GROUP ON EARTH OBSERVATIONS

2nd GEOSS Science and Technology Stakeholder Workshop
GEOSS: Supporting Science for the Millennium Development Goals and Beyond
Bonn, Germany, August 28—31, 2012

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Workshop Report

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Introduction

This report describes the findings and recommendations of the 2nd GEOSS Science and Technology Stakeholder Workshop. The GEOSS Science and Technology Stakeholder Network is an informal network bringing together major S&T stakeholders contributing to GEOSS or benefiting from Earth observations and GEOSS. A major venue for the dialogue of the S&T Stakeholders are workshops organized under the lead of the GEOSS S&T Stakeholder Network.

The 1st GEOSS S&T Stakeholder Workshop was held on May 9-11, 2011 in Bonn, Germany. The objective of this workshop was to network representatives of the broad group of stakeholders in S&T of GEOSS and to activate contributions from this network to the implementation of the S&T Road Map of the Group on Earth Observations (GEO.

The implementation of the Global Earth Observing System of Systems (GEOSS) is governed by the GEOSS Strategic Targets and detailed in the GEO Work Plan. The Science and Technology Road Map of GEO aims to ensure the linkage between GEO, GEOSS and the Science and Technology Community.

The 2nd GEOSS S&T Stakeholder Workshop assessed the alignment of these fundamental guidance documents of GEO with the needs of global research and monitoring for sustainability. The outcomes of the workshop compiled in this report describe the steps necessary to ensure that the future development of GEOSS is aligned with the needs arising from

the current Millennium Development Goals (MDGs) and the emerging Sustainable Development Goals (SDGs), as well as the Grand Challenges and Belmont Challenges addressed by the Future Earth - research for global sustainability Initiative.

The outcomes of the Workshop include three main parts:

- The "Bonn Statement", which provides recommendations directed towards the future GEO and GEOSS development and the linkage to the global sustainability research community.
- A near-term action plan, which details action that could, and should be implemented now.
- A document specifically addressed to the Post-2015 GEO Working Group.

Goals and Objectives of the Workshop

Workshop Scope and Objectives

The Group on Earth Observations (GEO) is implemented the Global Earth Observation System of Systems (GEOSS) with the goal to improve access to, and the use of Earth observations for a broad range of stakeholders. The 10 Year Implementation Plan for GEOSS states "GEOSS is a step toward addressing the challenges articulated by United Nations Millennium Declaration and the 2002 World Summit on Sustainable Development, including the achievement of the Millennium Development Goals. GEOSS will also further the implementation of international environmental treaty obligations."

The eight Millennium Development Goals (MDGs) cover a range of societal issues, all with a target date of 2015:

1. Eradicte extreme poverty and hunger;
2. Achive universal primary eduction;
3. Promote gender equality and empower women;
4. Reduce child mortality;
5. Improve maternal health;
6. Combate HIV/AIDS, malaria and other diseases;
7. Ensure environmental sustainability;
8. Develop a global partnership for development.

With this, the "MDGs form a blueprint agreed to by all the world's countries and all the world's leading development institutions. They have galvanized unprecedented efforts to meet the needs of the world's poorest." Although significant progress has been made towards many of the targets for each MDG, in many areas the goals will not be reached and there is an urgent need to lend more support. Science support is needed for many of the targets, and in most cases, Earth observations play a central role in enabling the required research. Moreover, our increasingly global society is facing a number of grand challenges on a changing planet that cannot be met without dedicated science support. Research for global sustainability needs to address these challenges in a integrated approach bringing together all stakeholders across the scientific disciplines. This has been acknowledged by the Future Earth Initiative. Earth observations are a crucial element of the basis for this research effort.

The objective of the workshop was to review the science questions and research topics that need to be addressed in order to support progress towards the MDGs and towards meeting the grand challenges, prior and after the current target date for the MDGs, and to identify Earth observations needed to facilitate the research.

Scientists and researchers engaged in environmental research supporting the MDGs and addressing the grand challenges are key stakeholders of GEOSS. Aligning the governing strategy for the implementation of GEOSS to the needs of these stakeholders has a high priority for GEO. The workshop reviewed the support of GEOSS for research on global sustainability and gave guidance on how to improve this support.

Workshop Organizers

Workshop Organizers

The workshop was jointly organized by the *GEOSS Science and Technology Stakeholder Network* and the *Group on Earth Observations* (GEO). The workshop was sponsored by the EGIDA Project and co-sponsored by a number of stakeholder organizations and projects, including the *Belmont Forum*; DIVERSITAS; the *European Science Foundation* (ESF); the *Federation of Earth Science Information Partners* (ESIP); *EuroGeoSurveys*; the Directorate Environment of the *European Commission*; the *International Council of Science* (ICSU); the *IEEE International Committee on Earth Observations* (IEEE/ICEO); the *International Geosphere-Biosphere Programme* (IGBP); the *International Human Dimension Program on Global Environmental Change* (IHDP); the *International Social Science Council* (ISSC); the *International Union of Geodesy and Geophysics* (IUGG) represented through the *International Association of Hydrological Sciences* (IAHS); the *Scientific Committee on Problems of the Environment* (SCOPE); the *Global Change System for Aanlysis, Research, and Training* (START); the *United Nations University Institute of Environment and Human Security* (UNU-EHS); the *World Climate Research Programme* (WCRP); and the *World Data System* (WDS) of ICSU. Projects co-sponsoring the workshop were the projects GeoViqua, and GEOWOW, all funded by the European Commission's Seventh Framework Programme (FP7). The Communities of Practice (CoPs) of GEO were represented through the GEO Work Plan Task ID-04.

Workshop Format

During the first day, the opening session set the stage for the workshop, and in a plenary session the MDGs were introduced together with the urgent science questions related to the MDGs and global sustainability. During the morning of the second day, two plenary sessions reviewed ongoing research related to the MDGs, the grand challenges, and the Future Earth initiative, and considered to what extent Earth observation provide support for the research needed to reach these goals. The two plenary sessions during the afternoon focused on GEO and GEOSS by considering the alignment of the GEOSS Strategic Targets with the MDGs and global sustainability research, and by demonstrating how GEOSS supports research for the MDGs and the Future Earth Initiative. On the third day, breakout sessions developed actions towards reaching the MDGs and addressing the grand challenges now and post-2015 in four broad areas: environmental sustainability and poverty, biodiversity, food and water security, and health. A fifth breakout session addressed issues related to the science-policy and science-public interfaces. The remaining plenary sessions of the third day reviewed the outcome of the breakout sessions, and developed a draft workshop statement. Finally, on Friday morning, two sessions developed drafts for an action plan for the next three years and a draft paper providing input for the Post-2015 GEO discussion.

Summary of Workshop Findings

Opening Session

Conveners: *Michael Nyenhuis*, *Hans-Peter Plag*

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Plenary Session 1: Science of the MDGs and Global Sustainability: Identifying Future Goals, Targets and Indicators

Conveners: *Anantha Duraiappah*, *Rick Lawford*

1. There is a real need for a coupled system conceptual framework drawing on the multiple disciplines to provide the basis of a discussion on goals, targets and indicators. This implies not just extending the MDG's, expanding the MDGs to include new goals but a revised framework but emphasizing teh integration of the existing MDGs within this framework.
2. There is a need for a stronger science-policy interface facilitating a broader stakeholder participation. This would allow bot a top down and bottom up approach to developing a framework and subsequently the goals, targets and indicators.
3. A more client driven approach approach should be adopted by GEOSS when generating data. Data to address the issues relevant to policy.
4. Data as a public good but to facilitate this, capacity building needs to be an integral part of the process allowing scientists from developing countries to be more active participants in the dialogue.
5. The SDGS should not be seen primarily as an environmental initiative and emphasize the need for more environmental data but as a more comprehensive framework requiring more data and information on economics and social aspects. This does not mean for GEOSS to start gathering social and economic data but a suggestion to build alliances with other systems generating those data such that a cohesive and coherent story on sustainable development can be told.

Plenary Session 2: Research for MDGs and future earth sustainability

Conveners: *Steven Wilson*, *Heide Hackmann*

Plenary Session 3: Earth Observations in Support of Research for the MDGs and Global Sustainability

Conveners: *Ghassem Asrar*, *Carol B. Meyer*, *Sybil P. Seitzinger*

Preamble

Increased interconnectedness of ecology and social system across scales due to globalization of world economy. Pressures on environ and magnitude of population growth require more sophisticated understanding of linkages/feedbacks highlight continued need for observations for rapidly emerging — greater emphasis on social-economic aspect of system

Peter Verburg: *Role of observing human-land cover interactions to monitor and model impacts on ecosystem service and human well-being*:
Importance of observations and monitoring, and greater emphasis on functionality beyond what is available for example in characterizing intensity of land use practices, (i.e. degree of land use and land conditions). Providing more detailed analysis for management practices (e.g., intensity of cropping system) — category of crop — soybean...etc. not good enough any more - need to know how intensive-extensive relates to sustainability... more multiple cropping and in some cases interspersed with livestock. We need a holistic approach to management of landscape for food, fiber, fuel and feed production. Need for use of multiple tools combining observations, models and analysis to develop the required knowledge and information for decision makers. Products focused/tailored for different application/purpose.

Need for greater involvement of a wider range of relevant disciplines — before remote sensing and ecosystems ... now need other expertise (e.g., animal husbandry, engineers, economic analysts...)

