Socio-economic Benefits From the Use of Earth Observation Workshop – Summary Proceedings

11 Through 13 July, 2011 – Ispra, Italy

Socio-economic benefits from the use of earth observation workshop – 11 through 13 July, 2011, Joint Research Center, Ispra, Italy

Introduction and workshop objectives

The benefits from improving Earth observation have been the subject of decades of research and discussion. The need for understanding environmental dynamics is even more urgent now given the recognized issues of climate change, sustainable food sources and increased need for energy. Scientists are increasingly being called upon to provide impartial scientific information to support decision- makers. The importance of science in informing societal decisions is driven by at least two factors: (i) a new recognition that there are significant global impacts of decisions made at national levels and (ii) the complex and non-linear nature of environmental driving functions that make optimization of outcomes less intuitive. This leads to the need for more observation-derived information in the hands of decision makers and their appreciation of the value of the information.

In addition, there is greater attention to performance of government programs and benefits and impacts of public investments. There is a need to discover and demonstrate innovative and practical uses to support policy, business, and management decisions of public and private organizations. While there have been successful examples of applications, efforts to substantiate their benefits have been lacking, especially a quantitative determination of value and impacts. These are also underlying capabilities needed to attract private sector investments and enable economic opportunities.

With these considerations in mind, the purpose of the workshop was to identify a program of activities to undertake during 2011-15 to support the development of capabilities internationally to determine, document, and quantify the socioeconomic benefits from Earth observations and their use, including the benefits that can and will be achieved by GEO and other international bodies. Such a program of activities may include the consolidation of dispersed bodies of literature relevant to the assembling of evidence and assessment of impacts and benefits of geographic information/Earth observation, the evaluation of different methodologies appropriate to undertake such assessments, the gathering of evidence of impacts/benefits in different user communities and societal benefits areas including the quantification of such benefits wherever possible, and outreach (including capacity building) activities to develop shared understanding across disciplinary boundaries on value and methods of assessment.

Acknowledgements and sponsorship

This workshop was organized by the following co-chairs: Max Craglia, from JRC, Lawrence Friedl from NASA, Steffen Fritz from IIASA, and Jay Pearlman from IEEE. The organizations and agencies listed below are acknowledged for providing financial, organizational and/or logistical co-sponsorship of the workshop:

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Summary of presentations and discussions.

July 11, 2011

Max Craglia introduced the Joint Research Center (JRC) as the Directorate General of the European Commission with the mission of providing customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. The Institute for Environment and Sustainability undertakes research on natural resources (water, air pollution, global change, etc.), integrated analysis (modeling, social and economic considerations) and infrastructures of data and services to underpin these models. The INSPIRE Directive is the European legal framework establishing a decentralized spatial data infrastructure in Europe to support environmental policy or policies affecting the environment. JRC is the technical coordinator for INSPIRE, and is currently developing the detailed technical specifications necessary to make the data infrastructures established in the 27 members states and 22 languages interoperable. In 2003, 04 an extended impact assessment for the INSPIRE proposal concluded that the benefits would exceed the cost by 7 to 10 times[1]; since 2006 several studies have been undertaken or commissioned by the JRC to verify the assumptions made in the impact assessment. In that context, Max gave a list of past and on going activities leading to this workshop.

Lawrence Friedl discussed the purpose of the workshop to identify a program of activities to undertake during 2011-15 to support the development of capabilities internationally to determine, document, and quantify the social, environmental, and economic benefits from Earth observations and their use, including the benefits that can be achieved by GEO and other international bodies. Lawrence then provided initial ideas for such a program and reviewed the agenda for the 3 days. There were 3 stage-setting talks interspersed by discussions. This prepared for the small groups interactions that took place later. Lawrence requested everyone to tell who they are, including their name and organization, and interest in the topic of the workshop. He asked for a brief answer to 3 questions: 1) what do you hope to gain from the workshop? 2) What do you hope to contribute? And 3) what do you hope the workshop will achieve?

[1] http://inspire.jrc.ec.europa.eu/index.cfm/pageid/6/init/1?category=15

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Workshop participants introduced themselves, indicating their goal for the workshop.

