review, advice, and recommendations; the recommendations did not seem to generate much interest or reaction. Given the Tasks that the SBIB was asked to undertake, it is most appropriate to have experts on the Board to lead the evaluations and discussions. However, those experts need better connections to the GEO Principals to ensure meaningful interactions.

## 4 RECOMMENDATION FOR THE NEXT DECADE

### 4.1 Institutions and Development Implementation Board (IDIB)

#### *4.1.1 Keep the engagement during the transition to the next decade*

The Board remains concerned that participation and the level of engagement in the GEO community may drop in the transition process, when, in fact, the opposite is desired. The Board welcomes the idea of Foundational Tasks that will provide opportunities for engagement, room for leadership and contributions from the community must be preserved. The Board, therefore, calls upon all GEO governance structures and the GEO community as a whole to use all possible mechanisms to sustain and grow the GEO community.

#### *4.1.2 More attention to cross-cutting activities*

One of the key lessons from the first ten years of GEO was that cross-cutting issues require active attention and analysis. This is true, in particular, with science and technology (ST), user engagement (UE), and capacity building (CB). In addition to the coordination within each area done by the Foundational Tasks, the IDIB recommends that once the Programme Board is established, it create an advisory group to ensure that cross-cutting ST, UE, and CB issues are addressed across all Tasks. This level of coordination within the Programme Board will be a crucial element of their evaluations of Flagships and Initiatives.

#### *4.1.3 Continuation of the current IDIB-related Tasks*

The Tasks currently under Institutions and Development are envisaged to be core functions of GEO and will be implemented through the new Foundational Tasks.

#### *4.1.4 Key factors for success in the next decade*

It is the view of the IDIB members that the items below must happen, in order for GEO's work to be effectively conducted. In other words, it will be much more difficult, if not impossible, to ensure success, regardless of the work, if these things do not happen:

- Keep people motivated;
- Provide equal recognition of efforts;

- Make people feel welcome;
- Mentor people, especially new members;
- Engage new communities;
- Provide all documents to everybody – free and open access to all documents;
- Ensure global distribution of participation, activities, and data;
- Build networks;
- Recognize the value of individual contributions;
- Capture and spread success stories;
- Continuous engagement and commitment through a defined routine [for example, three meetings per year and 6 teleconferences per year];
- Identify measurable targets, assess progress and gaps, follow-up and track recommendations; and
- Ensure that people with relevant experience are put on the Programme Board.

## 4.2 Infrastructure Implementation Board

### *4.2.1 Governance & Operation*

Disruption in the operations of the GCI must be avoided. The sustainability of GEOSS is dependent on coordinated maintenance and evolution of the GCI as a public service, delivering the data, information and knowledge that stakeholders need to inform their decision-making. As GEO adopts new governance structures to implement the Strategic Plan 2016- 2025, time is needed for such structures to be established and start operations. For the transition year of 2016, the IIB recommends maintaining a degree of continuity between the new structures and the current ones to ensure a smooth transition.

### *4.2.2 Architecture*

- Sustain the operations and evolution of the GCI taking into account the rapidly changing landscape in technology offerings and in the production and consumption of EO data. Promote the GEOSS Architecture Principles of openness, effectiveness, flexibility, sustainability and reliability as the basis for the evolution of the GCI, and ensure its interoperability with relevant research and policy-driven data infrastructures. Ensure that the GCI supports the implementation of the Data Sharing and Data Management principles;
- Increase collaboration and joint activities between the GCI and data providers on the one hand and scientific and policy-making users on the other to ensure that the indicators, information, and data needed to support scientific advances and policy-making are easily discoverable and accessible through the GCI. Shift focus from data discovery to ready-to-use information resources (data, products, services, models, and tools). Develop a GEO Knowledge Base to share not just data but knowledge of how the data can be used to address key scientific or policy questions, and foster a community of users addressing similar problems. Prioritize efforts and demonstrate added value focusing on Flagship and global Initiatives first;
- Increase efforts to coordinate the provision, and improve the integration, of space-based and *in-situ* data at global, regional, and national levels, including new data sources such as sensor networks and citizens, and improve integration of environmental and socio-economic data;
- Evolve the architecture to support a community platform for co-creation of products and services thereby enhancing the usability of Earth observation resources.