Observation systems are required to better understanding global context of regional/local changes — globalized economy — understanding local/regional changes in global context (drivers, impacts -- manifestation). Charles Huchinson: *Earth observation and information technologies for eradicating hunger*:
Observation and research provide a foundation for food production and food security. Several emergencies in 1960s and 1970s motivated organizations/countries to bring scientists, technologies, economists, etc. together to develop types of new analysis, capabilities, modeling/measurements to assess the state of global agriculture and food production. Learned by doing and discovered many nuances and complexities — reacting to emerging surprises. The focus was on saving life and property, and now to improve livelihoods, ... and in the context of prevention...which has multiple benefits...but additional complications not always foreseen, ... for example, bringing in additional food resources in times of scarcity affects the pricing of local crops potentially negatively Shift of focus to develop evidence-based earlier indicators of change that reduce risks to people, infrastructure and ecosystem New emerging capabilities and technologies — having info on precipitation, soil moisture, water resources, etc. new challenges, indicators. .. new capabilities can provide better information more reliable for basing decisions on risks, vulnerabilities and offering solutions Take capabilities available today and use in new ways to improve what to do, and to develop additional new capabilities Also should take advantage of emerging capabilities for delivery of information — mobile phones, crowd sources...social networking capabilities and emerging technologies for understanding, analysis and dissemination of information... observations and related information must be timely, reliable and affordable Complex and multifaceted global environmental problems...require international solutions through coordination and cooperation... important role of the GEOSS and GEC programs Vivian Lutz: *Phytoplankton & Society: Applications of Satellite Ocean Color*:
Oceans and biology — food web, production of oxygen and sequestration of CO_2 — ecosystem services. Major challenge is satellites only detect surface properties— chlorophyll — base of food chain. Example us of ocean color data to map- fronts off coast of India — improve fish catch and fuel efficiency but potential overexploitation and over-fishing— new governance considerations required. Helped with management of fisheries —. Developing ecosystem indicators of their health and their benefits using remote sensing to track fisheries vehicles and catch- management and stewardship of marine ecosystems. Recommendation — oceanobs'09 — needs to complete observation systems parts under sampled regions like southern ocean — new projects being put in place What can we do to avoid disruptions in long term records —-- example - vessel not working... interruption of database... are there risk mitigation strategies to avoid gaps in critical long-term observation records... sharing capabilities among GEO network to avoid disruption to long-term records. Continuity important but so is also innovation... need biogeochemistry... and biology that are more challenging but very important to obtain... rates of processes... Data sharing Enhance capacity building in developing countries for use of EO datasets Importance of analysis tools ... in light of large scale databases to help access to databases ---not have to move large datasets around and burden the limited capacity communication lines in some regions of the world— can analyze and visualize before moving over to their location- ease of access and overcoming telecommunication limitations especially in developing regions of the world In situ observations comparison with remote sensing — calibration/validation needs will continue in light of the ever changing observing systems due to innovation and new components and technologies.

Key Messages:

Observations are indispensable and critical part of future sustainability research, development and actions.

Greater emphasis on observations and their use for decision making processes.....using observations and analysis tools and the requisite expertise to develop tailored information for decision makers — beyond policy....for stewardship purposes.....individuals to nations-international.

Can we have more innovative ways of managing risks associated with continuity and building of new observations and networks ... e.g. loss of critical capabilities and risks to long-term observations records.

Given scope of problems facing a world with rapidly growing population and limited resources... 2/3 oceans... terrestrial ... main sources food fiber ... really opportunity for GEO to address these challenges...

Plenary Session 4: GEOSS Strategic Targets and Their Alignment to MDGs and Global Sustainability Research

Conveners: *Greg Withee*, *Douglas Cripe*

Several presentations in this session addressed the background and development of the GEO Strategic Targets, the Targets themselves, how the GEO Work Plan is supporting the

Targets, and the ongoing evaluation process of assessing GEOSS implementation with respect to the Targets. It was stated that the Targets were developed as aims or goals, representing a distillation of the 2-, 6-, and 10-year targets (241) of the GEOSS 10-Year Implementation Plan. The 2012-2015 Work Plan was designed to support these Targets, but specific statements about how the Targets could be achieved were viewed as too general for evaluation.

Regarding the alignment with the Millennium Development Goals and Global Sustainability Research it was stated by Dr. Barbara Ryan, the Director of the GEO Secretariat, that there was quite a bit of common ground in their alignment with the Targets, but again, the lack of specific content made a specific comparison challenging. A lively discussion followed the presentations and included discussions of relating the Targets to “urgency” and “product driven.” There was also some dialog on the need to improve communication through the GEO Web Page. It was thought that the web page should be improved to be complete, easy to use, and regularly updated and maintained.

Plenary Session 5: GEOSS’ support for MDGs and Future Earth Research

Conveners: *Douglas Cripe*, *Georgios Sarantakos*

This session featured examples of projects and initiatives conceived within the GEO international partnership that support global goals of the scientific research community:

- EO2Heaven (EC FP7) is exploring the application of Earth Observations to mitigate health risks in case studies in Saxony, Durban and Uganda.
- “Agile Analytics” are being developed through the EarthServer project (EC FP7) which aims to supplement web services with intelligent, rapid data extraction from large EO data sets
- UNEP-Live has employed GEOSS broker technology to improve data discovery and access through UNEP's catalogues.
- The GEO Agricultural Monitoring (GEO-GLAM) initiative was launched by the G-20 to coordinate activities of the agriculture community and to address the need for food security through better use of EO.
- The GEO BON initiative was established within the GEO framework initially to bring together the biodiversity community and establish partnerships in an observational network — more recently, it has adopted the focus of supporting the CBD.

These presentations provided illustrations of contributions GEO can make to global initiatives, from data discovery, access and interoperability, to creation of partnerships and networks, to initiatives requiring coordination and integration of EO to address specific concerns and supporting the achievement of global development goals.

Recommendation: GEO BON should establish stronger links with GEO member countries as well as explore making better use of the GCI.

Breakout Session B1: Environmental Sustainability and Poverty

Conveners: *James Syvitski*, *Rick Lawford*

Breakout Session B2: Biodiversity

Conveners: *Anne Larigauderie*, *Rob Jongman*, *Gary Geller*

Breakout Session B4: Food and Water Security

Conveners: *Gordon Young*, *Anik Bhaduri*

The Breakout Session (Food and Water Security) in the GEOSS Science and Technology Stakeholder Workshop addresses water and food security issues within the broader context of global security issues. The session has produced the following recommendations as end products on how best to incorporate earth observation monitoring systems into the management of water and food security.

- Placing water security within the much broader context: the many elements of global security in a world of change and uncertainty
- Policy- and decision-making in “silos” needs to give way to an approach that reduces trade-offs and builds synergies across sectors — a nexus approach”.
- Improved governance structures are needed that enable issues related to water, energy, food and environment to be considered within a single forum
- Need to develop plans for basin-wide management and maximize the use of Earth Observations and scenarios to make the decision process as transparent as possible.
- Capacity development is essential to assist nations in managing their resources and achieving water and food security

Four presentations were made on different aspects of the topic of Water and Food Security.

Gordon Young, President, International Association of Hydrological Sciences, set the tone of the session by highlighting the key objectives of the discussions, namely: i) to set water security within the broader framework of global security issues, ii) to define the elements of water security, iii) to focus on food security issues, iv) to elaborate on the relevance of global earth sciences, and v) to produce recommendations on how best to incorporate earth observation monitoring systems into the management of water and food security. In his presentation, Gordon Young also placed water and food security within the context of global security, where he highlighted key factors behind the on-going processes of global change, such as: population growth, climate change, and others. Elements of water security are comprised of diverse uses of water, including for human well-being (health and food security), economic development (energy, industry), social development and, equally importantly, water to sustain normal functioning of natural ecosystems. Moreover, water security is also associated with several water-related hazards such floods, droughts and pollution. In many cases, regions affected by water stress coincide with those where water is used unsustainably.

Anik Bhaduri, Global Water System Project, University of Bonn, made a presentation on the linkages between water and food security. He highlighted that with continued increase in population, limits are being met on the basic resource needed to produce food. Water gap will leave a food gap and affect global food security severely. Food crises may happen unless fundamental policy changes are made in future water use. What are the possible solutions? These will include strengthening the human dimension of water scarcity and quality management and policy, addressing land and water scarcity jointly, intensifying agricultural productivity with more efficient water use, efficient and equitable use and distribution of water, and fostering value-oriented water reuse. Anik Bhaduri also reported on the results of his joint research with several co-authors indicating that virtual water imports were positively associated with individual countryâ€™s water scarcity. Effective tools are needed to support decision-makers in a more timely and coordinated manner in response to risks related to water and food availability. Earth observations are an important basis to provide such information. However, significant investment is needed as sufficient infrastructure for data collection and distribution often does not exist, especially in developing countries, impeding the ability to cope with variability and change. For existing data, the challenge lies ahead to integrate earth observation and monitoring systems for agricultural commodities, and identify new metrics and valid indicators that can be applied across sectors to assess inter-linkages.

Rick Lawford, Morgan State University, made a presentation on the role of Earth Observations in enhancing security in the Water-Food Nexus. He emphasized that water is the entry point for sustainable development and the green economy. Without water security it will not be possible to realize the sustainable development goals and to cope with the wide range of economic and social risks that will arise from climate change, disasters and manipulation by humans of the Earthâ€™s surface. Water security requires the ability to i) map the availability and quality of surface and sub-surface waters, ii) measure and understand how the water cycle varies and changes, iii) predict how the availability and quality of water resources will change on a range of time and space scales, iv) support the integrated planning and management of water resources both nationally, internationally, and globally, and v) implement new technologies for water discovery and supply. Whatâ€™s needed are improved governance structures that enable issues related to water, energy, food and environment to be considered within a single forum, involve experts from different levels of government to interact with stakeholders and the public in consultative and decision making processes, seek fora where state or national leads can provide feedback which would be helpful to develop plans for basin-wide management and maximize the use of Earth Observations and scenarios to make the decision process as transparent as possible.

Jens Liebe, UN-Water Decade Programme on Capacity Development (UNW-DPC), highlighted that in Water-Energy-Food Security Nexus, capacity development is crucial to identify interconnections between sectors and actors, to promote learning and knowledge sharing across sectors and regions, to narrow the gap between the availability of solutions and skills and means to use them (e.g. technology), and to support decision-makers to develop appropriate policies, strategies and investments, and to explore and exploit synergies, identify and mitigate trade-offs. Capacity development is essential to assist nations in managing their resources and achieving water and food security, though eliminating the mismatch between availability of solutions and skills and means to use and benefit from them, overcoming a “silos” mentality for improved management. In this regard, Earth Observations can play an important role in providing data and developing tools which underpin sound resource management.

Breakout Session B5: Health

Conveners: *Gary Foley*, *Joerg Szarzinski*

Summary:
The Health session was co-chaired by Gary Foley and JÃ¶rg Szarzynski. Four presentations were given representing various aspects of the health sector; the evolution and structure of the health target as it relates to GEO, funding perspective of the development of health related funding schemes, health data collection and usage, and examples from the field in tele-medicine.

