European Commission

6TH GEO EUROPEAN PROJECTS' WORKSHOP

ROME, 7 & 8 MAY 2012

Note: This report concentrates on the Keynote addresses and on the reports of the Splinter Session discussions. The individual contributions to the Splinter Sessions are not reported on in detail but all presentations are available with all meeting documents at:

http://www.Earthobservations.org/geo_me_201205_gepw6.shtml

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The Sixth GEO European Projects' Workshop, Rome 7&8 May 2012

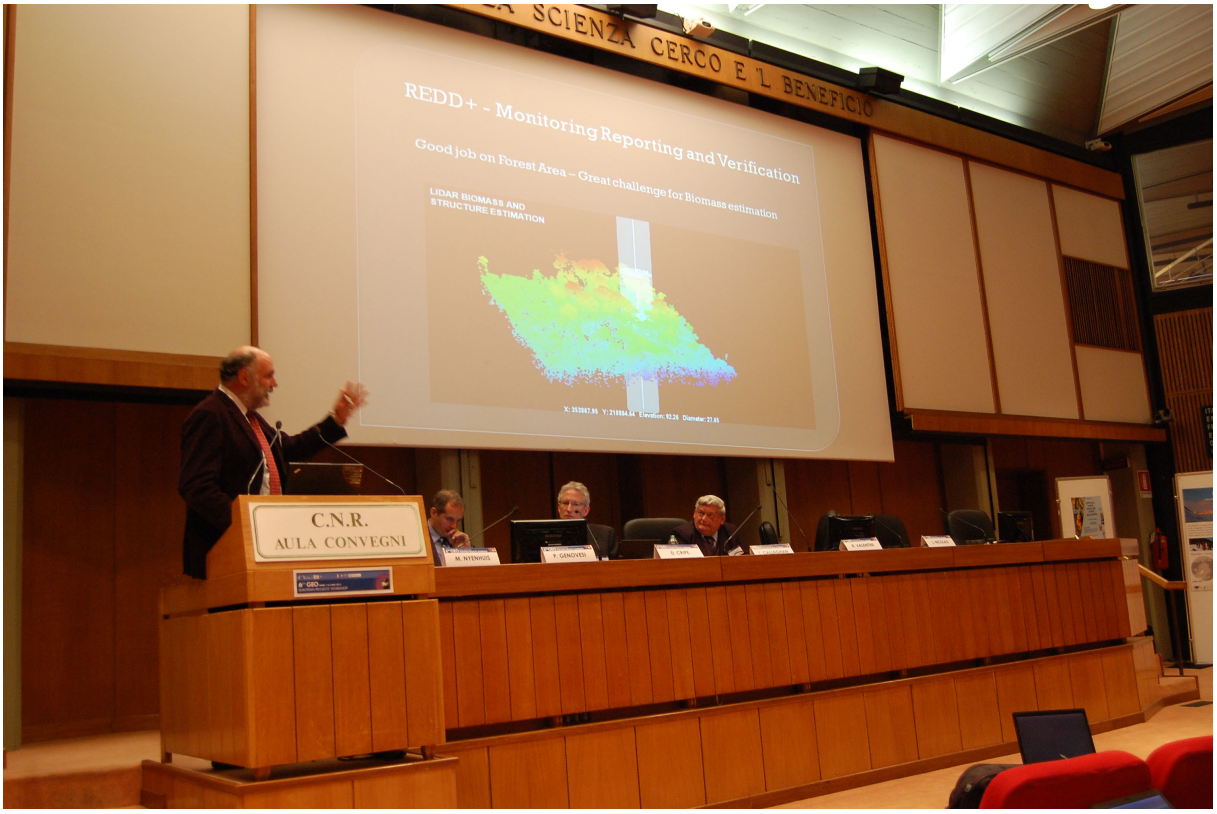
The sixth in the series of GEO European Projects' Workshops (GEPW6) took place on 7 and 8 May and was hosted in Rome by Italy's National Research Council (CNR). The event brought together some 170 participants, including many already actively involved in the European effort to construct GEOSS, but also many people who were hearing about GEO for the first time, such as young researchers from the Rome area.

Delegates were welcomed to Rome by the CNR President, Prof. Luigi Nicolais. The Workshop was opened by the President of the Italian Institute for Environmental Protection and Research, Prof. Bernardo De Bernardinis; the Italian GEO Principal and Italian Space Agency (ASI) Vice President, Prof. Ezio Bussoletti; Prof. Federico Cinquepalmi, Director, Office for the Promotion, Programming and Coordination of International Research from the Italian Ministry of Research and the European Commission's Director of Environment at the Directorate General for Research and Innovation, Dr Manuela Soares.

The principal theme of the workshop was assessing Europe's current and potential contribution to the 20012-2015 GEO Work Plan. Discussions also included consideration of the future of GEO beyond the current mandate, which runs until

2015. Rapporteurs noted the progress that has been made and the gaps that still exist.

The meeting was organised around a series of keynote addresses covering a selection of the GEO Societal Benefit Areas. These were followed by a number of individual splinter sessions with presentations by representatives of GEO-related projects and organisations. The keynote addresses concentrated mainly on the implementation of the GEO Work Plan over the next three years, how much progress has been made, and how Europe can best contribute over the current Work Plan's remaining three years. Most of the projects represented are receiving funding from the European Commission's Seventh Framework Programme for Research, either under the Environment theme or the Global Monitoring for Environment and Security (GMES) programme.



Introduction by Manuela Soares, Director of Environment at the Directorate General for Research and Innovation, European Commission

This sixth GEO European Projects Workshop is the latest in a series initiated by the European Commission in 2008 to foster European participation within the Group on Earth Observation (GEO).

These workshops help to increase coordination between existing or future Earth observation projects in Europe and the Global Earth Observation System of Systems (GEOSS). Following workshops held in Brussels in 2008, Stresa and Istanbul in 2009, Athens in 2010, and London last year, we were very pleased to have the opportunity to organise this meeting in Rome. Italy is a key partner in Europe on Earth observation having many renowned organisations involved in the Global Monitoring for Environment and Security initiative (GMES) and in FP7 Earth observation-related projects. Italy was closely associated with the launching of the GEO initiative in 2005 and has taken the lead on key GEO tasks such as the Global Mercury Observation System and, more recently, the GEOSS data-broker which is an important interoperability component of the GEO information system.

On behalf of the European Commission I would like to thank the Consiglio Nazionale delle Ricerche (CNR) for hosting this workshop, and the Instituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA) for their assistance.

Europe is one of the leaders of the GEO initiative together with the US, China, and South-Africa and this series of workshops aims at supporting this leadership. This workshop builds on the outcomes of the Eighth GEO Plenary meeting which took place in Istanbul last November. In my view, the Eighth GEO Plenary session has made the right decisions for GEOSS. Indeed, participants accepted the new 2012-2015 GEO Work Plan which will ensure the sound development of GEOSS until 2015. The Plenary has also established a Working Group to explore how GEO and the GEOSS should develop beyond 2015. The agenda for this workshop is a direct result of the decisions taken in Istanbul and, we will focus on two main agenda points:

The first main point is the implementation of the new GEO Work Plan over the next three years. We will address how Europe and the Framework Programme projects can best contribute to the tasks of this Work Plan in a number of societal challenges. These include oceans and society, climate, global land cover, biodiversity, health and disasters. This workshop is specifically focused on the contribution of FP7 projects

and GMES to the 2012-2015 GEO Work Plan without excluding other potential European initiatives. The conclusions drawn from the 2012 GEO Work Plan Symposium, held in Geneva from 30 April to 2 May, are an important input to be considered during this workshop. Indeed, this Symposium was an opportunity to bring together key contributions from the different GEO caucuses, countries, organisations and committees.

The second main agenda point for this workshop is the future of GEO and the GEOSS post-2015 and Europe's role in the process which was initiated by the GEO Ministers in 2010. The Ministers resolved to meet before the end of 2013 to review the recommendations and to take the necessary decisions for the future governance, role and work of GEO. We are considering the development of GEOSS beyond 2015, bearing in mind that the Seventh Framework Programme, which currently supports many European activities within GEO, will come to an end in 2013. It is therefore timely, particularly as we are shaping the future Framework for Research and Innovation in Europe for the period 2014-2020 - "Horizon 2020" -, to take advantage of this workshop and to discuss how GEO and GEOSS will fit into such a programme.

The Commission remains committed to supporting the implementation of a Global Earth Observation System of Systems. Horizon 2020 is structured around 3 priorities. One of which will focus on societal challenges and more specifically Climate action, resource efficiency and raw materials. Under this priority an explicit reference is made to developing comprehensive and sustained global environmental observation and information systems.

In addition, the Commission proposal goes on to state that: Union level actions will also support relevant international efforts and initiatives, including “inter alia” the Group on Earth Observations (GEO). As you know, the Commission proposal for Horizon 2020 is currently being reviewed by the European Parliament and the Council of the European Union. A decision could be taken in 2012-2013 with a view to launch Horizon 2020 in 2014.

Finally, I would like mention some of the activities we recently launched through the Research and Innovation Environment Programme which I am leading at the European Commission. These activities are part of the European Contribution to the GEO 2012-2015 Work Programme which concerns us at this Workshop. They also link to future activities under Horizon 2020.

We recently opened negotiations with five projects which will strengthen the in-situ component of GEOSS. These projects are based on the concept of Citizens' Observatories and will take advantage of the latent capability in everybody's mobile phone, tablet and laptop to monitor the environment.

The second example I would like to share with you concerns the Work Programme for our 2013 call for proposals, the last one under FP7. In this call, we have proposed topics which are high priority for GEOSS. In particular, we have introduced one topic dealing with the Environmental impact of cultivation which will support the GEO GLAM flagship initiative (the GEO Agriculture SBA). We have also introduced a topic on Global Water assessment which should help in developing the GEOSS activities in the GEO Water Societal Benefit Area. The lack of reliable data on water quantity, quality and usage has become a stumbling block for efforts to strengthen policies and enforce regulations. As 2013 will be the International Year of Water Cooperation for UNESCO, it is timely that GEOSS contributes to the delivery of the information necessary for Global Water management.

The Istanbul GEO Plenary meeting set the scene to ensure a smooth transition between the current GEO Implementation Plan and the activities necessary for maintaining and developing GEOSS beyond 2015. The Commission remains committed to supporting GEOSS in the future and we would like to continue to work with your organisations and governments to ensure that Europe benefits fully from its engagement with the GEOSS. Thanks to this series of workshops and to the participation of the European countries in the GEO European caucus we an excellent collaborative framework in Europe for GEO. This gives a high and unique visibility to the European actors in Earth Observation on the international scene.

Introduction by Prof. Bernardo De Bernardinis, President of ISPRA (Italian National Institute for Environmental Protection and Research)

First of all, I would like to thank the European Commission for choosing Italy for this important annual event and the CNR for hosting it. I must say, that I have been a “fan” of GEO since the very beginning, when I was the Chief of Operations in the Italian Civil Protection Department and my friend Ezio Bussoletti was trying to rally support from major Italian institutions to join the initial GEO group.

At the time I was very happy to join forces on account of what GEO can do for disaster prevention and management, notably to expand the use of satellite images and maps for managing the risk posed by fires, floods, earthquakes and other hazards. I'm very glad to see that the Italian Civil Protection will be here today to present its experience.

As ISPRA's President I am even happier to continue supporting GEO, on account of what GEO can do for the environment, sustainable growth and the green economy (water and natural resources; marine environment and maritime safety; urban development; biodiversity, agriculture and forestry; climate change; energy). The GEO's approach to organize its work based on societal benefits areas has proven very sensible throughout the years. In our times of economic crises, it is even more justifiable.

Combining data from different sources (space, in situ and aerial), analyzing and modeling them, can greatly improve their usefulness for decision making and also for private investments. GEO is making significant progress in bringing together many datasets and engaging scientific and technical experts to generate this added value. However, continuing progress will require more and more cooperation among data providers, modelers and users.