#### *4.2.3 Data Management*

- Contribute to the implementation of the GEOSS Data Sharing Principles through good data management practices that allow data to be shared as Open data, promptly and at minimum costs;
- Support providers of EO resources to GEOSS (in either public, private, or voluntary sectors including citizen science or related initiatives) in implementing the Data Management Principles of discoverability, accessibility, usability, and where relevant, preservation, and curation. Provide such support through guidelines, best practices, and promotion of training material;
- Work towards harmonization of key global datasets contributing to Societal Benefit Areas in collaboration with GEO Flagship and Initiatives, and new activities proposed in the framework of Global Geospatial Information Management (UN-GGIM). Encourage data providers to provide access through the GCI to (i) historical datasets for longitudinal analysis, and (ii) outcomes of modelling and forecasting activities for future scenario analysis.

### 4.3 Social Benefits Implementation Board

#### *4.3.1 Clear and measurable targets*

Ensure that during the SBA goal-setting exercise for Phase 2 of GEOSS implementation, efforts are made to clearly define the new Targets and measurable metrics against which progress can be effectively measured.

#### *4.3.2 Transitioning SBAs to the next decade*

The transition to the new GEO Implementation Plan is expected to go quite smoothly for those SBAs which are transitioning into relatively well-defined SBAs in the new Plan. Climate and Weather are two activities that may have a more difficult time maintaining recognition as they are not continuing as distinct SBAs. While these activities clearly cut across, and are important to all of the other SBAs, unless care is taken, they could lose their visibility and impact and could become afterthoughts in the GEO Programme rather than leading their own community of experts and advocating for GEOSS developments to support their needs,

#### *4.3.3 National coordination*

1) Develop stronger national coordinating mechanisms so that GEO Member Principals are aware of the issues in the different SBAs and mobilize national resources to help address those needs.

#### *4.3.4 Promote improved engagement and contributions*

In order to develop stronger commitment to future GEO efforts, the GEO Secretariat should implement a strategy that will improve the commitment of individuals to the programme. This could be done by project management training, recognition for exceptional service (at all levels), and enhanced visibility for projects and ideas, as well as other actions to increase the motivation of volunteers.

#### *4.3.5 Promote cross cutting activities*

a. Establish a mechanism whereby experts from the climate and weather fields can interact with the other SBAs to provide information on new data, systems and services, and can work with the other SBAs and their user communities to help co-design new GEOSS architectures to meet societal needs.

b. Initiate a number of co-design projects between the GCI and the SBA scientists who are users of the GEOSS database.

c. During 2016 (or early in Phase 2 of GEO) hold a workshop for all of the scientific leaders within the SBAs to encourage cross-SBA collaborations and new interdisciplinary projects.

d. Develop a Trust Fund to address the resource needs associated with developing and implementing cross-SBA projects and activities.

## 5 CONCLUDING REMARKS

The Boards acknowledges and appreciates the work done by the Implementation Plan Working Group (IPWG) and the strides it has taken to ensure GEO has a Strategic Plan that enables achievement of the GEO vision in the next decade, building on the work done by the GEO community in the current decade. In addition the Boards:

- Recognizes the importance of what GEO has accomplished from the *ad-hoc* GEO days to the present;
- Thanks the Member Countries and Participating Organizations, the Plenary and the Executive Committee for enabling the community to be active in GEO through the Committees, Boards and the various activities in the Work Plan;
- Foresees a future for GEO taking advantage of numerous opportunities to build upon and exceed the successes of the past;
- Is proud of the GEO community accomplishments supported through the Committees and the Boards;
- Has a vision of GEO being recognized by the United Nations Member States as a main source of interoperable data and knowledge, which is essential to underpin the actions of the nations of the Earth as they embrace the Sustainable Development Goals; and
- Strongly believe its Members and the GEO community can continue to play a necessary and important role in the future through the extensive contacts with the scientific community, the capacity building community and the communities of environmental decision-makers who have benefitted from GEO in the past, through user engagement, data sharing, and resource mobilization, and wish to continue to receive more and better benefits.