Overview of Presentations:

Gary Foley: Scope and Activities of the GEO/GEOSS Health Task Team and Community of Practice on Health

Summary:
The overall development of the health societal benefit area within GEO has been slower than expected and to date the WHO is sill not involved. Nevertheless, the GEO Health and Environment Community of Practice (CoP) has been actively involved in the process conducting several workshops over the last four years all being well attended. This CoP worked directly with Secretariat on the creation of the health task within the new Work Plan 2012-15 ensuring that it is well in line with both the goals of GEO and the needs that the health community is asking from GEOSS.

In light of the July 2012 a progress report to ExCom; the following points on the progress of the Work Plan health tasks were noted:

- HE-01 The task is to understand environmental factors that affect human health and well-being
  - Progressing slowly
  - Still need to bring the WHO on board
- HE-02 Tracking Pollutants
  - More activity work than outputs
  - Has more funding so progressing more rapidly than HE-01
  - Looking for more active participation

The most important aspect, that must be kept in mind when looking at this brief statement of progress, is: how can we take advantage of all of the advances in earth observations to better protect human health and well-being?

Detlef Böcking: Supporting Health Research Networks in Sub-Saharan Africa. An initiative of the German Ministry of Education and Research

Summary:
The core purpose of the presentation was to demonstrate the German government’s efforts in creating a collaborative comprehensive health-funding scheme. The BMBF provides national funding to health projects through its framework Programme for Health Research, contributing to various ongoing international activities and through the activities of the international bureau. In order to streamline the work being done by the BMBF a new funding concept that includes all projects was proposed: “Neglected and Poverty-Related Diseases”. The funding scheme will focus on Sub-Saharan Africa. Notable past problems to be addressed while working in the region:

- Tendency for scientific projects to be developed, funded, driven by Northern organizations
- Health not seen as a priority by African governments
- Lacking coordination between actors
- Research not related to a specific academy

While creating the concept, BMBF brought together stakeholders (national, European-wide, African-wide and multilateral) from around the development networks. Through engaging other development groups certain recommendations were developed; such as building on existing structures, putting funding into management capacities, and focusing work on training programs; among others. The project nexus will be comprised of an African research center at the core with the involvement from an African hospital, African university and a German research institution. Funding will only be provided to the African partners in the nexus.

Peter Heudtlass: Mapping Vulnerability MDGs and Earth observations in disaster epidemiology

Summary:
The presentation focused on the work being done by Center for Research on the Epidemiology of Disasters (CRED), potential for collaboration with GEO, and aspects for possible improvement. CRED has been collecting data for around 40 years on the health impact of disasters; however the centers main work focuses on research. CRED’s research on health related MDGs has primarily looked at 3 factors:

- Main risk factors and conditions?
- Which interventions work?
- Who and where is most affected?

CRED is well known for its work in data management through its International Disaster Database (EM-DAT) and The Human Impact of Complex Emergencies Database (CE-DAT). EM-DAT, event based database, has data from 1900-present and focuses on human and economic impact of ~20,000 disasters. Lesser-known CE-DAT, is a repository of health surveys collected by humanitarian agencies including sub-national data and geo reference. There is an increasing desire at CRED to beginning creating more products for policy makers that can better demonstrate the needs of a certain region better than solely producing a dataset. One such example is the recently created Conflict & Health â€“ Hotspot Analysis. Are these databases and products among the databases and clearinghouses of GEOSS?

Some challenges that could be possibly addressed by GEO in its Health Tasks and related socio-economic work are the need for:

- More and better spatial data
- More health data collection occurring among displaced populations
- Methods being reviewed

  - Comparative and trend analysis with non-systematic samples in space and time from multiple sources
- Denominators
  - Need better population data â€“ all current data is an estimation
  - AfriPop project â€“ tried to estimate population through satellite imagery
  - Possibility could get better satellite images

Rupert Gerzer: Telemedicine for remote areas and in emergency situations

Summary:
Access to health care in remote regions of the world is becoming increasingly more acceptable through the use of telemedicine and mobile health. Several case studies that the German Aerospace Center (DLR) is involved with were mentioned. For example in Argentina, DLR ran a project from 1997-2000 that was later taken over by the Argentinean government and is still in use today. It is theorized that these remote health centers are still active because of two variables: the technology is not complicated and capacity development occurred surrounding the use of the technology.

The bulk of the work conducted by DLR is done in cooperation with the German armed forces, beginning in 1996. The approach to this project is problem-market solution based. DLR keeps costs low by providing solutions that come directly from the market. Furthermore, the technology is easy to use and therefore does not require computer professionals to operate in the field. While the types of medicine are varied, i.e. teleradiology, teledentistry, etc., they have in common the fact that they focus on 2nd opinion medical advice. While also used for 1st opinions in some cases, this kind of technology does not function best for first-aid or emergency situations. On the other hand, mobile technology is being looked at more closely for its potential to provide information to emergency response teams for providing information on where the best care can be found for the patient. Work of this nature has been conducted through the H.E.L.P (Hospital Emergency Location Phone) project.

Some overall lessons learned have been:

- Tele-teaching and tele-education are a constant request by the doctors in remote areas
- Focus on Commercially available off-the-shelf (COTS) and Keep it short and simple (KISS)
- Sometimes don't need satellite, because of terrestrial connections

It would be prudent for GEO to connect with International Academy of Astronautics (IAA), because they are a network of people comprised of individuals from across the space community who have influence on their organizations and governments. In the future, they are looking to focus work on Africa. Also, the International Society of Telemedicine and eHealth will be having a conference on "International Society for Tele-medicine and eHealth ...Making eHealth Work" from 17-19 November 2012. (www.sftehin.net/conference)

Suggestions and Recommendations for GEO:

1. Open a discussion about collecting more satellite images on people in areas of conflict and distress.
2. Open a discussion about collecting more satellite images in Africa that could be used to determine population.
3. Connecting with International Academy of Astronautics (IAA).
4. Possibly send a proposition paper to the IAA that will help space agencies to focus on a specific concept, i.e. building of satellite stations in Africa.
5. Potentially sending a representative to the International Society of Telemedicine and eHealth conference on "International Society for Tele-medicine and eHealth ...Making eHelath Work" from 17-19 November 2012.
6. Directed at the GEO User Engagement Task team: ensure that the system of systems supports epidemiologists down the road.
7. Increase publicity of GEO to funding organizations.
8. Connecting with the BMBF (and other funding organizations) for knowledge sharing purposes. BMBF had no prior knowledge of GEO, and therefore they were not invited to their stakeholder meeting. BMBF willing to put GEO on a email list.
9. Increase the contact with CoPs (for data sharing purposes
10. Until a comprehensive open database base is available, the Health Task Team working with the GEOSS Common Infrastructure Task Team could provide links to all the data that is available globally related to GEOSS-Health.
11. Improve the website make it more user friendly.

Breakout Session B6: Science-Policy-Interface

Conveners: *Peter Haugan*, *Kathleen Fontaine*, *Hans-Peter Plag*

The session started with a presentation by Peter Haugan, who pointed out that in some cases, science is following policies (e.g., in checking the MDGs), and in other cases, driving policies (e.g., in the case of the Montreal Protocol). In other cases, such as climate change, the situation is more complex. Science can be categorized as applied science, comparable to professional consultancy, or post-normal. Characteristic for post-normal science including climate change are high uncertainties and high decision stakes. One role of science may be to reveal inconsistencies rather than to give definitive advice. He also emphasized that feeding into robust public deliberations may be the best contribution from social scientists and natural scientists to policy development. He asked what the role of GEO could be in this process, and emphasized the need to make knowledge work.

Ghassem Asrar pointed out that there is frustration in natural and social sciences about the fact that knowledge often is not put into action. It must be asked what, if anything, the scientists are doing wrong so that scientific knowledge does not reach to the decision makers or they do not respond. Despite the fact that for example the EGU and AGU organize entire sessions on this issue, little progress has been made. At the recent Rio+20 conference, new approaches to knowledge generation were proposed, including co-design, co-development and co-generation of knowledge, i.e., to have the stakeholders who can make use of the knowledge at the table. For example, for the generation of knowledge valuable to fishermen, these stakeholders should be at the table.

Another issue is communication, where language and terminology often create barriers. Natural scientists have a tendency to begin with the uncertainty, but should rather start with what they know and make this understandable. He emphasized the need to devote time to establishing connections to media, practitioners, and decision-makers and keeping sustained attention. The knowledge needs to be communicated repeatedly. The current reward system within sciences is not working since time devoted to this communication part is not positively taken into account. He also underlined the need for scientists to stay engaged to follow up policies after the basis has been established, with knowledge targeted and tailored to the audience which includes (sectorial) managers and the public.

Imraan Salojee discussed the need for capacity building and continuous capacity development in order to meeting global challenges through better governance. Here it is important not to focus only on capacity in the generation of knowledge but also the use of the knowledge for decision making. The underlying assumed linear model between science capacity and societal effects can not be taken for granted and an effort needs to be made to develop capacities that allow the societal benefits to be realized. This must involve support for many skills and activities, and develop structures and partnerships to build innovation capacities.

Paolo Mazzetti described the Model Web as an "Ecosystem of models" that could link models to answer particular questions. The motivation for the Model Web comes from users who focus on high-level representations. By building a web of interoperable models and data, a framework is created to define and run a scientific business process to answer "What if ...?" questions. He pointed out that the GEOSS User Requirements Registry could provide the framework for the development of business processes. The Model Web could be a tool to work in scenarios using science in policy development. It could also create transparency and confidence in science output, and contribute to capacity development.

The subsequent discussion emphasized the need for interfaces between the global sustainability research communities and the societal stakeholders. It was suggested to look at those areas where this interface works, e.g., the World Bank in relation to investments for disaster reduction. It was recommended that GEO would look at these examples for potential guidance. A geographical mapping of where science support for decision making works could be helpful. The required interfaces would have to be at a high level and based on a language understood by the societal stakeholders. Bringing the stakeholders to the table for the co-design and co-development of new knowledge would require a very large table, but this table could be virtual. The use of technologies available to many would greatly amplify the societal benefits of the knowledge, and the ideas expressed in Edwards (2012) were mentioned as relevant to the discussion. GEO could take a leading role in developing this virtual table. The potential role of the GEO CoPs was pointed out.

It would be important to acknowledge the scientists who collect data and contribute to the knowledge production. Since scientists often are not capable of speaking the language of the societal policy and decision makers, a translation is needed. Here, too, a role for GEO was identified. There is a need to involve social scientists to a much greater level, but experience shows that this is not easy. The turn-around time of scientific information in the peer-reviewed system is often too slow to meet the specific requirements of societal decision makers, particularly in areas related to global sustainability, climate change, and disaster risk reduction.