Ensuring that the information generated by and supplied through GEO (or through GMES) will satisfy the real needs and demands from users is not an easy task. It is a constantly evolving process, a learning-by-doing business that demands strong commitment from all sides (space companies, research organizations, public institutions with key responsibilities in delivering data and information).

Environment institutions, such as ISPRA, are often perceived as "users" of Earth Observation. Indeed we are. But we are also data producers through our own monitoring networks as well as data and information providers: to the Environment Ministries and through them to the EC for the EU Directives(e.g. WFD, MSFD), to the EEA, to Parliamentary Committees and to our citizens (e.g. the Annual Environmental Yearbook produced by ISPRA and several other thematic reports). We also process data through our assessments and evaluations.

It is our daily business to collect, assess and integrate data from all sources to turn it into "useful" information.

So, what can we do for GEO and what can GEO do for us? We have already provided to GEO our meta-data and will continue to do so. Together with our national partners we shall continue to provide contributions to the "Architecture Implementation Pilot Projects"; to work towards the implementation of the GEOSS Data Sharing Principles, particularly taking into account those being developed for GMES, which will be presented later this morning. We certainly support the principle of full, open and free of charge access, with the possibility to consider some marginal costs, when fully transparent and justified. We shall continue our partnerships in GEO and GMES projects, providing our expertise in facilitating data sharing at national and sub-national level (e.g. through the Italian Regional EPAs, which I have the honor to chair; through our work for the INSPIRE Directive; through our cooperation with EIONET of which ISPRA is the National FP). Our work with the EEA for the GMES Land Monitoring and in situ data and in the GMES User Forum is very useful to our contributions to GEO. We are also providing expertise for the current Monitoring and Evaluation of GEO's activities for biodiversity, agriculture and ecosystems. The results will certainly provide all of us with key insights on future work.

In turn, we expect GEO to continue to provide us with the stimulus to think global, beyond our national and European boundaries. We expect GEO to help us to improve the overall efficiency in collecting, managing, accessing and using earth observations in order to support the sustainable use of natural resources and better environmental accounting. In short, we expect GEO to help deliver more quality for less money, particularly for public Earth Observations Users.

Europe has provided a large amount of resources for the implementation of GEO, through FP7, through the very important experience from GMES pilot projects, through the contribution of national expertise and commitment. We can be proud that our European level activities are often pioneering at the global level (e.g. GMES Emergency Fast Track Service). But I'm sure that we can do more. For instance, we certainly need to be more cohesive and synergic and we need to establish some priorities. The strategic EU programs such as Horizon 2020 certainly provide us with key priorities, as well as the Joint Programming Initiatives being launched at the European level (e.g. the JPI on Agriculture, Food Security and Climate Change, the JPI on Water Challenges and the one on Urban Europe). In the meantime, workshops like this one offer us the opportunity for operational and practical work together, stemming from specific European projects and activities. Therefore, I would like to

thank again the EC, and particularly Manuela Soares, for the opportunity to hold this event in Rome.

Welcome address by Prof. Ezio Bussoletti, Italian GEO Principal

I have the pleasure to welcome you also on behalf of the Italian Minister of the Environment, Mr Corrado Clini. As the Director General for Research and Development in the Ministry of the Environment, he whole-heartedly supported the birth of GEO from the very beginning in 2003, fully aware of the opportunities for Europe and Italy to improve cooperation and coordination on Earth observation activities with strong positive effects on the management of the environment and a sustainable economy. Now, as a Minister in the present Government, he is even more convinced that the success of GEO is important and that the European GEO community must continue to improve its contribution to reaching the targets of the GEO 10 Year Implementation Plan which will end in 2015 and, at the same time, prepare the terrain for whatever GEO will be after 2015.

It is also a great pleasure for me, as the Italian "GEO Principal", appointed by the Ministry of the Environment, to welcome all of you, to this annual Workshop which the EC is organizing since 2007. It has indeed become a very useful opportunity to compare experiences among all those involved in GEO projects and related activities such as GMES. It is very important to recall here that GEO is, according to the desire of its founding fathers, including Italy, a so called "Voluntary Initiative". Based on the consensus of the European High Level Working Group, the EC is using European funding from the Research Budget to support many projects which are strategic to the implementation of GEO. Of course, these projects respond to the criteria and competition procedures of the EC call for proposals.

Being a voluntary initiative implies that the GEO's governance is much lighter than if it were based on fixed contributions from member countries. But, given the growing number of its membership since 2003 (it almost doubled) we must say that this flexibility has proven to be a success rather than a constraint. This is mostly the reason why the overall management of GEO may appear, particularly to newcomers (and sometimes actually really is) difficult to understand and with much room from improvement.

National GEO coordination also needs to be light and flexible and avoid useless red tape. The approach we have adopted in Italy is to encourage the maximum freedom

of initiative in proposing activities to implement the GEO Work Plan, provided that they can be supported by resources available through interested national Organizations or through EC programs. With the support of ISPRA, which provides the needed facilitation among national institutions, we have set up an open ended core group (ASI, CNR, INGV, Universities and of course ISPRA itself). We meet periodically and exchange views also electronically on the Work Plan and other key documents produced by GEO. Of course we also promote the participation of interested organizations in various GEO activities, meetings and in the Annual GEO Plenary where we also participate with a national stand. We are glad to see that this approach is working well, since I see here today many Italian colleagues, from those already involved in key GEO activities to those which may be interested on joining in the future.

Last but not least, I need also to mention the contribution that the Italian Space Program COSMO Sky Med composed of four polar all weather radar sensor satellites, represents an important contribution to GEOSS activities. Recent examples are the support provided to emergency response to earthquakes in several countries, ıncludıng Haiti, Tohoku-Okı ın Japan and Van ın Turkey. Thıs type of support ıs a major duty for us, ın partıcular for developıng countrıes, as a goal of our national Cooperation activity. Typical is the example of the Italian Space-base in Malinda, Kenya, where we collaborate with national local experts providing a fundamental support to servicing different satellites since 25 years while integrating this activity with high quality Capacity Building activities extended to other Afrıcan countrıes.

Italy also gives strong value to the results of the Monitoring and Evaluation Working Group of GEO. We have provided expert time to the Evaluation of the Architecture and Data Management component (thanks to the CNR) and to Evaluation of the Biodiversity, Agriculture and Ecosystem Component (thanks to ISPRA). Finally, I am sure that this Workshop will provide a lot of useful suggestions and recommendations on how Europe can continue to play a major role in advancing the objectives of GEO as it has always been in the past.

Implementing the GEO 2012-2015 Work Plan *(Alexia Massacand, GEO Work Plan Coordinator, GEO Secretariat)*

The cornerstones of the Work Plan include the GEOSS Common Infrastructure (GCI) and the GEOSS Data-Core. About 500 components have already registered with the GCI which is comprised of the GEO Portal, the clearing house and the user-requirement registry. These represent over 10 000 resource descriptions. The GEOSS data-CORE (Collection of Open Resources for Everyone) already contains some 120 datasets. Legal options for data exchange and liability issues have been explored. Integration of the Data Core into the GCI is underway.

Other developments have been the expansion of rapid and open access to disasters information with for example, the supersites websites created over the past year for Japan and Turkey and the opening of the ESA SAR archive.

There has been an expansion of GEONETCast and of the new dissemination of disaster imagery from the International Charter on space and major disasters. Further progress has been made in global records and human settlements mapping, Impact of environment on health, new systems and products to optimise energy exploitation, climate change detection, energy exploitation, Seasonal prediction research, carbon information and improved crop management.

Each Task of the 2012-2015 GEO Work Plan is being managed by a Task Team comprised of Leads and contributors, led by a Task Coordinator and supported by experts in the GEO secretariat. The Task Team is responsible for managing, executing and cross-coordination of Task Components. Details of the Tasks are included in Task sheets and include details such as expected achievements, milestones, issues and gaps, gap analysis etc. The Work Plan Management Structure is now supported by three Implementation Boards for Infrastructure, Institutions & Development and Information and Societal Benefits. The roles of the Boards are to monitor progress towards achieving the 2015 GEOSS Strategic Targets, coordinate across Tasks and to advice on task implementation.

Details are available on http://www.Earthobservations.org/geoss_imp.php

The GEO Work Plan Symposium had taken place from 30 April to 2 May. The outcomes included building synergies between the tasks, identifying cross-cutting issues, addressing issues and gaps, guidance and acceleration of the Work Plan

activities, assessment of progress towards the strategic targets and preparation for the 2013 update. The deadline for comments on the Technical Review is the 27 May. The documents and presentations from the Work Plan Symposium are available from: ftp://ftp.Earthobservations.org/201205_work_plan_symposium

GMES data and information policy *(Torsten Riedlinger, GMES Bureau, Directorate General for Enterprise and Industry, European Commission)*

Dr Riedlinger presented the Global Monitoring for Environment and Security (GMES) programme and outlined the objectives for a GMES data and information policy. GMES is an EU programme aimed at developing European information services based on satellite Earth Observation and in situ (non-space) data. GMES is implemented by the European Commission (EC) with the support from the European Space Agency (ESA) for the Space component and the European Environment Agency (EEA) for the in situ component. The objective of GMES is to monitor and forecast the state of the environment on land, sea and in the atmosphere, in support to climate change mitigation and adaptation strategies, for managing efficiently emergency situations and improving the security of every citizen.

The speaker gave a global overview of GMES funding which in the period up to 2013 would have amounted to an investment of €3,200 million. In the Post-2013 period, the annual costs counts up to around €834 million per year.

The value of GMES lies in the provision of information. Short-term benefits include the support of the implementation of current policies and legislation. In the medium term, benefits extend to the support of the definition and formulation of new policies and downstream services. Longer term benefits of GMES impact on the formulation and implementation of policies with a global reach. Dr Riedlinger pointed out that GMES is expected to deliver benefits worth at least four times the costs by 2030. GMES activities are now in a phase of transition from preparatory and research activities to an operational phase. The activity which is a flagship of the European Union's space policy is included in the Industrial Policy Initiative of Europe 2020.

The GMES Communication of 2011 launched the institutional debate related to the future of GMES and clarifies:

- funding: by proposing the setting up of a GMES fund to be made available by MS, taking account of contribution based on GNI
- governance: by proposing the outsourcing of management tasks
- data policy: where the overriding goal is to provide full and open access to GMES data and information

In moving towards a data and information policy for GMES services, consideration will have to be given to:

- What data and information is obtained?
- How it is transmitted, stored, processed and distributed?
- Which terms and conditions are granted to information recipients?
- What long term data and information availability arrangements are established?

The main dissemination mode for GMES will adhere as much as possible to the open data approach – i.e. full and open access for all uses on a worldwide basis, with transparency on data processing and sources but no warranty. In exceptional cases however (e.g. security related), dissemination will be restricted to authorised users on a temporary basis and with a possible ban on redistribution.

In the immediate future, legislation will be prepared on GMES Data and Information Policy including security criteria. Implementing measures will also be adopted.

It is essential to ensure continuity of GMES services and to have an operational programme adopted by the end of 2013. Discussions are currently on-going at the European Parliament and at the Council of Ministers.

More information on GMES: http://ec.europa.eu/gmes

The potential contribution of Earth observation to environmental policies. (*Josiane Masson, Directorate General Environment, European Commission).*

Flagship initiatives including the 'Digital Agenda', the 'Innovation Union' and 'Resource efficiency' will be reflected in the European Union's Seventh Environmental Action Programme. The Directorate General for Environment's own policy priorities also include the Current review of the Water Framework Directive ("Blueprint on water") and the 2013 Review and revision of the Air Quality Directive.