## APPENDIX 1

## TARGETS AND TASKS ASSIGNEMENT TO GEO IMPLEMENTATION BOARDS

| Board | Target | Description | Tasks |
|---|---|---|---|
| IIB | Architecture | Achieve sustained operation, continuity and interoperability of existing and new systems that provide essential environmental observations and information, including the GEOSS Common Infrastructure (GCI) that facilitates access to, and use of, these observations and information. | • IN-01 Earth Observing Systems;<br>• IN-02: Earth Data Sets;<br>• IN-03: GEOSS Common Infrastructure;<br>• IN-04: GEOSS Communication Networks;<br>• IN-05: GEOSS Design and Interoperability. |
| | Data Management | Provide a shared, easily accessible, timely, sustained stream of comprehensive data of documented quality, as well as metadata and information products, for informed decision-making. | |
| IDIB | Capacity Building | Enhance the coordination of efforts to strengthen individual, institutional and infrastructure capacities, particularly in developing countries, to produce and use Earth observations and derived information products. | • ID-01 Advancing GEOSS Data Sharing Principles;<br>• ID-02 Developing Institutional and Individual Capacity;<br>• ID-03 Science and Technology in GEOSS;<br>• ID-04 Building a User-Driven GEOSS;<br>• ID-05 Catalyzing Resources for GEOSS Implementation. |
| | Science & Technology | Ensure full interaction and engagement of relevant science and technology communities such that GEOSS advances through integration of innovations in Earth observation science and technology, enabling the research community to fully benefit from GEOSS accomplishments. | |
| | User Engagement | Ensure critical user information needs for decision making are recognized and met through Earth observations. | |
| SBIB | Agriculture | Improve the utilization of Earth observations and expanded application capabilities to advance sustainable agriculture, aquaculture, fisheries and forestry in areas including early warning, risk assessment, food security, market efficiency, and, as appropriate, combating desertification. | • SB-01 Oceans and Society: Blue Planet;<br>• SB-02 Global Land Cover;<br>• SB-03 Global Forest Observation;<br>• SB-04 Global Urban Observation and Information;<br>• SB-05 Impact Assessment of Human |
| | Biodiversity | Establish, in conjunction with a comprehensive ecosystem monitoring capability, a worldwide biodiversity observation network to collect, manage, share and | |

| Board | Target | Description | Tasks |
|---|---|---|---|
| SBIB | | analyze observations of the status and trends of the world's biodiversity, and enable decision-making in support of the conservation and improved management of natural resources. | Activities;<br>• AG-01 Global Agricultural Monitoring and Early Warning;<br>• BI-01 Global Biodiversity Observation (GEO BON);<br>• CL-01 Climate Information for Adaptation;<br>• CL-02 Global Carbon Observation and Analysis;<br>• DI-01 Informing Risk Management and Disaster Reduction;<br>• EC-01 Global Ecosystem Monitoring;<br>• EN-01 Energy and Geo-Resources Management;<br>• HE-01 Tools and Information for Health Decision-Making;<br>• HE-02 Tracking Pollutants;<br>• WA-01 Integrated Water Information (incl. Floods and Droughts);<br>• WE-01 High-Impact Weather Prediction and Information. |
| | Climate | Achieve effective and sustained operation of the global climate observing system and reliable delivery of climate information of a quality needed for predicting, mitigating and adapting to climate variability and change, including for better understanding of the global carbon cycle. | |
| | Disasters | Enable the global coordination of observing and information systems to support all phases of the risk management cycle associated with hazards (mitigation and preparedness, early warning, response, and recovery). | |
| | Ecosystems | Establish, in conjunction with a comprehensive biodiversity observation network, a wide-ranging monitoring capability for all ecosystems and the human impacts on them, to improve the assessment, protection and sustainable management of terrestrial, coastal and marine resources and the delivery of associated ecosystem services. | |
| | Energy | Close critical gaps in energy-related Earth observations and increase their use in all energy sectors in support of energy operations, as well as energy policy planning and implementation, to enable affordable energy with minimized environmental impact while moving towards a low-carbon footprint. | |
| | Health | Substantially expand the availability, use, and application of environmental information for public health decision-making in areas of health that include allergens, toxins, infectious diseases, food-borne diseases, and chronic diseases, particularly with regard to the impact of climate and ecosystem changes. | |
| | Water | Produce comprehensive sets of data and information products to support decision-making for efficient management of the world's water resources, based on coordinated, sustained observations of the water cycle on multiple scales. | |
| | Weather | Close critical gaps in meteorological and related ocean observations, and enhance observational and information capabilities for the protection of life and property, especially with regard to high-impact events, and in the developing world. | |