Kylie Armstrong is a program director in the Australian Government; she works on pricing models for fundamental and spatial data for business cases; she would like to gain methodology consistency; she could contribute research and case studies already done, establish consistent methodology and identify gaps.
Richard Bernknopf is a research professor in the Economics Department at the University of New Mexico after retiring from the US Geological Survey; he is an economist; he focuses on value of information studies; he would like to learn about what others are doing, and gain new colleagues; he could contribute to case studies.
Maria Theresa Borzacchiello is a post-doc in transportation engineering; she believes that there are lessons to learn from other disciplines; she would like to gain a better understanding of EO.
Arnold Brecht is interested in assessment of GSDI; generic overview of what is going on and path to continue; very concrete action plans with steps.
Hilcea Ferreira from INPE in Brazil has a background in education; she is a co-chair of the capacity build committee; she has developing country experience regarding sharing data.
Lawrence Friedl is director, applied science program, NASA; as a co-organizer of the workshop he is looking for practical and innovative uses of EO; he would like to se a concrete program of activities, identify others who can be part of the communities or should be invited (other parts of the world); he would like to energize the community, and budget for this type of activities. He is looking for a progression of actions to fund and mechanisms.
Steffen Fritz from IIASA is one of the workshop co-organizers; the workshop is a good opportunity to share knowledge on methods, tools and challenges.
Andrea Giacomell is a free lance consultant for non-profit companies; facilitator of one of the working groups for INSPIRE; he has worked a lot in EO, not much in remote sensing however; he would like to gain a better understanding of the state of the art in EO; he is looking for a refreshed community; he can contribute the definition of objectives and negative assumption, and develop an action plan (short).
Melissa Kenney is an AAAS Science and Technology Fellow hosted by the NOAA Climate Program Office and liaison to the U.S. Global Change Research Program to coordinate the Indicator Framework for National Climate Assessment. She is also an Assistant Research Scientist in Environmental Decision Analysis at Johns Hopkins University in the Department of Geography and Environmental Engineering. She has expertise in integrated physical, ecological, and societal indicators of climate change. She has current research on the value of information, specifically the value of proposed research, to inform environmental decisions. During the workshop, she would like to gain a better understanding of uses of Earth Observation (EO), the research opportunities to expand VOI methods for EO, and how such information can link to the current indicators efforts.

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Nicolay Khabarov, from IIASA is working on disasters; he is looking for an exchange of opinions regarding methodologies.
Onno Kulk from Amsterdam worked on GEObene; he is assessing the willingness to pay for EO in concrete case studies; he is interested to hear about other ways to assess same value.
Roger Longhorn has been working on GSDI and as an information policy advisor; he ha participated in workshops over the last 5 years and had found no concrete framework or methodology regarding non-monetary benefits.
Molly Macaulay is director of research at Resource for the Future; EO from space gives a unique view to resources; she would like to gain additional colleagues; she can contribute the perspective of economists, continuing from last year's work; she would like to achieve change to do our own job better.
Michael Obersteiner from IIASA has done a lot of impact assessment; often data is so bad that it is very difficult; he worked on the GEObene projects (benefit assessments) then went to the GEO secretariat, focusing on benefits; he would like to have further discussion on why we have so little impact regarding benefits of earth observation.
Francoise Pearlman is with the IEEE Committee on Earth Observation; she is retired from the aerospace industry where she was a technical manager with focus on systems of systems. She will contribute to the workshop proceedings.
Jay Pearlman is one of the workshop co-organizers; being with IEEE, he focuses on the global nature and social impact of technologies from a technical view point; he started in Earth Observation through building and flying sensors; he participated in a science team on applications; he is interested in having impacts on the daily lives of people; there is a need for very clear cut demonstration for developing compelling arguments; he is looking for the next steps on collaboration, such as building capacity more broadly, with small and innovative organizations.
Francesco Pignatelli was an engineer in the space industry, moving to applications about 10 years ago; he coordinates the work of scientists in GMES involved in work on the first draft of impact assessment; for GEOSS, he is co-chair of User Interface Committee; he is interested in concrete proposals for stakeholders.
Alenka Poplin from HafenCity University in Hamburg, hosted last year's Value of Geoinformation (GeoValue 2010) workshop; she is interested in value and pricing of geoinformation; she would like to met people who organized and participated the Value of Information workshop in the US in 2010 and gain a better view of methodologies for quantifying the value of geoinformation; she has looked at transaction costs and link between methodologies and study cases.
Paty Romero-Lankao from UCAR is focusing on climate change and methodologies; she is looking for the minimum set of rules to work together.
Alex Ruane is at the NASA Goddard Institute for Space Studies, where he is involved in agricultural research projects and climate scenario development; he is looking at the agricultural perspective and crop modeling on a fine scale; he can contribute perspectives and methodologies; he would like to make more connections; and develop a program for impact assessment.

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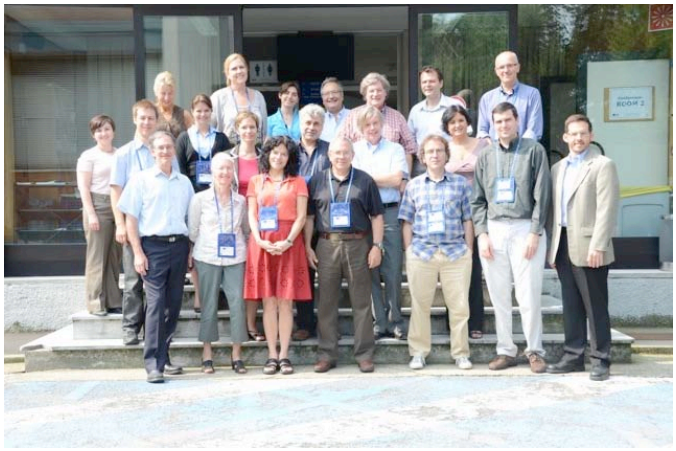
Danny Vandenbrouke from the University of Leuven is a geographer (user of EO); he has been frustrated by the outcomes of his projects, and started doing assessments of multi-disciplinary aspect of SDI; he has a major project in the Flemish region using various disciplines; he would like to gain new faces around the table, connect to other communities and e-gov; he could contribute his INSPIRE experience; he would like to achieve an action program with concrete ideas on projects (methods and test set-ups).