DG Environment would like to use Earth observation services to improve the evidence base behind environmental policies. Earth observation can help in this respect through a range of inputs including:

- The design and development of policy by providing better data on for example land-cover and land-use changes and trends.
- The implementation, effectiveness and compliance of Directives such as air quality, habitats, water and floods by member states can also be facilitated.
- Earth observation can provide data on the state of the environment as well as information to the public (and the authorities). The Nine Societal Benefit Areas of Geo address the four priority areas of the current (Sixth) Environmental Action Programme
- Climate change, Nature & Biodiversity, Environment & health and natural resources & waste as well as the seven thematic strategies).

Information needs at a global scale include the impact of European activities on the global environment and vice versa. International treaties and monitoring under conventions also rely on data especially for desertification, droughts, food-security policy, global biodiversity and deforestation.

The Commission's Directorate general for Environment itself is not currently using Earth observation products but supports a free and open data policy. Complementing space based technologies with in-situ monitoring is essential. There is a need for continuity and sustainability in long-term data series and change detection.

Keynote speech on the GEO 'Infrastructure' Tasks *(Max Craglia, Joint Research Centre of the European Commission)*

The main aims of the Infrastructure tasks are to improve GEO Common Infrastructure (GCI) performance and connectivity, to connect mature thematic systems to the GCI, and to support multi-disciplinary interoperability.

The GEO Work Plan Symposium and the Infrastructure Implementation Board meeting had taken place the previous week. It is clear that there are many thematic community initiatives, each with its own information system and portal. The GCI needs to perform better and be better connected to these initiatives in a true System of Systems logic. Brokering is needed because there are many communities each with their own standards and protocols. Brokering demonstrated the added value of making connections across disciplines and systems but has also shown the limitations of the current approach: many datasets are now discoverable but few easily accessible. The new priority must be access and use.

The GEOSS Data CORE is a unique feature of GEOSS. It should be a priority action to turn the many pledges from GEO members into accessible data. Turning the GEOSS Data CORE into the strategic asset of GEOSS to demonstrate its added value is also a high priority.

Improved governance in GEO had been introduced through Cross Implementation Boards coordination and synergy across the many tasks and components that contribute to achievement of strategic targets

The European contribution is crucial as it is a significant source of funding to develop GEOSS. Many projects are directly linked to developing the GCI and supporting the evolution of GEOSS post 2015. There is a need to adopt a “Project of Projects” approach to ensure synergy and optimize European contribution in addressing user requirements (e.g. the GEOWOW project).

The expectations from the Splinter Session were to reach a clearer view of European R&D Projects’ contributions to GEOSS Data CORE, develop a synergy plan to improve re-use of components and project outcomes to help meet the GEO Strategic Targets and to arrive at a shared view of key priorities on which we can demonstrate added value of GEOSS to policy, science, and society.

Splinter Session - Infrastructure *(Chair: Massimo Craglia, Joint Research Centre, European Commission, Rapporteur: Luigi Fusco, European Space Agency)*

Six presentations were made at the Splinter Session;

These were:

- *Lessons from the 2nd GEO Evaluation on Architecture and Data Management, (Paolo Mazzetti, CNR, IT)*
- GEOWOW: Towards an Evolved GEOSS Common Infrastructure" (Roberto Cossu, ESA)
- EUROGEOSS (Stefano Nativi, CNR, IT)
- GeoViQua. Trustworthy Earth observation data (Joan Maso, CREAF, ES)
- Report from the Kick-off meeting of AIP-5 (Athina Trakas, Open Geospatial Consortium, DE)

- "Tools, technologies and lessons learnt EC FP7 projects deploying GEOSS infrastructure" (Mike Grant, Plymouth Marine Lab., UK)

The objectives of the Splinter Session were to:

- Present the projects' engagement to bring the GEOSS forward
- Discuss European collaboration as needed to implement the relevant WP 2012-15 tasks
- Identify a shared view of key priorities on which we can demonstrate added value of GEOSS to policy, science, and society
- In technical terms referring to the future GCI infrastructure:
    - Identify a clearer view of European R&D Projects' contributions to the GEOSS Data CORE
    - And to come up with a synergy plan to improve re-use of components and project outcomes

The points raised included:

- Many issues identified in the Evaluation of Data Management being addressed (brokering, semantic, ranking, quality).
- Multiple ways to interact with GCI starting to be addressed. Need better articulation of user scenarios and needs.
- Scalability of data access and use an issues for BIG data emerging as important.
- Need to quantify effort and resources needed for large data volumes
- Need to work on linking vocabulary across disciplines
- Community-specific or Global data models? Standardization vs harmonisation
- Need to share not just data but also understanding of processes
- Cloud computing may provide solutions for large processing services, but we need more experience on use for scientific purposes

Following the discussion, the Splinter Session concluded that:

- We are making progress and European contribution proving crucial
- Need to strengthen synergies across projects. Support for some joint activities on selected areas in new calls?
- Big Data and processing needs becoming an issue. Need to involve private sector more to support processing needs?
- Data CORE contributions need strengthening

Keynote address: Oceans and Society – Blue Planet (*Christoph Waldman, University of Bremen/Marum, DE)*

Professor Waldman began with a briefing on the relevant Work Plan tasks and the European Projects currently contributing to them.

Europe would benefit from GEOSS implementation in the area of "Oceans and Society by ensuring a more effective exchange of knowledge and information across different disciplines. Learning from other discipline‘s best practices, developing optimal data products and services, integrating existing data infrastructures, and improving the assessment of the status of the ocean environment would be to Europe's advantage .

Requirements in terms of resources, collaboration and governance include the prioritization of services and adaptation of the GEO Common Infrastructure to the needs of geo-hazards, algal blooms, ocean forecasting and sustainable fisheries. Other needs include improving the linkage between weather and ocean data services and strengthening the engagement of GMES to give Europe a stronger voice in GEOSS and giving direction.

There is a need for demonstrating the importance and relevance of continuous ocean monitoring within GEOSS (GEOWOW). Architectural concepts such as the brokering service approach as in EGIDA should be used to build up demonstrators and operational services. Besides research institutions, other stakeholders, like companies and NGOs, have to get more strongly involved European legislation should support the idea of establishing independently operated environmental monitoring infrastructures alongside to on-going offshore activities.

Splinter Session on Oceans and Society – Blue Planet *(Chair: Christoph Waldman, University of Bremen/Marum, DE, Rapporteur: Steve Groom, Plymouth Marine Laboratory, UK*)

Six projects were presented:

–THOR – "Thermohaline overturning at risk?" Laurent Mortier (UPMC / ENSTA, FR)

–EMSO European Multidisciplinary Seafloor Observatory (Paolo Favali, INGV, IT)

–EAMNet- Europe-Africa Marine EO Network (Steve Groom, PML, UK)

–MyOcean – Building the GMES marine core service - EU contribution to GEOSS (Jun She, DMI, DK)

–OPEC Operational Ecology: Ecosystem forecast products to enhance marine GMES applications (Jun She, DMI, DK)

–GROOM : Towards a European Glider Infrastructure for the benefit of marine research and operational oceanography. Laurent Mortier (UPMC / ENSTA, FR)

The Rapporteur presented the conclusions of the Splinter Session:

The session identified current efforts as well as gaps and possible new projects in each of the four components ('Global Ocean Information Coordination and Access', 'Operational Systems for Monitoring of Marine and Coastal Ecosystems', 'A Global Operational Ocean Forecasting Network' and 'Applications of Earth observations and information to sustainable fishery and aquaculture management'. While there were many projects and programmes, a number of gaps and ideas for new projects were discussed. From the presentations made, it became clear that there was a heterogeneity of data type/variables available.

In the discussion on 'Global Ocean Information Coordination and Access', participants raised their concerns about the issue of continuity – how to maintain projects which have a limited lifetime. The possibility of a framework for Ocean Observing was raised.

Participants felt that infrastructure is facilitating user-uptake particularly in developing countries (relevant to all components).

On 'Operational Systems for Monitoring of Marine and Coastal Ecosystems', it was felt that the Sentinels would provide one answer to the need for high-resolution coastal monitoring. There was a need however for offshore exploration.

On the subject of 'A Global Operational Ocean Forecasting Network', the idea of linking ocean and meteorological forecasting was discussed as well as the need for capacity building and maintenance in developing countries. There was support for global ocean network coordination.

Report of the Splinter Session "Other Geo-related Projects" *(Chair: Raffaele Di Amicis, Foundation Graphitech, IT, Rapporteur: Tim Jacobs, Vito, BE)*

9 presentations were included in this Splinter Session:

- ENERGEO : Martijn Schaap (TNO, NL)

- ENDORSE: Energy DOwnstrReam Services – Providing energy components for GMES (Marion Schroedter-Homscheidt, Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), DE)

- i- Scope (geographical information and smart cities) (Raffaele Di Amicis, Foundation Graphitech, IT)

- Agriculture and forestry in Africa (Tim Jacobs, VITO, BE)

- Capacity building – Gap Analysis of Earth observation capacity in the Balkans (Petros Patias, Aristotle University of Thessaloniki, GR)

- GMES In-situ coordination (Mette Müller, EEA)

- GEO infrastructure and capacities in Central Asian Countries (Rukiye Ozcivelek, UZAY Tubitak, TR)

- 'GEO outreach to the wider Balkan region'. (Vesna Crnojevic-Bengin, University of Novi Sad, RS)

- GNSS for Global Environmental Earth Observation and GEOSS (Cristina Martin-Puig, Space Engineering - Starlab Consulting Division, ES)

As the projects in this Splinter Session were not on a single Topic or Societal Benefit Area, the rapporteur drew up specific conclusions covering scope, results, applications, impact and challenges for each one and these are available on the slides.

As conclusions common to all the presented projects, the rapporteur noted that important progress was made in the projects, in assessing (e.g. Balkan) and strengthening (e.g. Africa, Central Asia) capacities and partnerships.

Citizen involvement has been significant and also continues to gain in importance.

Furthermore, there were already significant contributions to GEO, whereby project partners have acted as (co-)leads in the tasks, and it is clear that European projects can further contribute to the 2012-2015 Work Plan (e.g. GEOGLAM).

The projects furthermore showed potential that is being or still needs to be further explored, in particular in terms of building synergies between and raising awareness at all levels (EU, regional, national and local).

At the same time, cost-effectiveness remains a clear concern and challenge, in particular for in-situ observation, and potentially also through R&D synergies between EO and GNSS.

Keynote speech on the contribution of European projects to health-related Tasks in GEO. (*Nicola Pirrone, CNR-Institute of Atmospheric pollution research, Rome, IT)*

The Health Societal Benefit Area encompasses the understanding of environmental factors affecting human health and well-being. Contributions are being made by the CNES, France as well as by EU funded projects such as EO2HEAVEN and EO-Miners. Minerals had been included in the latest GEO Work Plan (2012-2015) and were addressed by two Societal Benefit Areas – 'Energy and Geo-resources management' and 'Impact assessment of human activities'.

Both components of the second Health Task (HE-02) 'tracking pollutants' are being addressed. The first, 'Global Mercury Observation System' is being addressed by the EU-funded project of the same name (acronym GMOS), coordinated by Dr Pirrone. GMOS aims to develop an interoperable global system for monitoring mercury (and its compounds) in air, water and soil. This is being achieved through the harmonisation of standard operating procedures. The project is building on the contributions of the UNEP Mercury Programme and has established 40 ground-based observation systems in the northern and southern hemisphere as well as operating of an aircraft-based programme.

The emergence and accumulation of nano-particles in soil water and air is a source of organic pollution with unknown effects on the environment and on health. Awareness raising and monitoring are needed in order to detect accumulation and harmful effects.

Recommendations for the future include closer cooperation with the GEO Infrastructure tasks as well as 'Institutions and Development' (particularly data-sharing and catalysing resources). There is a need to develop more advanced sensors for pollution monitoring in order to make the process less labour-intensive. Development of a strategic plan for infrastructure management in the period post-2012 and the establishment of a more structured technical support infrastructure able to support policy making were needed.