The session identified the following questions to be addressed by GEO:

- Is the scientific knowledge related to sustainability, climate change, disaster risk, etc., provided in a form that it can be put to work? For example, are (uncertain) predictions of future trajectories of the climate system what is needed or would probability density functions (PDFs) provide a better basis for policy making? In many cases, where predictions are uncertain or not possible, we use our knowledge of the PDFs to decide on risk reduction (e.g, by wearing seat belts in cars), and a similar probability-based approach to sustainability could be more workable than a prediction-based approach.
- Do we need to work with those who need the information for policy and decision making? To what extent can we respond to their information needs and get them to tell us what they need?
- How could GEO get involved in the co-production of knowledge and also develop a “pull component” allowing those who are in need of knowledge to pull this as needed. In particular, the ability to ask “What if ...” questions would support decision making. If this pull component would be available to stakeholders at all societal levels, this would also lead to a democratizing of knowledge by giving equal access to knowledge.
- How can we better identify where large uncertainties require a probabilistic approach and where certainties can be used in a more deterministic approach?

The session underlined the need for competence in the use of knowledge for decision making and recommended that GEO would have a focus on the development of capacity in the societal use of knowledge derived from Earth observations in collaboration with other organizations. In particular, there is a need to bring in the required expertise, particularly in computer science, social sciences, and science communication. GEO should consider the potential role of industry in building these competences and innovation, particularly in the Post-2015 period.

Plenary Session P6: Synthesis of the Breakout Sessions

Conveners: *Stuart Marsh*, *Hans-Peter Plag*

Plenary Session P7: The Way Forward

Conveners: *Barbara Ryan*, *Kathleen Fontaine*

Plenary Session P8: Towards an Action Plan

Conveners: *Paola Campus*, *Jay Pearlman*

The Session was opened by Jay Pearlman, who introduced the motivation for the anticipated action plan. The 10-Year Implementation Plan for GEOSS endoresed in 2005 states that “GEO will establish, within 10 years, its system of systems to provide timely data and products for local, national, regional, and international policy makers.” The Implementation plan defines that “the purpose of GEOSS is to achieve comprehensive, coordinated and sustained observations of the Earth system, in order to improve monitoring of the state of the Earth, increase understanding of Earth processes, and enhance prediction of the behavior of the Earth system.” “GEOSS will meet the need for timely, quality long-term global information as a basis for sound decision making.” The GEOSS Strategic Target for Data states the goal to “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.” He then reviewed the SBAs, and discussed challenges of the science - policy interface. He outlined a concept for an integrative approach to sustainability, which links the bottom-up, problem oriented approach focusing on local problems through indicators to the top-down, normative approach, which is expressed in constitutive elements, general goals and rules. He emphasized the importance of indicators for both approaches.

Ellsworth LeDrew then used the example of the International Polar Year (IPY) to discuss aspects of the chain from data to information to action. He emphasized the need to have users involved from the beginning, and stated that the success for GEOSS could be the achievement of a set of targets for which the users feel ownership. The decision makers need a pull-capacity for information. GEOSS should account for co-design, co-development, and co-production of information with users involved from the start. In order to build a user-driven GEOSS, he saw the need to re-energize the CoPs as part of the governance process within GEO. The CoPs provide the social and methodological 'Glue' and can help to prevent that the GEO Tasks are silos. He requested that GEO processes are adapted to the needs of the community. He emphasized the importance of the users by concluding that sustainable development is a result of decisions by users in the planning process.

The subsequent panel discussion with panelists Roberto Azzolini, Alan Edwards, Ellsworth LeDrew, and Sybil Seitzinger addressed four main areas: Data and Information, Communication, Capacity Building and Education, and Strategy.

Plenary Session P9: Preparing Input for the Post-2015 Working Group

Conveners: *Alan Edwards*, *Helmut Staudenrausch*

The Bonn Statement

2nd GEOSS Science and Technology Stakeholder Workshop

GEOSS: Supporting Science for the

Millennium Development Goals and Beyond

Bonn, Germany, August 28 - 31, 2012

- Draft Bonn Statement -

Version 1.0

Preamble

The Implementation of the Global Earth Observation System of Systems (GEOSS) by the Group on Earth Observations (GEO) is aiming to achieve the Strategic Targets for GEOSS. These Targets mainly concern the coordination and integration of Earth observing systems and promotion of data access and use in support of informed decision making across nine Societal Benefit Areas (SBAs), which relate to the Millennium Development Goals (MDGs), the emerging Sustainable Development Goals (SDGs) and global sustainability research. The achievement of these Targets would be a step towards addressing the challenges articulated by the 2002 World Summit on Sustainable Development, including the achievement of the Millennium Development Goals (MDGs).

The 2nd GEOSS Science and Technology Stakeholder Workshop held in Bonn, Germany on August 28-31, 2012, reviewed the alignment of the Strategic Targets of GEOSS with the research needs of the MDGs, SDGs, and global sustainability. The workshop was organized by the GEOSS S&T Stakeholder Network together with a total of 21 international research organizations, United Nations agencies, funding agencies, and research projects funded by the European Commission.

The workshop participants emphasized the challenge of global sustainability, underlined the need for a research effort to support decision makers, policy makers and the public in making progress towards increased sustainability and resilience, and urged the Member Countries and Participating Organizations of GEO to make available the Earth observations needed for this research. The â€œBonn Statementâ€ summarizes this support for global sustainability research.

Realizing that

- Within the context of the MDGs, humanity is challenged by accelerated population growth, food and water security, poverty, inequality, and public health issues;
- Humanity has grown into the dominating factor in the increasingly changing Earth system, shaping the Earth's surface, changing the chemistry of atmosphere, ocean, and soils, reducing biodiversity, and modifying mass cycles;
- A new city of 1 million people in needed every 10 days;
- The impact of humanity of the planet is rapidly increasing;

Recognizing that

- The global community of countries has agreed on the need for sustainable development, poverty eradication, and has set itself goals such as the MDGs and SDGs that would improve the wellbeing of many;
- Frameworks such as UNCCD, CBD, UNFCCC, etc, have been established by the UN;
- Major research effort are underway to provide the knowledge required for decision making that would bring humanity closer to these goals and sustainability;
- The governments of the Member Countries of GEO have agree to work towards a coordinated Earth observations system of systems;
- Although Earth observations are crucial for the research needed to understand the requirements of global sustainability, they are not available to the extent needed,
- The changes of the planet are not observed sufficiently and without sufficient observations we will not be able to reconstruct the changes ever;
- Sufficient data need to be collected and preserved so that in the future indicators can capture trends in the Earth system;

We, the participants of the 2nd GEOSS Science and Technology Stakeholder Workshop â€œGEOSS: Supporting Science for the Millennium Development Goals and Beyond,â€ held in Bonn, Germany, August 28â€”31, 2012,

Call on the science and technology sector to:

- Undertake research regarding a range of globally consistent human development data, with contributions by Earth observations to those data streams;
- Develop the indicators that would inform and support decision makers in their quest for sustainable development;
- Recognize, within a global partnership, the synergies and complementarities between the different parties, and seek to maximize these whilst avoiding overlaps;
- Make an effort to register services and data in GEOSS;

Call on world governments, in particular, GEO Members, to:

- Invest in research and technological development in support of SBAs, MDGs, SDGs, Future Earth research;
- Invest in the dissemination and utilization of Earth observation products for societal benefits and in the continued provision of sustained Earth observations from satellite, airborne and in-situ systems;

- Adhere to Data Sharing Principles (broad and open access to data and information) based on open standards for interoperability and to put in place mechanisms so that data can be freely shared for the creation of the knowledge that is needed for global sustainability;
- Strengthen the interactions and partnerships between developed and developing nations;
- Invest in capacity building, education and training in the use of Earth observations for decision making at all levels;

Call on GEO to:

- Consider emerging technologies providing global access to Earth observations and derived knowledge in the development of GEOSS and focus on building infrastructure that allows combination of top-down and bottom-up information;
- Bring into the development of GEOSS a broader spectrum of expertise, including social scientists;
- Expand GEOâ€™s remit to include socio-economic data and participation of specialists in these areas;
- Develop mechanisms for the stronger involvement of the users, international science programmes, policy and decision makers and industry in the entire workflow of the development of knowledge and products;
- Develop white papers on the potential for clustering of SBA and Tasks (e.g. Blue Planet) to maximize synergy, address sustainability issues (e.g., water-energy-food) and other cross-cutting issues such as socio-economics and human dimensions;
- Make an efforts to develop a sense of ownership amongst the users for the GEOSS Targets, with a strengthened role for the CoPs as an important component of the annual work plan process;
- Offer GEOSS infrastructure for data management to the international science programmes (in particular, Future Earth);
- Acknowledge the need for different types of interfaces for policymakers, decision makers and the public in general, and consider interfaces that allow pulling information when needed;
- Foster capacity building and development of new and existing capacity with respect to the use of knowledge in evidence-based management for both providers and users of EO;
- Build on and promote knowledge base and lessons learned;
- Encourage outreach and communication, in particular to citizens;
- Focus on the provision of knowledge, through products and decision support tools and related capacity building among end-users so they can use them to promote human well-being;
- Consider, where appropriate, contributions from commercial companies to utilize benefits of Earth observations;

Call on the Communities of Practice to:

- Make an effort to actively participate in the development, implementation, and monitoring of the GEO Work Plan by participating in Work Plan reviews, Task Teams, and the Implementation Boards

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Action Plan for 2012 to 2015

2nd GEOSS Science and Technology Stakeholder Workshop

GEOSS: Supporting Science for the

Millennium Development Goals and Beyond

Bonn, Germany, August 28 - 31, 2012

- Action Plan -

Version 1.0

Preamble

The Group on Earth Observations(GEO) has the goal to establish, within 10 years, its Global Earth Observation System of Systems (GEOSS) to provide timely data and products for local, national, regional, and international policy makers, decision makers, and the general public. The purpose of GEOSS is to achieve comprehensive, coordinated and sustained observations of the Earth system, in order to improve monitoring of the state of the Earth, increase understanding of Earth processes, and enhance prediction of the behavior of the Earth system. GEOSS will meet the need for timely, quality long-term global information as a basis for sound decision making. GEOSS will 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. The participants of the 2nd GEOSS Science and Technology Stakeholder Workshop held in Bonn, Germany, on August 28-31, 2012, agreed on a Statement, the â€œBonn Statement,â€ which recommends a number of actions to ensure that the goals for GEOSS are achieved, GEOSS becomes a resource supporting global sustainability research, and the science and technology communities involved in global sustainability research fully benefit from GEOSS and Earth observations in general. This Action Plan details the actions to be implemented in the remaining period of the first 10-year implementation phase of GEOSS.