Splinter sessions "Health" ***(Chair: Nicola Pirrone, CNR, IT, Rapporteur Kym Watson Fraunhofer IOSB, DE)***

Three presentations were made:

- Earth Observation and Environmental modelling for the mitigation of Health risks: Overview of the EO2HEAVEN contribution to GEOSS and the health thread in AIP-5 (José Lorenzo, Atos, ES)

- Impact assessment of human activities, the EO-MINERS showcase: EO contribution in monitoring environmental and societal impact of mining activities (Stephane Chevrel, BRGM REM, FR)

- Impact assessment of human activities, the ImpactMin showcase: EO contribution in monitoring environmental and societal impact of mining activities (Peter Gyuris, Geonardo, HU).

The Rapporteur summarised the open aspects of this Societal Benefit Area and the recommendations for further work which had emerged from the session:

- interoperability with existing systems
- access to data and services – especially health related
- fusion of Earth Observation and in-situ data (different spatio-temporal resolutions, validation), integrating space borne, airborne and subsurface data
- dialogue needed between industry, regulatory bodies and society; facing conflict with economic interests
- development of risk indices, impact indicators; proper communication to society
- extendibility to other contexts
- diverse requirements of decision makers and scientists
- mobile clients for field work where connectivity is low
    - data visualization, data upload, also of health data
- exploitation of crowd sourcing

- sustainability of results after project end

Keynote Speech on Global land Cover *(Alan Belward, Joint Research Centre European Commission)*

In its support of Rio+20 The European Commission is undertaking a number of actions:

- Establishing a partnership to increase energy access, energy security and promote renewable energy and energy efficiency – build on the EU Africa Energy Partnership
- Establishing surveillance and enforcement mechanisms
- Improving land quality and combatting desertification
- Support the Global Soil Partnership
- Implement global land use monitoring as part of GEOSS
- Reinforce links across MEAs

Since 1990, the JRC has been sampling over 4000 sites in South America, Africa and Asia, measuring the change in natural vegetation, forest management, carbon, biodiversity and cover change. Tools used have been interactive mapping, reference reports, data management and analysis and capacity building. High-resolution imaging and simulations are currently available which imply more accurate estimations of logged areas for example. Future areas for action include:

- the development of harmonised and transparent ways of measuring environmental impacts
- the development of indicators
- Analytical work to estimate economy-wide impacts and improve modelling ability in areas relevant to resource efficiency

In addition, new information for protected area management is needed. Datasets need to be interoperable and integrated. Web services need to be provided but to have shared input and output.

Splinter Session on Global land Cover *(Giacomo de'Liguori Carino, European Environment Agency)*

Two presentations were made:

- **Resolving uncertainty in global land cover (Steffen Fritz, IIASA, AT)**
- **'GEOLAND 2' (Alan Belward, JRC, EC)**

The Rapporteur summarised the points raised and the discussion as follows:

• Europe has a rich heritage of producing global land cover maps - but at low resolution and experience of generating hybrid datasets

• Europe offers enormous reserves of information/methods/tools and networks for validating HR land cover datasets but is not able to generate them today (GMES' platforms/services could contribute)

– Extensive experience of characterizing error/disagreement among existing global products

– Geographically focused networks (e.g. Arctic, Africa…), crowd sourcing and game-based tools, capacity to enlarge linguistic base of these (though they are English dominated today)

• Europe could potentially provide access to 'National" HR datasets not at EU level, but also with other countries

• Use of crowd sourcing for the provision of data via new tools (mob app., 2.0, etc.).

• Care must be exercised to demonstrate buy-in value for all partners (especially developing countries)

• Engaging the citizen both within Europe and rest of the world (particular focus on developing countries)

• Institutional responsibility/mechanisms need to be identified for integrating European validation input

• Many public policy areas can be served by better spatial and thematic information with improved accuracy and including land-use information - especially

(but not exclusively) multilateral environmental agreements and the Rio Conventions + World Bank

- The advantages of free, full and open access to data was demonstrated

  It increases of number of users, assures more of the archive is used (obtained at great public expense), promotes geographical spread of use (including facilitating access in developing countries), increases the number of applications and nature of application

- Sentinel-2 data offer huge potential (as do other European platforms, e.g. SPOT, DMC (RapidEye) to improve this

  These will be used for local, regional and global applications

- Land cover information is about trends, not just abrupt change

- Access to data: an open data policy must be accompanied by ease of access and use

– If data are easy to find, order, obtain and use then they will be used

- Keep all data– think pixels, not scenes… the handful of cloud free pixels at a particular location and particular time may be crucial to some user, time series are information-rich

Keynote speech on the use of Earth observation in disasters and civil protection in Italy (*Pierluigi Soddu, Italian Department of Civil Protection (DPC), IT)*

In the past, there had been some obstacles to the full employment of Earth observation tools in Civil Protection situations in Italy due to high cost, lack of awareness, inadequate spatial and temporal resolutions among others. Now however, the benefits of using Earth observation techniques have been recognised and are being used for continuous monitoring with advantage that the same level of detail is being obtained for the whole of Italy. The ready-to-use and geo-referenced data for GIS systems were one benefit along with the fast delivery of updated information. The availability of long periods of data (for historical analysis) is of great

benefit. Common procedures have been established for the use of Earth observation data.

The use of Earth observation in Italy was helping to improve emergency management for some well identified events such as floods, atmospheric and water pollution. Examples of the information obtained include the boundaries of flooded areas, the extent of land displacement due to subsidence or active faults, information on river networks, dams and reservoirs.

GMES had a role in civil protection in including the identification of priorities and requirements. The portfolio of the GMES Initial Operations is the result of requests from the users. A number of practical cases of ERS activation were described in detail by the speaker including the case of forest fires in Liguria and an oil spill in the Lambro River. Details of these cases are shown in the slides (available on the GEO website).

Keynote speech on natural disasters. ***(John Ludden, British Geological Survey, UK)***.

Natural disasters had caused €120 billion of damage in 2011 alone – the single costliest year in history. In the ten years from 2000, more than 2.2 billion people had been affected by natural disasters and 840,000 of these had been killed. The number of people at risk from floods is expected to rise to around 20% of the world's population by 2050.

The 2010 Eyjafjallajökull volcanic eruption in Iceland caused an unprecedented closure of UK, European and North Atlantic air space, at a cost of € 4 billion to the world economy.

Under current regulation, air pollution will be the top cause of environmentally related deaths worldwide by 2050. There are an estimated 420,000 premature deaths in China and India each year from exposure to particulate matter.

Rising temperatures, shifting rainfall patterns and increasing humidity affect the transmission of diseases. Vector-borne diseases currently kill approximately 1.1 million people per year, and diarrhoeal diseases 2.2 million.

Solar storms can damage satellites, the electricity grid and interfere with communications. A US National Research Council report estimates costs of $1-2

trillion in the first year after a large solar storm. The damage caused to satellites alone could be $30billion.

In order to enhance the understanding of the physical processes behind the hazard events, interdisciplinary analysis and projections as well as management tools for vulnerability and risk.

There is a need for more infrastructure and research capacity in order to underpin decisions and actions. An observatory of the surface and subsurface of the Earth that allows researchers access to instrument, log and monitor for a variety of purposes including geothermal energy, geo-hazards, mineral systems, environmental change, water resources and carbon dioxide storage was being proposed.

While GEO is mostly focussing on response, there was a need to consider all phases of a disaster. Risk assessment being crucial to identify areas of concern, multi-hazard risks must also be considered. Professor Ludden gave the example of volcanoes where of the 1500 worldwide, only 40 are being adequately monitored. He called for better connectivity between EC and national funding as well as closer links between research programmes, infrastructure and training as well as between infrastructure, agencies, institutes and industry.

Baseline, archived and new data need to be better integrated. Combined information should be available for all types of user. Significant effort needs to be put into ground-based observing system. The new EC-funded Supersites initiative is a good start to this.

The use of Earth observation data for disaster management must be increased, through the development of best practices for its integration in the full cycle of disaster management, including both risk reduction and disaster response. Better coordination, governance and leadership is needed. Lastly, the speaker called for Africa to become a European priority for capacity development in the area of disasters.

Splinter Session on Disasters *(Chair: John Ludden, British Geological Survey, UK, Rapporteur, Luca Demicheli, Eurogeosurveys)*

Nine projects were presented:

- Disasters: Supersites initiatives as a candidate test site where to effectively integrate in-situ and satellite Earth observations. (Massimo Cocco, INGV, EPOS Coordinator)

- A GMES Service of GEOHAZARDS (Ren Capes, Fugro NPA Ltd, UK)

- Building Appropriate Institutions to Support the Use of Earth Observations for Human Security". (Agnieszka Lukaszczyk, Secure World Foundation, BE)

- Mapping seismic damage with Very High Resolution COSMO/SkyMed data: an all-Italian contribution to geohazard components of GEO DI-01(Fabio Dell'Acqua, University of Pavia / EUCENTRE, IT)

- Early Warning System for Reduction of Marine Storm Impacts (Paolo Ciavola, University of Ferrara, IT)

- Mitigating the effects of future volcanic eruptions in Iceland (Freysteinn Sigmundsson, Institute of Earth Sciences, University of Iceland, IS)

- "NOVAC - a global network for volcano gas monitoring" *(Bo Galle, Chalmers University, SE)*

- VADASE - A new approach to real-time estimate coseismic displacements for near-field tsunami forecasting (*Matteo Crespi, Area di Geodesia e Geomatica - DICEA - Università di Roma "La Sapienza", IT*)

- BRISEIDE: Towards a time driven Pan-European geographical coverage. BRISEIDE project progress towards achieving its objectives and reaching its impact. *(Raffaele De Amicis, Foundation Graphitech, Trento, IT)*

The Rapporteur presented a summary of the identified existing synergies, contributions and inputs to the GEO Work Plan 2012-15 asking "How can the EU funded EO projects have a stronger impact in the 2012-15 Work Plan Tasks?" They were summarised as follows:

- Disasters or hazards? The issue of coordination is key

- GEO and/or the EC should ensure disasters/hazards are always high in the agenda and supported with adequate funding mechanisms, BUT:
- Public money cannot be wasted!
- A few priorities should always drive the selection criteria for funded or endorsed initiatives:
- Are official institutions supporting the initiative?
- Data access and data maintenance should be guaranteed
- This is not necessarily up to the EC nor to the operator => institutions? Then (more) coordination among implementing entities should be preferred.
- Favour large, international actions which involve worldwide strategies, increase the critical mass, exploit synergies and adopt interdisciplinary approaches (EPOS, OneGeology)
- Activities must be compliant or integrated with the major existing ones, such as OneGeology or the INSPIRE Directive
- Harmonisation of information and more coordination in data collection should be ensured, making users able to access information and data itself really useful
- Goal => Effectively integrate EO and in-situ data
- The actions should promote science and innovation
- Outreach and dissemination are key:
- Communication, communication, communication!

MOREOVER:

- Data quality => liability
- Avoid duplication of activities (UN-SPIDER and GEO: do they cooperate?) and need to link initiatives
- Need to invest more in developing world

- What about megacities?

Keynote address 'Water' ***(Michael Nyenhuis, Department of Geography, University of Bonn, DE).***

Water resources are under great pressure. As stressed by the 4th World Water Development Report (2012), suitable indicators are required to monitor the state and changes of the 'water world' These indicators are needed to address natural, socio-economic and political dimensions and to support various policy goals. A substantial amount of Earth observation information is required to derive indicators.

The GEO strategic target on Water aims to produce comprehensive sets of data and information products to support decision-making for efficient management of the world's water resources, based on coordinated, sustained observations of the water cycle on multiple scales. This would be achieved through:

- the development of an operational monitoring system for the global water cycle, combining space-based, airborne, and in-situ observation networks.
- The development of widely available, sustained water cycle data sets and related information products, at both global and basin scales, tailored to the near- and long-term needs of stakeholders and end-users

There are opportunities for Europe to contribute in each components of the GEO Work Plan. Many EC funded projects were already contributing. Opportunities exist for further contributions ranging from development of products and technology through observation and participation in various programmes such as the Water SBA conference, AfriGEOSS, the IWGCO Community of Practice etc. He pointed in particular to the African and Middle-East regions as potential priority areas.