Introduction

This document formulates concrete actions that should be undertaken by GEO (GEO Secretariat, Implementation Boards, GEO Task Teams, Communities of Practice, individual Member Countries and/or Participating Organizations) and GEOSS S&T Stakeholders to implement the recommendations agreed upon by the participants of the 2nd GEOSS S&T Stakeholder Workshop.

The background for the actions listed below is given in the comprehensive Workshop Report (see http://www.geo-tasks.org/workshops/2012_Bonn/ws_reporti.php).

The Bonn Statement: Recommendations and Stakeholders

The following table lists the recommendations given in the Bonn Statement and identifies the relevant stakeholders, the organizations who would be involved in the implementation, and the potential lead organizations for the implementation. The column â€œA/Pâ€ indicates whether there an action for the 2012-2015 period has been included below and/or whether the recommendation is addressed in the Input document for the Post-2015 GEO Discussion.

Recommendation	Main Stakeholders	Implemented by	Lead for Implementation	A/P
Undertake research regarding a range of globally consistent human development data, with contributions by Earth observations to those data streams	S&T communities	International science organizations	ICSU and ISSC	A
Develop the indicators that would inform and support decision makers in their quest for sustainable development	S&T communities	International science organizations	IGBP	A
Recognize, within a global partnership, the synergies and complementarities between the different parties, and seek to maximize these whilst avoiding overlaps	S&T communities			P
Make an effort to register services and data in GEOSS	S&T communities			A ST-1
Invest in research and technological development in support of SBAs, MDGs, SDGs, Future Earth research	Governments	GEO Member States	GEO Secretariat	A/P
Invest in the dissemination and utilization of Earth observation products for societal benefits and in the continued provision of sustained Earth observations from satellite, airborne and in-situ systems;	Governments	GEO Member States	GEO Secretariat	A/P
Adhere to Data Sharing Principles (broad and open access to data and information) based on open standards for interoperability and to put in place mechanisms so that data can be freely shared for the creation of the knowledge that is needed for global sustainability	Governments and international organizations	GEO Member States and Participating Organizations (POs)	GEO Secretariat	A/P
Strengthen the interactions and partnerships between developed and developing nations	Governments and international organizations	GEO Member States and POs	GEO Secretariat	A/P GS-5
Invest in capacity building, education and training in the use of Earth observations for decision making at all levels	Governments and international organizations	GEO Member States and POs	GEO Secretariat	A/P

Consider emerging technologies providing global access to Earth observations and derived knowledge in the development of GEOSS and focus on building infrastructure that allows combination of top-down and bottom-up information	GEO Member Countries and POs	GEO Work Plan Tasks	Infrastructure Implementation Board	A IB-2
Bring into the development of GEOSS a broader spectrum of expertise, including social scientists	GEO Member Countries and POs	GEO POs and Work Plan Task Teams	Implementation Boards	A GS-1
Expand GEOâ€™s remit to include socio-economic data and participation of specialists in these areas	GEO Member Countries	GEO Plenary	GEO Secretariat	A/P
Develop mechanisms for the stronger involvement of the users, international science programmes, policy and decision makers and industry in the entire workflow of the development of knowledge and products	GEO Member Countries and POs, GEOSS users	GEO Work Plan Tasks	Implementation Boards	A/P GS-2
Develop white papers on the potential for clustering of SBA and Tasks (e.g. Blue Planet) to maximize synergy, address sustainability issues (e.g., water-energy-food) and other cross-cutting issues such as socio-economics and human dimensions	GEO Member Countries and POs	GEO Work Plan Tasks and ad hoc Working Groups	Implementation Boards and/or GEO Secretariat	A GS-3
Make an efforts to develop a sense of ownership amongst the users for the GEOSS Targets, with a strengthened role for the CoPs as an important component of the annual work plan process	GEOSS users	Work Plan tasks (ID-04), ID IB	Implementation Boards and/or GEO Secretariat	A IB-1
Offer GEOSS infrastructure for data management to the international science programmes (in particular, Future Earth)	GEOSS providers and S&T communities	GCI Provider Group and Future Earth	GEO Secretariat	A/P
Acknowledge the need for different types of interfaces for policymakers, decision makers and the public in general, and consider interfaces that allow pulling information when needed	GEO Member Countries and POs	GCI Providers and GEO Work Plan Tasks	GEO Secretariat and/or Implementation Boards	A/P
Foster capacity building and development of new and existing capacity with respect to the use of knowledge in evidence-based management for both providers and users of EO	GEO Member Countries and POs		GEO Secretariat	A GS-4
Build on and promote knowledge base and lessons learned				A/P
Encourage outreach and communication, in particular to citizens	GEO community	Implementation Boards together with GEO Secretariat	GEO Secretariat	A/P
Focus on the provision of knowledge, through products and decision support tools and related capacity building among end-users so they can use them to promote human well-being	GEO Member Countries and POs			P
Consider, where appropriate, contributions from commercial companies to utilize benefits of Earth observations	GEO Member Countries and POs	GEO Plenary	Implementation Boards and GEO Secretariat	A/P
Make an effort to actively participate in the development, implementation, and monitoring of the GEO Work Plan by	Communities of Practice	Communities of Practice	GEO Secretariat with ID-04	A CP-1

participating in Work Plan reviews, Task Teams, and the Implementation Boards				

Actions to be implemented under the lead of the GEO Secretariat

GS-1: An approach should be developed to actively and effectively engage social and economic sciences in GEO and the development of GEOSS.

Note: The GEOSS/IPCC recommendations emphasize the need for this engagement, which is important for progress toward decision support. The mission of GEOSS is to support decision making, and decision making involves social and economic aspects. Utilizing citizen observations also requires social science expertise.

GS-2: An effort should be made to facilitate a stronger involvement of the users, international science programmes, policy and decision makers and industry in the entire workflow of the development of knowledge and products.

Note:

GS-3: The development of white papers should be initiated on the potential for clustering of SBA and Tasks (e.g. Blue Planet) to maximize synergy, address sustainability issues (e.g., water-energy-food) and other cross-cutting issues such as socio-economics and human dimensions.

Note:

GS-4: Capacity building and development of new and existing capacity with respect to the use of knowledge in evidence-based management for both providers and users of EO should be promoted.

GS-5: A stronger interactions and partnerships between developed and developing nations should be nurtured.

Actions to be implemented under the lead of the Implementation Boards

IB-1: Efforts should be made to develop a sense of ownership amongst the users for the GEOSS Targets, with a strengthened role for the CoPs, as an important component of the annual work plan process.

Note:

IB-2: Facilitate the development of infrastructure that brings together the top-down observations of GEOSS with bottom-up observations based on crowd-sourcing.

Note: The Implementation Boards can identify opportunities where existing and developing GEOSS infrastructure can be integrated with crowd-sourcing components to allow bottom-up observations to be accessible through GEOSS. This action can be delegated to Work plan Tasks but should be monitored by the Implementation Boards.

IB-3: Understanding that decision makers need actionable information, not data, focus should be on improving the science-policy and science-public interface and adding components that allow pulling information when needed.

Note:

Actions for Communities of Practice

CP-1: The CoPs should make an effort to actively participate in the development, implementation, and monitoring of the GEO Work Plan by participating in Work Plan reviews, Task Teams, and the Implementation Boards.

Note:

Actions for S&T Communities

ST-1: The international scientific organizations engaged in global sustainability research should make an effort to register their datasets, services, standards and agreements, user needs, and best practices in the respective registries of the GEOSS Common Infrastructure.

Note:

Actions for Funding Agencies

FA-1: Funding agencies should work withy GEO to identify potential resources to support the implementation of the Action on GEO.

Annex

Useful hyperlinks:

Workshop website;

Bonn Statement

GEO Work Plan Implementation website; GEO website; Communities of Practice (CoP) websites; â€¦

Workshop Input to the Post-2015 GEO Process

2nd GEOSS Science and Technology Stakeholder Workshop

GEOSS: Supporting Science for the

Millennium Development Goals and Beyond

Bonn, Germany, August 28 - 31, 2012

- GEO Post-2015 Input -

Version 1.0

Everything will work out in the end,
and if it hasn't worked out yet, then it isn't the end!

Preamble

The Implementation of the Global Earth Observation System of Systems (GEOSS) by the Group on Earth Observations (GEO) is aiming to achieve the Strategic Targets for GEOSS. These Targets mainly concern the coordination and integration of Earth observing systems and promotion of data access and use in support of informed decision making across nine Societal Benefit Areas (SBAs), which relate to the Millennium Development Goals (MDGs), the emerging Sustainable Development Goals (SDGs) and global sustainability research. The achievement of these Targets would be a step towards addressing the challenges articulated by the 2002 World Summit on Sustainable Development, including the achievement of the Millennium Development Goals (MDGs).

The 2nd GEOSS Science and Technology Stakeholder Workshop held in Bonn, Germany on August 28-31, 2012, reviewed the alignment of the Strategic Targets of GEOSS with the research needs of the MDGs, SDGs, and global sustainability. The workshop was organized by the GEOSS S&T Stakeholder Network together with a total of 21 international research organizations, United Nations agencies, funding agencies, and research projects funded by the European Commission.

The workshop participants emphasized the challenge of global sustainability, underlined the need for a research effort to support decision makers, policy makers and the public in making progress towards increased sustainability and resilience, and urged the Member Countries and Participating Organizations of GEO to make available the Earth observations needed for this research. The document summarizes the outcomes of the Workshop relevant for the Post-2015 GEO.

Scope and Objectives of the 2nd GEOSS S&T Stakeholder Workshop

The 10 Year Implementation Plan for GEOSS states â€œGEOSS is a step toward addressing the challenges articulated by United Nations Millennium Declaration and the 2002 World Summit on Sustainable Development, including the achievement of the Millennium Development Goals. GEOSS will also further the implementation of international environmental treaty obligations.â€

The eight Millennium Development Goals (MDGs) cover a range of societal issues, all with a target date of 2015:

- Eradicate extreme poverty and hunger;
- Achieve universal primary education;
- Promote gender equality and empower women;
- Reduce child mortality;
- Improve maternal health;
- Combat HIV/AIDS, malaria and other diseases;
- Ensure environmental sustainability;
- Develop a global partnership for development.

The objective of the workshop was to review the science questions and research topics that need to be addressed in order to support progress towards the MDGs and towards meeting the grand challenges, prior and after the current target date for the MDGs, and to identify Earth observations needed to facilitate the research.

Scientists and researchers engaged in environmental research supporting the MDGs and addressing the grand challenges are key stakeholders of GEOSS. Aligning the strategy for the implementation of GEOSS to the needs of these stakeholders has a high priority for GEO.

The Workshop brought together a wide-range of representatives from the international science and research stakeholder organizations, funding agencies providing resources for sustainability research, intergovernmental agencies defining and maintaining frameworks relevant for global sustainability, and earth observation providers. The participants looked to provide the contributions and needs of the Science & Technology communities as input to GEO as it looks to shape the Global Earth Observation System of Systems in the period post-2015.

The output of the workshop includes the â€œBonn Statement,â€ which summarizes the research needs associated with the MDGs and grand challenges and details the strategy for a GEOSS that would ensure the availability of Earth observations required for addressing these research needs.

The implementation of GEOSS is governed by the GEOSS Strategic Targets and detailed in the GEO Work Plan. The workshop assessed the current implementation of the GEOSS with respect to the needs of global research and monitoring for sustainability, both in the period 2012-2015 and for GEO post-2015.

The various output documents from the Workshop are intended to provide valuable input to the post-2015 GEO discussions. The â€œBonn Statementâ€ summarize the recommendations agreed upon by the Workshop participants. The â€œBonn Action Planâ€ addresses those recommendations that can be implemented in the near term up to 2015. The current document details the recommendations that are relevant for the Post-2015 GEO discussion.

Recommendations for the Post-2015 GEO

The various discussions that took place during the Workshop provided input to the final Workshop session, "Preparing Input for the Post-2015 Working Group". This input was synthesized and used as the starting point to address the following questions:

A. Evolution or Revolution: Does the System of Systems Concept Work?

B. What issues have to be addressed?

C. Where and how does Science and Technology fit into GEO, post-2015?

These questions are considered in the next three sections. In each section, specific questions are derived that need to be addressed in the frame of the Post-2015 GEO discussion. Where possible, recommendations are made for the Post-2015 GEO.

A. Evolution or Revolution: Does the System of Systems Concept Work?

The answer to this question was a unanimous Yes. Hence GEO must ensure that the GEOSS can evolve, whilst also ensuring that the GEOSS retains the capability to embrace revolution!

How should the GEOSS evolve post-2015? Two alternative options were considered: (1) GEO should implement an effective â€œScience-Humanity interface,â€ i.e., and interface between earth-observation based science and the various decision makers in society; or (2) GEO should implement an effective Earth-observation-Science interface, that contributes an additional component to Science-Policy interfaces, ultimately forming a Earth Observation â€“ Science â€“ Policy interface.

For option (1), such an interface would include the capability to provide the data, information and knowledge needed by policy-makers, decision-makers in the public and private sectors, and citizens, so that they are able to make informed and independent decisions. The process of such an interface should seek to "**span data and knowledge**", truly "**democratising knowledge**" for the use of all humanity and providing "**actionable information**". Under option (1), GEO would cover the complete value chain from earth observations, the data processing, research to products of value for end users in all societal sectors.

For option (2), focus would be on an interface between Earth observation providers and science communities that can utilize the Earth observations to address societally relevant issues and utlimately realize the societal benefits of the Earth observations. GEO would focus on those science users who have the expertise to turn data into knowledge and knowledge into actionable information.

The provision of information and services for end users requires the necessary processing chain to be established starting from raw data, to processed data, to model output data, to information, and finally to services. In any given chain from observations to end users, not all steps need necessarily be present.

Question 1: How much of the processing chain from raw data to end applications and users should fall under GEO's remit?

What revolutions in Earth observations can be foreseen post-2015? The following major "revolution" should take place: GEO should ensure that **socio-economic data** can be discovered and accessed via the GEOSS. In other words, socio-economic data needs to be part of the chain from observations to end users, independent of the decision concerning Question 1.

In implementing this revolution, it will have to be decided whether GEO just seek to form partnerships with 3rd parties, who will be responsible for the actual collection and provision of the socio-economic data, or whether will GEO take responsibility for the collection, archiving, discovery and access to the socio-economic data.

Question 2: **Should GEO consider developing the concept of "Human Observatories" in parallel with "Earth Observatories" and if so what is required to support a "human observing system"?**

B. What issues have to be addressed?

The following issues were identified as important:

- Essential Indicators and Variables
- Data sharing
- Reorganization of SBAs
- Partnership of developing and devloped countries
- Capacity building
- The role of GEO

These issues are considered in the following one-by-one.

Essential Indicators: Essential indicators (EIs) of global sustainability are key for policy and decision making aimed at sustainable development. What are these EIs for which GEO should seek to ensure that the required data is available on a sustained, long-term basis? The indicators need to be defined by the global sustainability research community. In the context of sustainable development and the MDGs and SDGs, current economic indicators are recognized to be insufficient. For example, they fail to reflect the true status of ecological conditions. Environmental indicators are emerging (e.g., the Environmental Performance Index), but combined indicators are not well developed.

Should the S&T Community associated with GEO seek to develop new indicators, in particular in the context of a democratising of knowledge? Examples could be indicators that go beyond the GDP and measure aspects of human well-being (e.g., the Happy Planet Index, the World Peace Index).

A challenge is in the approach to EIs, which can start from the societal needs or from the observable quantities. The question is, what should comes first, the EIs or the Essential Variables (EVs)? Should we look to specify a broad range of measurable EVs, and then determine which EIs could be derived from these EVs? Or should we begin by defining the EIs characterizing sustainability and then deriving the EVs that would be required to obtain these indicators?

Starting with the EIs and deriving the EVs from them may mean that certain EVs are not actually measurable. This would immediately identify critical gaps that would need to be addressed by scientific and technological developments.

Question 3: Should GEO focus on the metric for sustainability and take a top-down approach to the development of sustainability indicators (Essential Indicators) as a guidance for the development of the GEOSS required to provide the data for these indicators?

Data sharing: GEO has an important role in strengthening and reinforcing data sharing, data interoperability, and data standards, which is crucial to enable the creation of the knowledge that is needed to support global sustainability. Those who fund the observing capacity and collection of data should ensure that the data is made freely and openly available without restrictions.

Recommendation: GEO should continue to have a strong focus on a framework that enables free data sharing and promotes data interoperability and the accessibility of information without the

need to actually access data.

Reorganization of SBAs: There is an urgent need for multi-disciplinarity, inter-disciplinarity, multi-sectoral research. Everything in the Earth system and human activities is inter-connected and inter-dependent. Global sustainability research is inherently cross-cutting. In the context of sustainability, there is a need for a global security framework, in which water, food and energy security are treated together and not separately. Ecosystem health and biodiversity are strongly linked, and they can not be separated from the food-water-energy nexus. The current SBA structure guiding GEO has a tendency to create silos and favors separate consideration of inhernetly intertwined topics. It also promotes duplication of efforts. It also can lead to specialized observation systems. For example, what are the consequences for GEO BON arising from the separation of the Biodiversity and Ecosystem SBAs and what would be the implications of a restructuring?

Question 4: Should GEO consider a regrouping of the SBAs to emphasize the interconnectivity of food, water, energy, human and ecosystem health, and biodiversity or replace the SBA structure by a theme and problem-oriented structuring?

Partnership of developing and devloped countries: Capacity Building: this is not just about providing access to data, it is also a question of developing real partnerships. GEO should therefore look to ensure that strong, lasting and effective partnerships are put in place between developed and developing countries, to ensure that all parties can make full use of GEOSS resources.

Recommendation: GEO should make a dedicated effort to establish sustained partnerships between developing and developed coountries with the goal utilize the societal benefits of GEOSS in both regions.

Capacity building: GEO should look to develop, implement, and mentor training and education across all EO domains and across all generations, from nursery school, through to University and beyond. Importantly, capacity building should comprise the capability to provide training for decision-makers in the use of EO data and information and how to use science knowledge in policy development and decision making. This capability is fundamental for evidence-based management. GEO is expected to help engaging national governmental institutions and funding organisations to ensure implementation.

Recommendation: GEO should strengthen its engagement in capacity building covering the collection and processes of EO as well as the use of science knowledge derived from EO in evidence-based management and policy-making.

The role of GEO: Very worryingly, many people still ask: "What is GEO's role"; "What is the added-value of GEOSS"? It is imperative that GEO clarifies its role and the added value of GEOSS. GEO must improve its outreach and communication capability. GEO must work more closely with other organisations and communities to ensure they are able to understand and realise the full benefits that the GEOSS can deliver.

Question: How can GEO better define its role and the added value of GEOSS, and what is needed to communicate this to the global governments, S&T communities, and the public?

C. Where and how does Science and Technology fit into GEO, post-2015?

The discussion of the relationship between GEO and the S&T communities, in particular those communities that are engaged in global sustainability research, identified the following topics:

- GEO's role in Post-2015 processes
- Mutual benefits
- GEOSS Strategic Targets
- S&T Community input for SBA reorganization
- Scientific expertise for GEO
- Emerging technologies
- Participation of commerical companies.

These topics are considered in the following one-by-one.

GEO's role in Post-2015 processes: There are a number of post-2015 processes underway, including those for the SDGs following the MDGs, and for GEO. It is vital that these processes are aligned. The global scientific and technological partnerships should be created, which recognise the competences of the different partners and which seeks to maximise the synergies and complementarities between them, whilst minimising overlaps and duplication. Importantly, in order to ensure sufficient alignment, would it be necessarey to have one partnership for this or can several partnerships achieve the same alignment? Should changes be foreseen to the GEO Membership and Governance structures to facilitate this partnership and the engagement of the parties concerned in GEO?

Question: What changes in GEO Membership and Governance structures are necessary to faciliate a partnership in the Post-2015 discussion that can ensure sufficient alignment between the various processes?