Participants were referred to the final report of the EUGENE project (www.eugene-fp7.eu) which had examined European strengths, opportunities and gaps in three Societal Benefit Areas including Water.

Splinter Session Water *(Chair: Joost Van Bemmelen, Rapporteur Roberto Cossu, - both European Space Agency)*

Three projects were presented:

- ChloroGIN-Lakes end-to-end demonstrator (Steve Groom, Plymouth Marine Laboratory, UK) Objective: to analyse water quality indicators in particular chlorophyll from in-situ measurements in combination with satellite derived estimates

- GLOWASIS - A GMES Global Water Scarcity Information Service (Rogier Westerhoff, Deltares, NL) Objective: pre-validate a Global Water Scarcity Information Service by improving seasonal forecasting by satellite derived data (rainfall, soil moisture, snowcover,…)

- CEOP-AEGIS (Massimo Menenti, Technical University of Delft, NL and University of Strasbourg, FR) objective is to improve knowledge on hydrology and meteorology (in particular river flow) of the Tibetan Plateau and its role in climate, monsoon and extreme events by explaining the complexity of water scarcity forecasting – policy briefs

The projects were contributing to the GEO tasks as follows:

- GEO WA-01-C1 Integrated products: soil moisture, runoff, precipitation, snow cover, integrated data in-situ satellite
- GEO WA-01-C2 - 'Information Systems for Hydro-Meteorological Extremes (Incl. Floods and Droughts)'
- GEO WA-01-C4 – Global Water Quality Products and Services: improved EO derived water quality dataset, new algorithm for inland water
- GEO WA-01-C5 Capacity building in Asia

The projects are contributing by the generation of new products from the integration of Earth observations from different sources, providing open data, dedicated portals, data access and processing

The Rapporteur identified some priorities and requirements in the water SBA including:

- Increased availability of (basic) data to monitor fresh water worldwide
- Need for large area hydrological models
- Integration of water quantity and quality
- Support for developing portals: avoid an unnecessary high number of portals. Development of a few highly customizable portals for the needs of the different user-communities?
- Data harmonization
- Support in community building and establishing collaborations
- How to interact with GEO? In practice it is not so straightforward.

Keynote Address "BIODIVERSITY -interlinking global biodiversity information platforms: challenges and options for future work" *(Piero Genovesi, Italian Institute for Environmental Protection and Research (ISPRA), Rome, IT and Chair of the IUCN/SSC Invasive Species Specialist Group)*

There is evidence of recent decline in global biodiversity and a parallel rise in invasive species – both phenomena affecting all taxonomic groups and all environments: marine, freshwater and terrestrial. 33% of threatened birds and 11% of threatened amphibians have been impacted by invasive species while it is a key factor in 54% of known animal extinctions and the only factor in 20% of extinctions. Other effects are allergic and even fatal reactions to contact with these alien species. Some such as the naval shipworm (*Teredo navalis)* have caused millions of Euro of damage to infrastructure. The water hyancinth (*Eichhornia spp.)* causes losses for over €4 million per year by clogging waterways. Climate change could facilitate invasion of large areas of southern Europe.

In its strategic Plan 2012- 2020, The Convention on Biological Diversity has set a number of targets including: i) that by 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained and ii) that by 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or

eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

The G8 meeting in 2009, also pledged to develop actions to control and eradicate invasive alien species. Among the priority actions to implement are early warning and rapid response.

The European Commission is working on a European Directive on Invasive Alien Species. Target 5 of the EU biodiversity policy 2020 identical to the CBD Target on the control and eradication of Invasive Alien Species). There is a commitment to implement a dedicated European information system on IAS and a feasibility study for the development of a European Early Warning and Rapid Response framework is currently being carried out and the authors are attending a meeting of the CBD's 'Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) in June 2012.

There are ongoing efforts to increase interoperability between IUCN, WCMC, GBIF, and the knowledge products including the Red List, the Global Invasive Species Database, the World Database on Protected Areas (WDPA) and the Global Island Database. Some of these online tools demonstrated during the talk.

The aim of GEO is to understand, monitor and conserve biodiversity. One of the priority actions mentioned in the GEO Work Plan is "to Characterize, monitor and predict changes in the distribution of invasive species".

'Take-home' messages:

- That significant biodiversity information is available and great advances are needed in the technical tools that enhance interoperability
- This is crucial to work at a supranational scale
- Tailor outcomes to concrete policy (prioritisation of action, early warning rapid response,…)
- Add value for potential partners: visibility, increased political support, access to funding
- Seriously address data quality

- Seriously address problems in data classification, harmonisation, semantic, terminology

Keynote address on Arctic Ecosystems and Biodiversity and the need to monitor and understand rapid changes and their multiple consequences. (*Terry Callaghan of the Royal Swedish Academy of Sciences, The University of Sheffield (UK), Tomsk State University, (Russia) and Thule Institute, University of Oulu, (Finland)*

The objectives of the address were fourfold:

- To emphasise the urgency of understanding and monitoring changes in Arctic terrestrial ecosystems
- To introduce the complexity of abiotic and biotic drivers of these changes and their variable responses
- To suggest priorities for EU monitoring, research and capacity building initiatives
- To highlight multiple facilitation roles by INTERACT

The reasons for focusing on the Arctic and the urgency behind it were several. The drivers of ecosystem change such as climate change are profound. The six years from 2005-2010 were the warmest on record in the Arctic. Biodiversity has lost its resilience with only 2 large Arctic herbivores and 2 large carnivores now surviving compared to six of each some 10,000 years ago. In the Tundra, ponds are visibly disappearing while shrubs and trees are expanding – in some cases dramatically.

Mid-winter thaws and rain-on snow events kill animals and vegetation and cause cascading effects. There has been a 33% decline in wild reindeer populations since 1990.

Arctic regulatory ecosystem services are fundamental. Biospheric feedbacks have potentially global implications. The Arctic has cooled the Earth by reflecting heat from the sun and regulating greenhouse gases. It has redistributed the Earth's heat and regulates sea level.

There are many drivers of change and multiple responses to a particular driver. Major changes include treeline movement northwards and upwards and development of krummholz into trees. Varying responses can be seen within the same climate regime where the treeline can go up, down or remain stable. In order to explain this, the local view is necessary. The attribution of change is difficult and multiple approaches are needed including monitoring, experimentation and modelling. This necessitates the different communities coming together.

The INTERACT project (supported by the EC's Infrastructures Programme under FP7) is building capacity for monitoring and research throughout the Arctic. 33 partners in 19 countries have brought 44 research stations together. The project is undertaking strategic sampling of the wide environmental envelope of the North and providing services for the Artic and northern Alpine regions where observing capacity is low. Some of the partners' monitoring has been going on for up to one hundred years and includes ground validation of remote sensing, model testing, sampling and inventorying, real-time monitoring etc.

Major conclusions:

- Mitigation and adaptation to change demands the big picture view with local interpretation: all scales need to be linked better
- Monitoring can be retrospective as well as current. Old data archives can be vulnerable to loss
- Monitoring needs to be combined with manipulation and model forecasting
- Many aspects are covered independently: integration needs to be improved – a coalition?

Splinter Session "Biodiversity and Ecosystems" (Chair: Lorenzo Ciccarese (ISPRA, IT) Rapporteurs: Terry Callaghan Royal Swedish Academy of Sciences, University of Sheffield UK, Tomsk State University, RU and Thule Institute, University of Oulu, FI, Hannele Savela, Thule Institute, University of Oulu, FI and Robert Kenward, Anatrack Ltd, U.K.)

Talks:

- e-SOTER – Regional pilot platform as EU contribution to a Global Soil Observing System. (Hannes Reuter, ISRIC)

- The outcome of EBONE (Rob Jongman, Wageningen UR, NL)

- Scope for Biodiversity and Ecosystem forecasts by integrating Citizen Science (Robert Kenward, Anatrack Ltd, U.K. and Giacomo de'Liguori Carino, EEA)

- "BIO_SOS project: habitat mapping from VHR Earth Observation data."(Palma Blonda, CNR, ISSIA, IT)

- EU BON: Building the European Biodiversity Observation Network - as a component for GEO BON (Christoph L. Häuser, Museum für Naturkunde - Leibniz Insitute for Research on Evolution and Biodiversity, Berlin)

- MEDINA: indicators and tools for ongoing monitoring and assessment of marine ecosystems in North Africa. (Roberto Pastres, University of Venice, IT)

- Monitoring Biodiversity in MS.MONINA. (Markus Eisl, eoVision GmbH, DE)

- Biodiversity Virtual e-Laboratory (BioVeL) as user of Earth observation products. (Hannu Saarenmaa, Digitisation Centre of the Finnish Museum of Natural History and University of Eastern Finland, FI)

Rapporteur comments; Biodiversity & Ecosystems splinter session

The views presented are those of the rapporteurs, based on the presentations and discussions of the splinter session

Overall Task Coverage

Quite good on Biodiversity (BI) and Ecosystems (EC), of course, but also on Health (HE) Infrastructure (IN) and Development (ID), except building User-driven GEOSS and finding resources for it.

No mention of biotic causation/remediation of disasters (DI) water refreshment (or fresh water in general), agriculture (AG), urban biodiversity, in other words rather poor on Societal Benefit (SB) except Blue Planet and Impact Assessment.

Rapporteurs noticed:

Much progress but few recommendations for remaining challenges

Differentiation of new projects from old not clear: more coordination is needed

Too few presenters were thinking about societal benefits at individual stakeholder level, most were talking for scientists or policymakers as users.

Heavy dependence on indicators; we are beyond that to mechanisms now.

Action Points:

Resources and mechanisms are needed to link and coordinate projects before new projects are funded.

Resources and mechanisms are also needed for continuity of successful projects; on the other hand, projects with long-term funding easily become complacent at a time of rapid change.

Project impact sections need to stress communication with the public, not just policymakers and other researchers.

Biocomplexity cannot be broken down into indicators or simple variables.

Data quality issues are not all being resolved.

General agreement that data sharing and access needs to improve dramatically.

Still insufficient coverage on microbes, genetic diversity, parasites/pathogens.

The Keynote address on Weather, Climate and Global Forest Observations *(Riccardo Valentini, University of Tuscia, and the Euromediterranean Center for Climate Change)*

The relevance of several GEOSS Strategic Targets to Carbon & Forest was explained:

From the Target on Climate: The development and facilitation of a comprehensive (atmosphere, ocean, land) global carbon observation and analysis system in support of monitoring based decision-making and related environmental treaty obligations.

From the Target on Agriculture: Increased use of Earth observing capabilities and supporting applications systems to produce timely, objective, reliable, and transparent forest statistics and information at the national and regional level. Improved collaboration and coordination on the use and applications of Earth observations for forestry.

From the Target on Ecosystems: Increased operational monitoring of major ecosystems on land on an annual basis, including properties such as biomass and carbon estimates of vegetation and soils based on remote sensing and sampled in-situ observations using internationally agreed standards

The Carbon Tracker and of the probability of staying within 2°C as function of cumulative CO_2 emission until 2050 was demonstrated.

Natural land and ocean CO_2 sinks removed 56% of all CO_2 emitted from human activities during the period 1958-2010, each sink in roughly equal proportion. During this period, the size of the natural sinks has grown almost at the same pace as the growth in emissions, although year-to-year variability is large. There is the possibility, however, that the fraction of all emissions remaining in the atmosphere has a positive trend due to changes in emissions growth rate and decline in the efficiency of natural sinks.