Mutual benefits: Data sharing and data interoperability are fundamental for the benefits of EO in S&T communities as well as the success of GEOSS. To facilitate the benefits, GEO should make its data management infrastructure available to international science programmes (e.g., Future Earth), and in return these programmes would register their data in GEOSS.

Recommendation: GEO and the international organizations engaged in the Future Earth Initiative should engaged in a dialog to work out how Future Earth could make use of GEOSS data management infrastructure and promote registration of data relevant to Future Earth in GEOSS.

GEOSS Strategic Targets: The GEOSS Strategic Targets determine to a large extent the design, functionality and services of GEOSS. Thus, the added value and benefits of GEOSS are inherently defined by these Targets. Therefor, efforts should be made to develop a sense of ownership amongst users of GEOSS for the GEOSS Strategic Targets. A strengthened role for the CoPs as an important component of the annual Work Plan process is considered of importance to achieve this goal.

Recommendation: GEO should recommit to the concept of CoPs as the main linkage to user communities of GEOSS and revisit its governance structure with the goal to ensure for the CoPs a strong role in the annual Work Plan process and an important voice in the progression of the GEOSS Strategic Targets.

S&T Community input for SBA reorganization: A reorganization of the SBAs and a potentially transition to a more theme-based structure needs careful consideration. GEO should work with S&T community within and outside of GEO to develop White Papers on the potential for clustering of SBA and Tasks (e.g., Blue Planet) to maximize synergy, address sustainability issues (e.g., food-water-energy nexus) and other cross-cutting issues such as socio-economics and human dimensions. The need for these White papers is addressed in an Action for the 2012-2015 period.

Recommendation: In the definition of a future guiding thematic structure for GEO, the findings of the White Papers should be taken into account.

Scientific expertise for GEO: There is a clear need for GEO to include a broader spectrum of expertise in the development of GEOSS. Independent of the decision to extent GEOSS to comprise a â€œHuman Observatory,â€ there is the need to including social scientists. The development of EIs will also require expertise in economy and the integration of economic data.

Recommendation: GEO should make an dedicated effort to integrate international social science organizations in GEO (e.g., as Participating Organizations), including the International Social Science Council.

Emerging Technologies: The technological revolutions happen at an increasing speed, and technologies providing global access to EOs and derived knowledge are constantly changing. â€œWhatever is decided todayis out-of-date by the time it is designed, tested and implemented! So the design of the GEOSS of the future must be very flexible and highly adaptiveâ€ (Edwards, 2012). In order to account for this rapid transition, GEO needs to have a dedicated focus on emerging technologies that can improve global access to Earth observations and derived knowledge.

Recommendation: GEO should promote the development of technologies providing global access to Earth observations and derived knowledge, and when proven, integrated these technologies into the GEOSS.

Participation of commerical companies: Commercial companies have an important role in utilizing the societal benefits of EOs, and they consitute a large user group of EOs, associated services and derived knowledge. They also operated infrastructure of value for the management, use and dissemination of EOs. In order to allow for a more active participation of commerical R&D companies in the development and operation of GEOSS, it will be important to consider how the GEO Membership and governance structures should be changed to accommodate the participation of the private sector in GEO.

Recommendation: GEO should review its memberhsip and governance to facilitate full participation of commercial R&D companies in developing the GEOSS and utilising the benefits of Earth observations.

Annex

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(Useful hyperlinks: Workshop website; Workshop Declaration; GEO Work Plan Implementation website; GEO website; Communities of Practice (CoP) websites; â€¦)

Appendix

A. Workshop Program

Tuesday, August 28, 2012

0800 - 1400:	*Registration*
1400 - 1545:	Opening Session (Conveners: *Michael Nyenhuis, Hans-Peter Plag*)
1400 - 1405	*Hans-Peter Plag*: Welcome (video)
1400 - 1410	*Michael Nyenhuis*: Welcome and Opening Remarks (video)
1410 - 1425	*Armin B. Cremers, Deputy Rector of the University of Bonn*: Welcome Note by University of Bonn (video)
1425 - 1435	*Paul Becker, Vice President DWD*: Welcome Note on Behalf of German GEO (video, pdf)
1435 - 1450	*Barbara Ryan, Director, GEO Secretariat*: Welcome Note on Behalf of GEO (video, ppt)
1450 - 1500	*Christiana Figueres, Executive Secretary, UNFCCC Secretariat*: Welcome Note on Behalf of UNFCC (video, avi)
1500 - 1545	*James P.M. Syvitski*: Keynote: *Observing the Anthropocene - The Geology of Humanity* (video, pptx, abstract, biography)
1545 - 1615:	*Coffee Break*
1615 - 1630	*Michael Nyenhuis, Hans-Peter Plag*: GEOSS Science and Stakeholder Network and Workshop Goals (video, ppt)
1630 - 1800:	P1: Science of the MDGs and Global Sustainability: Identifying Future Goals, Targets and Indicators (Conveners: *Anantha Duraiappah*, *Rick Lawford*)
1630-1640	*Anantha Duraiappah*: Science of the MDGs and Global Sustainability: Identifying Future Goals, Targets and Indicators (video, ppt)
1640-1650	*Rick Lawford*: Earth Observations and Sustainable Development Goals (video, pptx)
1650-1700	*Heidi Wittmer*: Science of the MDGs and Global Sustainability: Identifying Future Goals, Targets and Indicators (ppt)
1700-1710	*Wolfgang Cramer*: Observations, Sustainable Development and the Millennium Development Goals (pdf)
1710-1740	*All*: Discussion
1740-1800	*Conveners*: Key lessons learnt

Wednesday, August 29, 2012

0830 - 0900:	*Coffee*
0900 - 1045:	P2: Research for MDGs and future earth sustainability(Conveners: *Steven Wilson*, *Heide Hackmann*)
0900-0920	*Steven Wilson*: The Future Earth Initiative (pptx)
0920-0940	*Wolfgang Cramer*: Research on Biodiversity and Ecosystem Services (pdf)
0940-1000	*Sybil Seitzinger*: International integrated geosphere-biosphere research programs (pptx)
1000-1020	*Ghassem Arar*: International climate research programs (ppt)
1020-1040	*Juan-Carlos Villagran*: International disaster research programmes: from knowledge to resilience (ppt, abstract, biography)
1045 - 1115:	*Coffee Break*
1115 - 1300:	P3: Earth Observations in Support of Research for the MDGs and Global Sustainability (Introductiory slides; Conveners: *Ghassem Asrar*, *Carol B. Meyer*, *Sybil P. Seitzinger*)
1115-1135	*Peter Verburg*: Role of observing human-land cover interactions to monitor and model impacts on ecosystem service and human well-being (pptx, biography)
1135-1155	*Charles Huchinson*: Earth observation and information technologies for eradicating hunger (pptx, biography)
1155-1215	*Vivian Lutz*: Phytoplankton & Society: Applications of Satellite Ocean Color (ppt, biography)
1215-1300	*All*: Discussion
1300 - 1400:	*Lunch*

1400 - 1545:	P4: GEOSS Strategic Targets and Their Alignment to MDGs and Global Sustainability Research (Conveners: *Greg Withee*, *Douglas Cripe*)
1400-1420	*Greg Withee*: GEOSS Strategic Targets: Guiding principles and motivation (ppt)
1420-1440	*Alan Edwards*: Feedback on Use of the Strategic Targets by the Implementation Boards (pptx)
1440-1450	*Douglas Cripe*: Use of the Strategic Targets for Work Plan Development (ppt)
1450-1510	*Gary Foley*: The Use of the Targets by the Institutions & Development Implementation Board in Monitoring the Work Plan Implementation (pptx)
1510-1530	*Lars Ingolf Eide*: Monitoring GEO's success against the Strategic Targets and meeting the Targets with a bottom-up approach to the GEO Work Plan (pptx)
1530-1600	*Barbara Ryan*: Alignment of the GEOSS Strategic Targets to MGDs and global sustainability research needs (pptx)
1530-1545	*All*: Discussion
1545 - 1615:	*Coffee Break*
1615 - 1815:	P5: GEOSS' support for MDGs and Future Earth Research (Conveners: *Douglas Cripe*, *Georgios Sarantakos*)
1615-1635	*Kym Watson*: EO2HEAVEN contribution to Health (ppt)
1635-1655	*Peter Baumann*: The EarthServer initiative: towards Agile Big Data Services (ppt, abstract, biography)
1655-1715	*Mick Wilson*: GEOSS/UNEP-Live collaboration (ppt)
1715-1735	*Douglas Cripe*: GEOSS-IPCC recommendations (ppt)
1735-1755	*Steffen Fritz*: The role of Earth Observation in agriculture to support Food Security and the MDG (pptx)
1755-1815	*Anne Larigauderie*: GEO BON: Addressing the observation needs of the UN Strategic Plan for Biodiversity 2011-2020 (ppt)
1900 - 2100:	*Hosted Group Dinner*

Thursday, August 30, 2012

0830 - 0900:	*Coffee*
0900 - 1045:	(Plenary room) B1: Environmental Sustainability and Poverty (Convener: *James Syvitski*)
0900-0920	*Anantha Duraiappah*: Human Development programs (ppt)
0920-0940	*Alex de Sherbinin*: (ppt)
0940-1000	*Fabrice Renaud*: Ecosystems, their Services and Disaster Risk Reduction — Examples from Coastal Areas (ppt, abstract, biography)
1000-1045	*All*: Discussion
0900 - 1045:	(Seminar room VII)B2: Biodiversity (Conveners: *Anne Larigauderie*, *Rob Jongman*, *Gary Geller*)
0900-0920	*Anne Larigauderie*: Building a global observing system for biodiversity: the GEO BON Initiative (ppt)
0920-0940	*Rob Jongman*: Essential Biodiversity Variables: towards an agreement on a common approach for biodiversity (pptx)
0940-1000	*Wolfgang Cramer*: A blueprint for a global operational ecosystem services observation system, based on data and models.
1000-1045	*All*: Discussion.
1045 - 1115:	*Coffee Break*
1115 - 1300:	(Plenary room) B4: Food and Water Security (Conveners: *Gordon Young*, *Anik Bhaduri*)
1115-1130	*Gordon Young*: Overview of water security challenges (pptx, biography)
1130-1145	*Anik Bhaduri*: Overview of food security challenges (pptx, biography)
1145-1205	*Rick Lawford*: Water security (pptx, biography)
1205-1225	*Jens Liebe*: Food security (pptx, abstract, biography)
1225-1300	*All*: Discussion: How can the Earth science community help solving water and food security issues?
1115 - 1300:	(Seminar room VII) B5: Health (Conveners: *Gary Foley*, *Joerg Szarzinski*)
1115-1120	*Gary Foley, Joerg Szarzynski*: Introduction (ppt)
1115-1135	*Gary Foley*: GEO Health (pptx)
1135-1155	*Detlef Böcking*: Supporting Health Research Networks in Subsaharan Africa. An initiative of the German Ministry of Education and Research (BMBF) (ppt)
1155-1215	*Peter Heudtlass*: Mapping vulnerability - MDGs and Earth observation in disaster epidemiology (pptx)
1215-1235	*Rupert Gerzer*: Telemedicine for remote areas and in emergeny situations (potx)
1235-1300	*All*: Discussion: How can the Earth observation improve health services?
1115 - 1300:	(Seminar room IX) B6: Science-Policy-Interface (Conveners: *Peter Haugan*, *Kathleen Fontaine*, *Hans-Peter Plag*)
1115-1120	*Conveners*: Introduction: Challenges, Objectives, Goals
1120-1130	*Peter Haugan*: From observing system evidence to policy: Why the linear model of science does not work for complex issues like climate change (pptx)
1130-1150	*Ghassem Asrar*: Use of data in public services
1150-1205	*Imraan Saloojee*: Meeting Global Challenges through Better Governance: International co-operation in science, technology, and innovation (pptx)
1205-1220	*Paolo Mazzetti*: The Model Web approach: a push-pull component for the science-policy interface? (pptx)
1220-1250	*All*: Discussion of the core questions
1250-1300	*Conveners*: Session summary
1300 - 1400:	*Lunch*
1400 - 1545:	P6: Synthesis of the Breakout Sessions (Conveners: *Stuart Marsh*, *Hans-Peter Plag*)
1400-1410	*Michael Nyenhuis*: B1: Environmental sustainability and poverty (ppt)
1410-1420	*Rob Jongman*: B2: Biodiversity (pptx)
1420-1430	*Alisher Mirzabaev*: B4: Food and water security (ppt, biography)
1430-1440	*Gary Foley and Jörg Szarzinski*: B5: Health (ppt)
1440-1450	*Peter Haugan*: B6: Science-policy interface (pptx)
1450-1530	*All*: Discussion
1530-1545	*Stuart Marsh and Hans-Peter Plag*: Summary of conclusions, recommendations, and proposed actions (pptx)
1545 - 1615:	*Coffee Break*
1615 - 1800:	P7: The Way Forward (Conveners: *Barbara Ryan*, *Kathleen Fontaine*)
1615-1625	*Maria Uhle*: Belmont Forum International Opportunities Fund: Helping to Catalyze International Collaboration for Global Change Research for Sustainability (pptx)
1625-1640	*Hans-Peter Plag*: Draft "Bonn Statement" (doc)

1640-1750	*All*: Discussion of Bonn Statement in three breakout groups
1750-1800	*Stuart Marsh*: Report from Group 1 (doc)
1750-1800	*Douglas Cripe*: Report from Group 2 (doc)
1750-1800	*Greg Whithee*: Report from Group 3 (doc)

Friday, August 31, 2012

0830 - 0900:	*Coffee*
0900 - 1115:	P8: Towards an Action Plan (Conveners: *Paola Campus*, *Jay Pearlman*)
0900-0915	*Jay Pearlman*: Introduction (ppt, Draft Session Contents)
0915-0930	*Ellsworth LeDrew*: Polar Data: Moving on from IPY (pptx)
0930-1000	*Panel (Sybil Seitzinger, Ellsworth LeDrew, Alan Edwards, Roberto Azzolini)*: Discussion: Serving global sustainability research: Actions for GEO
1000-1115	*All*: Discussion: Utilizing the societal benefits of GEOSS: Actions for the GEOSS S&T Stakeholder network (ppt)
1115 - 1140:	*Coffee Break*
1140 - 1245:	P9: Preparing Input for the Post-2015 Working Group (Conveners: *Alan Edwards*, *Helmut Staudenrausch*)
1140-1150	*Helmut Staudenrausch*: Introduction to the Post-2015 GEO Process (ppt)
1250-1215	*Alan Edwards*: Draft input document for the Post-2015 GEO Working Group (pptx, draft document)
1215-1245	*All*: Discussion
1245 - 1300:	Final Remarks and Workshop Closing

B. Workshop Participants

	Participant		Organization
1	Ghassem	Asrar	World Climate Research Programme (WCRP)
2	Roberto	Azzolini	European Science Foundation, European Polar Board
3	Peter	Baumann	Jacobs University Bremen, Germany
4	Paul	Becker	Deutscher Wetterdienst (DWD), Germany
5	Michael	Berger	European Space Agency (ESA-ESRIN)
6	Anik	Bhaduri	Global Water System Project (GWSP)
7	Detlef	Böcking	German Aerospace Center (DLR), Germany
8	Georgio	Boni	CIMA Research Foundation, Italy
9	Henry	Bulley	Central Connecticut State University, USA
10	Bente Lilja	Bye	Bente Lilja Bye (BLB), Norway
11	Paola	Campus	European Science Foundation (ESF)
12	Victor	Castillo	United Nations Convention to Combat Desertification (UNCCD)
13	Raja Ram	Chhatkuli	Kathmandu University, Nepal
14	Wolfgang	Cramer	Institut Méditerranéen de Biodiversité et d'Ecologie marine et continentale (IMBE)
15	Armin	Cremers	University of Bonn, Germany
16	Douglas	Cripe	GEO Secretariat
17	Ian	Davidson	European Environment Agency (EEA)
18	Bart	de Lathouwer	Open Geospatial Consortium (OGC) â€“ EO2HEAVEN
19	Alex	de Sherbinin	The Earth Institute at Columbia University, USA
20	Carsten	Dettmann	Federal Ministry of Transport, Department of Aerospace, Germany
21	Anantha	Duraiappah	International Human Dimensions Programme on Global Environmental Change (IHDP)
22	Alan	Edwards	European Commission
23	Jana	Eichel	University of Bonn, Germany
24	Lars I.	Eide	Norwegian Space Centre, Norway
25	Christina	Figueres	United Nations Framework Convention on Climate Change (UNFCCC)
26	Gary	Foley	US Environmental Protection Agency, USA
27	Kathy	Fontaine	National Aeronautics and Space Administration (NASA), USA
28	Steffen	Fritz	International Institute for Applied Systems Analysis (IIASA), Austria
29	Rupert	Gerzer	German Aerospace Center (DLR), Germany
30	Stephanie	Göbel	University of Bonn, Germany
31	Heide	Hackmann	International Social Science Council (ISSC)
32	Peter	Haugan	Nansen Environmental and Remote Sensing Center (NERSC), Norway
33	Peter	HeudtlaÃŸ	Center for Research on the Epidemiology of Disasters (CRED), Belgium
34	Jörn	Hoffmann	German Aerospace Center (DLR), Germany
35	Gabriele	Hufschmidt	University of Bonn, Germany
36	Charles	Hutchinson	University of Arizona, USA
37	Robert	Jongman	Wageningen University & Research Center, The Netherlands
38	Shelley	Jules-Plag	Tiwah, Inc.
39	Doris	Klein	German Aerospace Center (DLR), Germany
40	Anne	Knauer	United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER)
41	Usa	Kullaprawithaya	Royal Thai Embassy, Belgium
42	Jürgen	Kusche	University of Bonn, Germany
43	Anne	Larigauderie	DIVERSITAS
44	Richard	Lawford	University of Manitoba, Canada

45	Ken	Lawrie	British Geological Survey, UK
46	Ellsworth	LeDrew	University of Waterloo, Canada
47	Rocio	Lichte	United Nations Framework Convention on Climate Change (UNFCCC) Secretariat
48	Jens	Liebe	UN-Water Decade Programme on Capacity Development (UNW-DPC)
49	Vivian	Lutz	National Institute for Fisheries Research and Development (INIDEP), Argentina
50	Stuart	Marsh	British Geological Survey, UK
51	Joan	Masó	Centre for Ecological Research and Forestry Applications (CREAF), Spain; GeoViQua
52	Desirée	Matheis	University of Bonn, Germany
53	Paolo	Mazzetti	National Research Council (CNR), Italy
54	Alisher	Mirzabaev	University of Bonn, Germany
55	Mustapha	Mokrane	International Council for Science (ICSU) - World Data System
56	Leisl J.	Neskakis	International Human Dimensions Programme on Global Environmental Change (IHDP)
57	Axel	Nothnagel	University of Bonn, Germany
58	Michael	Nyenhuis	University of Bonn, Germany
59	Elisabeth	Opie	Fraunhofer Society, Germany
60	Francoise	Pearlman	IEEE
61	Jay	Pearlman	IEEE
62	Hans-Peter	Plag	IEEE and University of Nevada, USA
63	Yubao	Qiu	GEO Secretariat
64	Fabrice	Renaud	United Nations University - Institute for Environment and Human Security (UNU-EHS)
65	Ente	Rood	Royal Tropical Institute, The Netherlands
66	Jessica	Rosenfeld	United Nations University - Institute for Environment and Human Security (UNU-EHS)
67	Barbara	Ryan	GEO Secretariat
68	Imraan	Saloojee	Department of Science & Technology, South Africa
69	Sybil P.	Seitzinger	International Geosphere-Biosphere Programme (IGBP)
70	Andrew	Skidmore	University of Twente, The Netherlands
71	Kay	Smith	British Geological Survey, UK
72	Helmut	Staudenrausch	German Aerospace Center (DLR), Germany
73	James	Syvitski	International Geosphere-Biosphere Programme (IGBP)
74	Jörg	Szarzynski	United Nations University - Institute for Environment and Human Security (UNU-EHS)
75	Athina	Trakas	Open Geospatial Consortium (OGC)
76	Peter H.	Verburg	University of Amsterdam, The Netherlands
77	Juan Carlos	Villagran de Leon	United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER)
78	Kym	Watson	Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (IOSB)
79	Steven	Wilson	International Council for Science (ICSU)
80	Mick	Wilson	United Nations Environment Programme (UNEP)
81	Gregory	Withee	U.S. Geological Survey (USGS) Emeritus
82	Gordon	Young	International Union of Geodesy and Geophysics (IUGG)/ International Association of Hydrological Sciences (IAHS)

C. Further reading

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