The trend in the ocean sink is estimated by using an ensemble of 5 ocean-process models for 1959-2008. For 2009 and 2010, the sink is estimated from anomalies calculated with a sub-set of these models. The models were normalized to the observed mean land and ocean sinks for 1990-2000, estimated from a range of oceanic and atmospheric observations. Models were forced with meteorological data from the US national Centers for Environmental Prediction and atmospheric CO_2

concentration. The land sink is calculated as the residual of the sum of all sources minus atmosphere and ocean sinks.

The global carbon budget is comprised of:

- Atmospheric CO^2. The data is provided by the US National Oceanic and Atmospheric Administration Earth System Research Laboratory. Accumulation of atmospheric CO^2 is the most accurately measured quantity in the global carbon budget with an uncertainty of about 4%.

- Emissions from CO^2 fossil fuel. CO^2 emissions from fossil fuel and other industrial processes are calculated by the Carbon Dioxide Information Analysis Center of the US Oak Ridge National Laboratory. For the period 1958 to 2007 the calculations were based on United Nations Energy Statistics and cement data from the US Geological Survey, and for the years 2008 and 2009 the calculations were based on BP energy data. Uncertainty of the global fossil fuel CO^2 emissions estimate is about ±6% (currently ±0.5 PgC). Uncertainty of emissions from individual countries can be several-fold bigger.

- Emissions from land use change. CO^2 emissions from land use change are calculated by using a book-keeping method with the revised data on land use change from the Food and agriculture Organization of the United Nationals Global Forest Resource Assessment 2010. Uncertainty on this flux is the highest of all budget components.

- Ocean CO_2 sink. The global ocean sink is estimated using an ensemble of five process ocean models. Models are forced with meteorological data from the US national Centers for Environmental Prediction and atmospheric CO_2 concentration. Current uncertainty is around 0.5 PgC y-1.

- Land CO_2 sink. The terrestrial sink is estimated as the residual from the sum of all sources minus ocean and atmosphere sink. The sink can also be estimated using terrestrial biogeochemical models as in previous carbon budget updates. Current uncertainty 1 PgC.

(More information on data sources, uncertainty, and methods are available at:

http://www.tyndall.ac.uk/global-carbon-budget-2010)

The ICOS (Integrated Carbon Observation System) is a distributed network of stations with European coverage which will be operational in 2014. ICOS will provide wall-to-wall European and North Atlantic coverage. It will be able to quantify regional greenhouse gas fluxes (10km / daily). The same sensors will be deployed at all stations and there will be centralised and near real time data processing. Standards will be compatible with international systems including GEOSS, WMO and GTOS. ICOS will provide the backbone data for operational flux modelling.

In summary, Professor Valentini gave the following key messages:

- Improving global monitoring of forests is essential to understand the future climate and the additional burden on anthropogenic emission reduction
- Biomass monitoring (not only areas changes) are fundamental for addressing MRV in REDD+ mechanisms. Great challenge for research. Need more EU involvement (ESA Biomass mission)
- Expansion of climate related space and “in situ” observations to CH4 and N2O fluxes into the atmosphere. (Need more EU research “in situ” observations and networks)
- Inter annual variability of weather extremes are of paramount importance for addressing vulnerabilities of our societies. Role and importance of seasonal and decadal predictions (EU climate services)
- Integration of space and “in situ observations” across a range of spatial and temporal scale. Improve of Data Assimilation Systems. Improve role of systematic observations infrastructure with increasing complexity. (EU strengthening ESFRI initiatives)

Splinter Session Weather, Climate & Global Forest Observation *Chair: Riccardo Valentini, University of Tuscia and CMCC - Euro-Mediterranean Center for Climate Change , IT Rapporteur: Maria Dalla Costa, ISPRA, IT*

Talks:

- "Toward a coordinated global carbon observation and analysis system: The GEOCARBON project (Antonio Bombelli, CMCC - Euro-Mediterranean Center for Climate Change, IT)

- Water vapour estimation using different techniques for the South American region and their comparison (Gabriele Colosimo, Università di Roma "La Sapienza", IT)

- ECMWF's activities in atmospheric composition and climate monitoring (Manfred Kloeppel, ECMWF)

- 'ACTRIS' An Integrated Atmospheric Observing System (Gelsomina Pappalardo, CNR-IMAA, IT)

- "ReCover: Forest Monitoring services in support to REDD activities" (Donata Pedrazzani, Remote Sensing Applications and Services Division, GMV, ES)

Chair: Riccardo Valentini, University of Tuscia IT - Rapporteur: Maria Dalla Costa, ISPRA, IT

This report was provided by the Rapporteur:

The break out session benefitted from several excellent presentations, summarized below, also from experts currently outside the “GEO Box”, but willing to contribute to the implementation of the GEO 2012-2015 Work Plan.

- The GEOCARBON FP7 project, was presented by Antonio Bombelli from the Euro-Mediterranean Centre for Climate Change, Italy. The main objective of the project is to coordinate the contribution of European and international leading research institutes towards the development of an Operational Global Integrated Carbon Observation and Analysis System. The project will build upon past and existing European experiences, to improve the strategic approach and particularly to work towards a truly sustainable global infrastructure with a strong European contribution. It was stressed that it is absolutely necessary to move from a sum of assorted research projects to a

more comprehensive vision based on the needed streams of data. Of course, this must be accompanied by the knowledge of associated costs. In fact, the project will deliver an economic assessment of the value of an enhanced Global Carbon Observing System. The need to establish in Europe a GEO Carbon Office was also underlined.

- The work on Water Vapour estimation using different techniques for the entire South America region, carried out within the bilateral agreement between Italy and Argentina, was presented by Gabriele Colosimo, from the University of Rome "La Sapienza". The work could provide an important addition to the tasks of the GEO WP 2012-2015, by converging into existing networks such as GCOS. It was also underlined that GNSS can provide an important additional contribution to the global long term atmospheric water vapour retrieval.

- The MACC (Monitoring Atmospheric Composition & Climate) FP7 project was presented by Manfred Kloeppel. It constitutes the pre-operational GMES atmospheric monitoring and forecasting service and it just entered its second phase until July 2014. It is seen as an infrastructure for delivering high quality and open access data streams on atmospheric composition. There will be increased coordination of validation activities and increased efforts on estimation of emissions. The ERA-CLIM (Re-analysis of observational data)FP7 Project produces a complete, comprehensive and coherent record of recent climate for the benefits of most GEO SBAs. Both projects provide excellent European contributions to GEO

- The ACTRIS (Aerosol, Clouds, and Trace gases Research Infrastructure Network) FP7 Project was presented by Gelsomina Pappalardo, from CNR-IMAA. It is building a research infrastructure providing long-term high quality QA/QC and open free access to relevant atmospheric parameters (aerosol, cloud and trace gases). It can also contribute for atmospheric components to cross cutting tasks of the GEO WP 2012-2015: climate, weather, water, health and disasters

- The project ReCOVER on Forest Monitoring services in support to REDD activities was presented by Donata Pedrazzani, from GMV Spain, adding a private player perspective. The project is delivering, to well identified users, estimates of carbon biomass baselines. The crucial issues still open, true also

for other fields of activities, are ground references and continuity of SAR open data.

Key conclusions and recommendations:

- European observations systems and research infrastructures, based on a 20 year perspective, are evolving in line with GEO's strategic targets and will therefore provide a key GEOSS implementation pillar for the delivery of data streams relevant to GEO societal benefit areas.

- These infrastructures are already involving key stakeholders and are tackling issues such as c/b analysis and legal governance

- They could represent a concrete example of GEOSS implementation at European level, provided that GEO European Members will ensure their support for which a more complete picture is needed on the actual costs and benefits

- Better coordinated, streamlined, sustainable over time and stronger research and monitoring infrastructures are essential to enable Europe to be an even stronger player in building integrated global observing systems, in line with GEO's objectives up to 2015 and beyond.

- The research community fully acknowledges the plethora of existing research projects and initiatives, all generating different data streams, directly contributing to the GEO long-term targets.

- A recommendation was put forward to the GEO Secretariat to promote, with the support of interested organizations, a Blueprint of the essential data streams, with associated cost/benefits, taking into account the "Critical Earth Observation Priorities" already issued by GEO and the recent C/B Analysis for GMES

- The "newcomers" to the GEO Community in the splinter session were encouraged to connect with the GEO Secretariat and with the Task Leads and Contact Points of the relevant tasks of the GEO WP 2012-2015.

GEO Post-2015 *(Gilles Ollier, European Commission)*

At the GEO Ministerial meeting in Beijing in November 2010, it was resolved "to meet before the end of 2013 to review the progress of implementation against the GEOSS Strategic Targets and the recommendations for the governance, role and future work of GEO beyond 2015 and to take the necessary decisions"

The "GEO Post-2015 Working Group" was consequently established by the GEO-VIII Plenary meeting in Beijng in 2011.

Sixteen GEO Members and nine Participating Organizations have nominated individuals to participate in the Working Group and the group is co-chaired by the United States, South Africa and the European Commission.

The mandate of the group is:

- *to assess options and scenarios for the next phase of GEOSS*
- *consider the scope of activities, institutional arrangements, internal governance and resourcing of GEO.*
- *consider the findings of the Mid-Term Evaluation*
- *and to produce recommendations under the guidance of the Plenary that will be forwarded to the GEO-X Plenary and 2013 Ministerial Summit for decisions*

The Group has had its first meeting and several teleconferences in order to prepare a draft document which will be finalized by the Executive Committee of GEO (Excom) in July this year. It will then be distributed to other GEO bodies for comment before being sent for consideration by the next GEO Plenary (GEO IX will take place in November 2012).

So far a general consensus has emerged:

- Since 2005, GEO has established itself as a unique organization that has been generally effective, although there are important challenges that still need to be addressed
- GEO and GEOSS should both continue in the years after 2015;
- GEO should be non-juridical status

- WMO should continue to host GEO and support it administratively in the post-2015 period;
- There should be no radical changes to GEO's mandate;
- The central focus of GEO should remain interoperability, coordination, access, and facilitation;
- GEO should build on its successes, address its weaknesses, and make incremental improvements in the post-2015 period.

A number of issues have been identified for further discussion; in particular as concerns management and implementation. These include:

- What kind of management approach GEO should establish for the incubation, funding, and management of global initiatives such as GEOGLAM, GFOI, and GEO BON.
- Whether such initiatives should remain within GEO or, as they mature, be handed to other entities and operated without the oversight of the GEO Plenary;
- Whether GEO should consider changes in the Secretariat and its staffing, funding and responsibilities;
- Whether GEO should continue with the current system of multi-year Work Plans, or should it adopt another approach to guiding its activities,
- Whether GEO should establish a new set of Strategic Targets to guide its work over the next 10 years.

EGIDA's approach to a sustainable GEO *(Stefano Nativi, CNR, IT)*

The goal of EGIDA is to support the broader implementation and effectiveness of the GEO Science and Technology Roadmap and the mission of GEOSS through coherent and interoperable networking of national and international initiatives and European projects. EGIDA is promoting GEO in S&T communities and engaging them in developing the GEOSS. This so-called 'EGIDA approach' targets EU programmes as well as national initiatives in an effort to harmonise top-down and bottom-up approaches.

EGIDA is supporting the GEO Work Plan Tasks in 'Science and technology in GEOSS (ID03) by endeavouring to get GEO/GEOSS better acknowledged. A proposal has been made for a GEOSS citation standard and the project is beginning a test implementation in GEO Common Infrastructure. There is also a proposal for a GEO-label The GeoViQua project has undertaken a questionnaire which has now been completed. The identification of examples showing GEOSS at work has also been started and examples are being added to GEOSS Portfolio.

To support GEO's requirement for continuity and long-term monitoring, EGIDA is working on a methodology and process for the evaluation of the relevance of specific observation infrastructure to GEOSS, a report on GEOSS Component Continuity indicators and a process for communicating scientific priorities in Earth observation. Subsequent deliverables in this area will cover a continuity database and an availability test report as well as a Framework for the sustained operation of GEOSS.

In Support of GEO Task ID-05 ('Catalysing Resources for GEOSS implementation'), EGIDA aims to catalyse research and development resources and propose a framework concept for European funding agencies

Bottom-up tasks being undertaken by EGIDA include:

- an Analysis of National and European Initiatives and Projects/outreach to FP7 programmes
- the design of a (EGIDA) Methodology for capacity building and resource mobilization
- assess this S&T Methodology by implementing (four) Specific Use Cases in developing countries
- organization of and support to Community Workshops and meetings (networking)

The EGIDA methodology consists of a general approach for implementing a (re-)engineering process of the S&T national infrastructures and systems.

The transfer EGIDA S&T Methodology was illustrated by four specific use cases including "HOT SPOT POLLUTION IN THE MEDITERRANEAN", "MEDITERRANEAN REGION" (focus here is on partnership, infrastructures, products and services involving southern Mediterranean countries), "PAN-EUROPEAN AIR QUALITY FOR HEALTH" and "SLOVENIA" (methodology transfer in a small country use case).

EGIDA has established a range of networking initiatives including the worldwide EGIDA Stakeholder Network, a series of workshops, an open group on LINKEDIN, articles in the 'Earthzine' magazine as well as its own website through which its products are available.

New top-down products due to be prepared by June include a methodology and process for the evaluation of relevance of observation infrastructure, continuity indicators for GEOSS components and a process for communicating scientific priorities in Earth Observation. Several bottom up products are also in the pipeline. These include reports on the EGIDA transfer cases.

The GEONETCAB approach to Capacity Building *(Mark Noort , ITC, Twente University, NL)*

In order to realise the potential of Earth observations to involve (and empower) new groups of end-users in the Societal Benefit Areas, the weakest links in the chain from provider to user need to be addressed.

The GEONetCab project is facilitating capacity building and brokerage as part of a marketing effort to promote the use of Earth observation. The target groups of the project are decision makers, Earth observation professionals and community organizations. .

Capacity building is defined by GEONETCAB as 'learning and being capable of adding something new to a previously defined purpose' while brokerage is 'linking providers and (potential) users of a product or service'. Capacity development definitions can then evolve to broader, all-encompassing concepts including individuals, organisations, regions, countries. Other important concepts of Capacity Building include local ownership, empowerment, making implicit knowledge explicit, varying competence and knowledge levels and value chains for networks.

In considering Capacity Development, there are some important considerations including the "relative immaturity' of the addressable markets to the Earth observation solution" as well as the potential to market GEO through the marketing of Earth observation and the potential economic and societal benefits.

In the context of marketing of Earth observation products and services, GEONETCAB has carried out regional studies in central Europe (Poland and the Czech Republic) and in French-Speaking and Southern Africa to assess the current situation regarding capacity in Earth observation and to identify opportunities and bottlenecks. The regional studies have resulted in a synthesis document which includes a comparison and lessons learned in the participating countries. The most promising interventions focus on a combination of capacity building and promotion to remove bottlenecks and achieve quick-win solutions. Showing economic and social benefits is of cardinal importance to enable the adoption of Earth Observation solutions by new users and decision makers.

Marketing studies have been undertaken within GEONETCAB in order to assess the market potential for Earth observation products and services.

Instruments for Capacity Building developed by GEONETCAB are Marketing Toolkits, success stories, the capacity building web and a 'road show' visiting funding organisations and other potential clients. The Marketing toolkits describe international trends and developments in a GEO Societal Benefit Area and provide information on how to promote Earth observation applications. The toolkits also describe ways of obtaining funding and of capacity building. GEONETCAB "success stories" provide descriptions of successful applications or Earth observations in a language that potential clients understand. The Capacity Building web provides a guide to free and low-cost software, tutorials and references to training courses as well as general information and references to Earth observation applications and marketing toolkits.

GEONETCAB's Capacity Building Strategy has led to an analysis of capacity development in general and an outline of strategy and tactics that work for capacity building in Earth observation.

(More detailed information from:
http://www.itc.nl/library/papers_2012/general/noort_capacity.pdf)

Conclusions

The GEO European Projects' Workshop has shown how effectively Europe is already contributing to the tasks of the new GEO Work Plan (2012-2015), in particular through the implementation of FP7 projects supported under the Space (GMES) and the Environment themes.

The GEO Work Plan Tasks discussed at the workshop included the development of the GEO Information System and the tasks dealing with ocean monitoring and observation, health, global land cover, disasters, water resources, biodiversity and ecosystems, as well as weather, climate and global forest observation. The workshop demonstrated Europe's success in supporting these tasks with some 50 FP7-supported projects being represented through presentations and posters.

One of the most successful European activities is the development of a novel information system needed to access and share Earth Observation data at global level. This information system is specifically developed to deal with complex information. Several projects supported by the Seventh Framework Programme contribute to its design and implementation while cutting-edge technologies are provided by organisations such as CERN or data providers such as ESA. The workshop provided an opportunity to promote the use and development of this system amongst several communities including the European Earth observation data owners, and users from environmental service providers.

Progress was also seen in Europe's contribution to the implementation of the Global Biodiversity Observation Network (GEO BON) as well as in the Global Mercury Observation System (GMOS) in the health domain. Significant advances were also described in the areas of Land Cover and ocean observation in particular through the GMES projects GEOLAND2 and MyOCEAN.

The contributions to the GEO Work Plan presented at the workshop will continue and will be supplemented by a number of new FP7 projects. These include two "Supersite" projects in the domain of disasters which will start working later this year. The 2013 call for proposals in the Environment theme will cover the topics of Water (Assessment of Global Water Resources), and Agriculture (GEO GLAM project).

In the discussion on GEO post-2015, the participants remarked that the GEOSS was originally conceived as a tool to support decision-makers. It was emphasized by the participants to this session that this should continue to be the rational for GEO post-2015, (or 'GEO II'). Within this context, it remains necessary for GEO to continue, as far as possible, to coordinate Earth observation at the global level. A key focus for the GEOSS should remain on making high quality data and information products freely and openly available, in a form appropriate for informed decision-making. However, the provision of such information products through the GEOSS should not be seen as implying that the GEOSS becomes simply an operational service. The GEOSS should provide free, open and unrestricted access to EO data that can have value added to it as it passes through the entire information chain.

It was recommended that GEO should participate in the UN interagency forum, which it was felt would be beneficial for learning how UN agencies use space observations in their activities and what their needs are.

In addition, there was also a suggestion that dialogue is needed with the private sector, through which mutual interests could be explored. It was recommended that efforts be made to identify key European small and medium-sized enterprises (SMEs) already involved in FP7 projects and to build on these established connections. This would facilitate the use of new technologies and enable cheaper solutions for Earth observation to be explored. Engagement with the private sector would not only bring benefits to GEO but also enable the private sector to access GEO data and information. The launching of new FP7-supported projects dealing with the concept of 'Citizens' Observatories' which involve many Small and Medium-sized Enterprises will begin to address this need.

Another key issue that was identified was the existence of critical gaps and continuity issues with respect to observing systems. GEO would benefit from timely communication with space agencies to preclude such gaps. It was widely felt that the in-situ component of GEOSS should be given special attention. The idea of moving towards a "global observatory" was put forward. It was agreed however that this would require considerably more integration than the GEOSS.

The GEO workshop in Rome was also an opportunity for many Italian participants to attend a GEO meeting many for the first time. This has the effect of further promoting the GEO initiative in Italy and engaging more Italian participants in the European effort towards the GEOSS. It was announced that as a follow-up to the workshop there will be a coordination of the Italian research projects at the Institute for Environmental Protection and Research (ISPRA). Other European countries were encouraged to do likewise in order to maximize the benefits to the GEO network.

Finally, in view of the forthcoming RIO+20 Summit, the GEPW participants released the following declaration

GEO'S CONTRIBUTION TO THE OBJECTIVES OF RIO + 20

THE PARTICIPANTS IN THE 6TH GEO EUROPEAN PROJECTS' WORKSHOP WIDELY AGREED ON THE NEED TO CONTINUE THE JOINT EFFORTS AT THE NATIONAL, EUROPEAN AND GLOBAL LEVEL TO IMPROVE EARTH OBSERVATIONS AND INFORMATION, THROUGH MORE EFFECTIVE AND INTEGRATED MONITORING SYSTEMS AND INFRASTRUCURES, TO PROVIDE SUPPORT TO POLICY-MAKERS, AT ALL LEVELS, FOR IMPROVED DECISION MAKING.

THE GOOD RESULTS PROVIDED SO FAR BY THE GEO COMMUNITY AND THE EXAMPLES OF BENEFITS IN NINE KEY SOCIETAL BENEFIT AREAS (DISASTERS PREVENTION AND MANAGEMENT, HEALTH, ENERGY, CLIMATE, AGRICULTURE, ECOSYSTEMS, BIODIVERSITY, WATER AND WEATHER) PROVE THAT GEO CAN GIVE AN IMPORTANT CONTRIBUTION TO RESOURCE EFFICIENCY, SUSTAINABLE GROWTH AND THE GREEN ECONOMY.

THEREFORE, PARTICIPANTS IN THE WORKSHOPS HAVE AGREED TO ADVOCATE WITH THEIR NATIONAL DELEGATES RESPONSIBLE FOR THE NEGOTIATIONs WITHIN THE RIO+20 PROCESS, THAT THE FINAL SUMMIT DECLARATION SHOULD FULLY RECOGNIZE THE ADVANTAGES TO CONTINUE SUPPORTING THE GEOSS IMPLEMENTATION TO INCREASE THE BENEFITS FROM SPACE TECHNOLOGIES, IN SITU DATA AND GEOSPATIAL INFORMATION, AS AN IMPORTANT CONTRIBUTION TO A GREEN ECONOMY, FROM THE LOCAL TO THE GLOBAL LEVEL.

Annex I - Agenda

GEO EUROPEAN PROJECTS' WORKSHOP
Consiglio Nazionale delle Ricerche
(National Research Council of Italy), ROME 7 & 8 May 2012
Agenda

08:00 – 09:00 Registration

9.00 – 10.00 Opening session and introductory statements
Chair – Nicola Pirrone, CNR, IT

Welcome remarks by
- CNR President, Luigi Nicolais
- ISPRA President, Bernardo De Bernardinis
- Italian GEO Principal, Ezio Bussoletti
- European Commission, Manuela Soares

10.00 – 11.00 The GEO Work Plan 2012-2015 - Chair Gilles Ollier, DG Research and Innovation, EC

Implementing the GEO 2012-2015 Work Plan
Alexia Massacand, GEO Secretariat

Potential contribution of Earth Observation in support to the implementation of ENV European policies' Josiane Masson, DG Environment, EC

Infrastructure

- **The brokering approach to facilitate the GEOSS infrastructure implementation** Massimo Craglia, Joint Research Centre, *EC*
- **GMES Data Policy** Torsten Riedlinger, GMES Bureau, DG Enterprise and Industry, EC

Oceans and Society: Blue planet

Christoph Waldman, University of Bremen/Marum, DE

11.00 - 11.30: Coffee break and posters

11.30-13.00 Splinter Session on the above topics with individual presentations and discussions.

Splinter session "Infrastructure" *Chair: Max Craglia (JRC) Rapporteur: Luigi Fusco (ESA)*

Talks:

- Lessons from the 2nd GEO Evaluation on Architecture and Data Management, (P. Mazzeti, CNR, IT)

- "GEOWOW: Towards an Evolved GEOSS Common Infrastructure" (Joost Van Bemmelen, ESA)

- EUROGEOSS (Stefano Nativi, CNR, IT)

- GeoViQua. Trustworthy Earth observation data (*Joan Maso, CREAF, ES)*

- Report from the Kick-off meeting of AIP-5 (Athina Trakas, Open Geospatial Consortium, DE)

- "Tools, technologies and lessons learnt EC FP7 projects deploying GEOSS infrastructure" (Mike Grant, Plymouth Marine Laboratory, UK)

Splinter session "Oceans and Society" *Chair: Christoph Waldman (U. Bremen/Marum, DE) Rapporteur: Steve Groom (Plymouth Marine Laboratory)*

Talks:

- THOR – "Thermohaline overturning at risk?" Laurent Mortier (UPMC / ENSTA, FR)

- EMSO European Multidisciplinary Seafloor Observatory (Paolo Favali, INGV, IT)

- EAMNet- Europe-Africa Marine EO Network (Steve Groom, Plymouth Marine Laboratory, UK)

- "MyOcean" - an EU contribution to GEOSS (Jun She, Danish Meteorological Institute, DK)

- 'OPEC' Operational Ecology: Ecosystem forecast products to enhance marine GMES applications (Jun She, Danish Meteorological Institute, DK)

-GROOM : Towards a European Glider Infrastructure for the benefit of marine research and operational oceanography. Laurent Mortier (UPMC / ENSTA, FR)

Splinter Session on other GEO-related projects
Chair: Raffaele De Amicis, Foundation Graphitech, Trento. Rapporteur: Tim Jacobs(VITO)

Talks:

- ENERGEO : Martijn Schaap (TNO, NL)

- ENDORSE: Energy DOwnstrReam Services – Providing energy components for GMES *(Marion Schroedter-Homscheidt, Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), DE)*

- i- Scope (geographical information and smart cities)
(Raffaele Di Amicis, Foundation Graphitech, IT)

- Agriculture and forestry in Africa (Tim Jacobs, VITO, BE)

- Capacity building – Gap Analysis of Earth observation capacity in the Balkans (Petros Patias, Aristotle University of Thessaloniki, GR)

- GMES In-situ coordination (Mette Müller, EEA)

- GEO infrastructure and capacities in Central Asian Countries (Rukiye Ozcivelek, UZAY Tubitak, TR)

- 'GEO outreach to the wider Balkan region'. (Vesna Crnojevic-Bengin, University of Novi Sad, RS)

- GNSS for Global Environmental Earth Observation and GEOSS (Cristina Martin-Puig, Space Engineering - Starlab Consulting Division, ES)

13.00 – 14.30 Lunch and posters

14.30 – 15.30 Keynote addresses **Chair:** Maria Dalla Costa, ISPRA, IT

- **Health -** Nicola Pirrone, CNR, IT

- **Global Land Cover -** Alan Belward, JRC

- **Disasters** (two talks)
  - Luca ROSSI, Italian Civil Protection Department, IT
  - John Ludden, British Geological Survey, UK

15.30-16.00 Coffee break and posters

16.00 – 17.30 Splinter sessions with individual presentations and discussions

- **Health (including Impact Assessment of Human Activities) -** *Chair: Nicola Pirrone, CNR. Rapporteur: Kym Watson Fraunhofer IOSB, DE*

Talks:

- Earth Observation and Environmental modelling for the mitigation of Health risks: Overview of the EO2HEAVEN contribution to GEOSS and the health thread in AIP-5 *(José Lorenzo Atos, ES)*

- Impact assessment of human activities, the EO-MINERS showcase : EO contribution in monitoring environmental and societal impact of mining activities (Stephane Chevrel, BRGM REM, FR)

- Impact assessment of human activities, the ImpactMin showcase : EO contribution in monitoring environmental and societal impact of mining activities (Peter Gyuris, Geonardo, Hu)

- **Global Land Cover** *- Alan Belward, Joint Research Centre, EC, Rapporteur: Giacomo de'Liguori Carino, EEA*

Talks:
Resolving uncertainty in global land cover (*Steffen Fritz, IIASA, AT*)

'GEOLAND 2' (Alan Belward, JRC, EC)

- **Disasters** *Chair: John Ludden, British Geological Survey, Rapporteur: Luca Demicheli (EuroGeoSurveys)*

Talks:

- Disasters: Supersites initiatives as a candidate test site where to effectively integrate in-situ and satellite Earth observations. (Massimo Cocco, INGV, EPOS Coordinator)

- A GMES Service of GEOHAZARDS (Ren Capes, Fugro NPA Ltd, UK)

- Building Appropriate Institutions to Support the Use of Earth Observations for Human Security". (Agnieszka Lukaszczyk, Secure World Foundation, BE)

- Mapping seismic damage with Very High Resolution COSMO/SkyMed data: an all-Italian contribution to geohazard components of GEO DI-01(Fabio Dell'Acqua, University of Pavia / EUCENTRE, IT)

- Early Warning System for Reduction of Marine Storm Impacts (Paolo Ciavola, University of Ferrara, IT)

- Mitigating the effects of future volcanic eruptions in Iceland (Freysteinn Sigmundsson, Institute of Earth Sciences, University of Iceland, IS)

- "NOVAC – a global network for volcano gas monitoring" *(Bo Galle, Chalmers University, SE)*

- VADASE – A new approach to real-time estimate coseismic displacements for near-field tsunami forecasting (*Matteo Crespi, Area di Geodesia e Geomatica – DICEA – Università di Roma "La Sapienza", IT*)

BRISEIDE: Towards a time driven Pan-European geographical coverage.
Subtitle: BRISEIDE project progress towards achieving its objectives and reaching its impact. *(Raffaele De Amicis, Foundation Graphitech, Trento, IT)*

DAY TWO

09.00 Keynote addresses **Chair: Douglas Cripe, GEO Secretariat**

- **Water** Michael Nyenhuis, University of Bonn
- **Biodiversity & ecosystems** (two talks)

  Piero Genovesi ISPRA, Italian National Institute for Environmental Protection and Research

  Terry Callaghan Royal Swedish Academy of Sciences, University of Sheffield
- **Weather, Climate & Global Forest Observation**

  Riccardo Valentini, University of Tuscia and CMCC - Euro-Mediterranean Center for Climate Change "Carbon, forest and climate change"

10.00-11.00 coffee break and posters

11.00 – 12.30 Splinter sessions with individual presentations and discussions

- **Water** *Chair: Joost Van Bemmelen, ESA Rapporteur: Roberto Cossu (ESA)*

Talks:

- ChloroGIN-Lakes end-to-end demonstrator (Steve Groom, Plymouth Marine Laboratory, UK)

- GLOWASIS – A GMES Global Water Scarcity Information Service (Rogier Westerhoff, Deltares, NL)
- CEOP-AEGIS (Massimo Menenti, Technical University of Delft, NL)

- **Biodiversity & Ecosystems** *Chair: Lorenzo Ciccarese (ISPRA, IT) Rapporteur: Terry Callaghan Royal Swedish Academy of Sciences, University of Sheffield UK/SE*

Talks:

- e-SOTER – Regional pilot platform as EU contribution to a Global Soil Observing System. (Hannes Reuter, ISRIC)

- The outcome of EBONE (Rob Jongman, Wageningen UR, NL)

- Scope for Biodiversity and Ecosystem forecasts by integrating Citizen Science (Robert Kenward, Anatrack Ltd, U.K. and Giacomo de'Liguori Carino, EEA)

- "BIO_SOS project: habitat mapping from VHR Earth Observation data."(Palma Blonda, CNR, ISSIA, IT)

- EU BON: Building the European Biodiversity Observation Network - as a component for GEO BON (Christoph L. Häuser, Museum für Naturkunde - Leibniz Insitute for Research on Evolution and Biodiversity, Berlin)

- MEDINA: indicators and tools for ongoing monitoring and assessment of marine ecosystems in North Africa. (Roberto Pastres, University of Venice, IT)

- Monitoring Biodiversity in MS.MONINA. (Markus Eisl, eoVision GmbH, DE)

- Biodiversity Virtual e-Laboratory (BioVeL) as user of earth observation products. (Hannu Saarenmaa, Digitisation Centre of the Finnish Museum of Natural History and University of Eastern Finland, FI)

- **Weather, Climate & Global Forest Observation** *Chair: Riccardo Valentini, University of Tuscia and CMCC – Euro-Mediterranean Center for Climate Change , IT Rapporteur: Maria Dalla Costa, ISPRA, IT*

Talks:

- "Toward a coordinated global carbon observation and analysis system: The GEOCARBON project (Antonio Bombelli, CMCC - Euro-Mediterranean Center for Climate Change, IT)

- Water vapor estimation using different techniques for the South American region and their comparison (Gabriele Colosimo, Università di Roma "La Sapienza", IT)

- ECMWF's activities in atmospheric composition and climate monitoring *(Manfred Kloeppel, ECMWF)*

- 'ACTRIS' An Integrated Atmospheric Observing System (Gelsomina *Pappalardo, CNR-IMAA, IT)*

"ReCover: Forest Monitoring services in support to REDD activities" (Donata Pedrazzani, Remote Sensing Applications and Services Division, GMV, ES)

12.30 -14.00 Lunch and posters

14.00 – 16.00: GEO post-2015

Co Chaired by Italy and the E.C.

- Update on the preparation of GEO post-2015

Gilles Ollier, EC, Alexia Massacand, GEO Secretariat , Douglas Cripe, GEO Secretariat

- EGIDA's approach to a sustainable GEO - Stefano Nativi, CNR, IT

- The GEONETCAB approach to Capacity Building - Mark Noort , ITC, Twente University, NL

16.00 Coffee break

- Brief Reports from Splinter Sessions (Rapporteurs)

- Concluding Remarks by the co-chairs

ANNEX II List of Participants GEPW6

LASTNAME	First name	ORGANISATION	COUNTRY
ALKEMADE	Frans	SRON	NETHERLANDS (THE)
ANTIC	Boris	University of Novi Sad	SERBIA
ANTONIOU	Natassa	Secure World Foundation	BELGIUM
AZPILICUETA	Francisco	Facultad de Ciencias Astronomicas Universidad Nacional de La Plata, Argentina	ITALY
BELWARD	Alan	Joint Research Centre, European commission	
BERANZOLI	Laura	EMSO Preparatory Phase Coordination team	ITALY
BÉROUD	Florence	REA	BELGIUM
BIBERACHER	Markus	Research Studios Austria	AUSTRIA
BIGAGLI	Lorenzo	CNR	
BLANC	Isabelle	MINES ParisTech	FRANCE
BLONDA	Palma	CNR-ISSIA	ITALY
BOMBELLI	Antonio	CMCC - Euro-Mediterranean Center for Climate Change	ITALY
BONI	Giorgio	CIMA Research Foundation	ITALY
BRATINA	Vojko	European Commission	
BRUGNOLI	Enrico	CNR-DIP AMBIENTE	ITALY
BRUNET	Borislav	Provincial Secretariat for Agriculture, Water Economy and Forestry, Exectuive Council of the Autonomous Province of Vojvodina	SERBIA
BRUSTIA	Elisa	ISPRA	ITALY
BRUZZI	Stefano	ASI	FRANCE
BUSSOLETTI	Ezio	Agenzia Spaziale Italiana	ITALY
BYE	Bente Lilja	BLB	NORWAY
CALKOEN	Charles	BMT ARGOSS BV	NETHERLANDS (THE)
CALLAGHAN	Terry V.	INTERACT	SWEDEN
CALORI	Andrea Virginia	Facultad de Ingenieria - Universidad Nacional de Cuyo	ITALY
CAPES	Ren	Fugro NPA Ltd	UNITED KINGDOM
CAPPUCCI	Sergio	enea	ITALY
CARMINATI	Valentina	ISPRA	ITALY
CEYLAN	Ömer	Geonardo Ltd	
CHEVREL	Stephane	BRGM	FRANCE
CIAVOLA	Paolo	University of Ferrara	ITALY
CICCARESE	Lorenzo	ISPRA	ITALY
CILERDZIC	Aleksandar	GDi GISDATA	SERBIA
CINNIRELLA	Sergio	CNR-IIA	ITALY
CINQUEPALMI	Federico	Italian Office for the Promotion, Programming and Coordination of International Research	
CIPOLLONI	Carlo	Geological Survey of Italy - ISPRA	ITALY

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