Workshop participants

Jay Pearlman – GEOSS Framework and Implementation
He addressed the background on GEO/GEOSS, and the nine societal benefit areas. GEOSS should be able to support and help these areas with the core goal of comprehensive coordinated and sustained observations; this includes political as well as technical considerations; examples include landsat data being free and now the Indian 1m data also being free; the goal is to facilitate access to information for improved decision making. There are 3 perceptions of GEOSS: 1) a system for integrating models and observations; 2) a system for coordinating the nine societal benefit areas; and 3) a system for converging observation systems worldwide. GEOSS includes Earth system models and Earth observation systems, which together feed the decision support systems, which are not part of GEOSS. The GEOSS Common Infrastructure (GCI) includes a web portal, clearinghouse, and registry of components, standards and best practices. A new work plan is being developed for the way forward (2012-15). It includes 14 activities built on a foundation of data sharing; however, there is still a multidisciplinary challenge; food security for example depends on food and water; similarly, EuroGEOSS, cuts across forest, drought, and bio-diversity. Jay gave a summary of GEOSS success and challenge. Examples of success stories included disaster response for Haiti, handling of meningitis in Africa, climate (monitoring of forest), and water harvesting in India (leading to agricultural change). Despite the success stories, the Measurement and Evaluation (M&E) findings regarding GEOSS benefits indicated that the GEOSS implementation approach does not explicitly describe an end-to-end process of how

the application of resources supports the overall vision and goals of GEOSS, how or why benefits are expected, or when benefits will be achieved.

Lawrence Friedl – Socioeconomic benefits from use of Earth observation.
What level of skills and capabilities do EO and spatial data communities have to contribute to public policy and policy analysis? Looking at the familiarity of terms in economy and policy versus Remote Sensing (RS) & EO, there is a gap in knowledge between communities, which can be bridged by collaboration. We should not expect either field to become expert in the other, but we do need to find ways to make connections. Desire is that Earth science people will know people to contact in other fields to do an evaluation and an analysis of socioeconomic benefits. Lawrence highlighted needs and opportunities. Despite successes in Earth science applications, there is an inability to substantiate the socioeconomic benefits & impacts. There is a need for development of those skills, as well as the development of case studies and body of literature across different sectors, types of decision-making, and applications topics. Part of effort is bridging the social sciences & economic fields with the Earth science and physical science fields: knowing with whom to partner and how to talk with them.

Steffen Fritz – The RS community needs to find better tools and methodologies; products are often generated for the sake of the product; one needs to consider how the product will be used. For example, the globe cover product is downloaded 50,000 time but we do not know how it is being used. IIASA was created in 1972 to solve problems, which are too large to be solved by one entity. In recent workshops at IIASA, they have focused on 'doing instead of talking'; attendees bring data to the workshop, which is very successful; the goal is to reduce duplication via collaboration.

Lawrence Friedl – He would like to focus on developing a program of activities, with initial recommendations as a target for the workshop. Are there lessons we can draw on? Where to start? What are the potential outcomes? We should identify major and minor elements in a program; where to be in the future; how much energy and time to spend; what mixture of approaches to consider (plan, analysis, outreach…). We need to look at initial ideas of a program; reasonable goals for 2 to 3 years. Examples include papers, unique course, special journal issue, set of case studies; getting EO papers in economic journals or reverse.

Paty Romero-Lankao – A tale of two teams: bringing together data-curation and interdisciplinary groups – challenges and benefits.
She is a sociologist doing interdisciplinary research in the area of climate change, at the National Center for Atmospheric Research (NCAR), looking at resilient and sustainable

cities. Why cities – they are drivers of climate issues and also sources of innovative responses; but the responses are not effective. The goal of the RS-city study is to identify fundamental causes and patterns of vulnerability. The effort is focused on research defining a vulnerable situation across a series of cities including New Orleans, Lusaka, and Santiago. There are many challenges: scientists come from different traditions (surveys and interviews cannot be converted into indicators); identification of hazards relies on physical sciences, while mechanisms for exposure involves social sciences, and health practitioners. Data varies: there are many dimensions, different spatial scales, and different times. Determinant of sensitivity and adaptive capacity vary depending on the level of analysis (for example city-wide versus individual variables). The work includes overlapping areas with data conservancy-type problems. Major areas include provenance and preservation, transparency, multi-disciplinarity and integration/synthesis. The Urban Resiliency Observatory makes available meta-analysis and meta-framework tool to support researchers, data synthesis tool (web site tool to integrate and transform heterogeneous data), and decision-support tools aimed at policy makers. In conclusion, our emerging area of research requires data from multi-disciplinary sources, which are heterogeneous and incompatible in their native forms. A network of researchers can explore emerging concepts, ways of data integrations and reuse. However, to inform operational decision-makers requires such data to be integrated and synthesized. To address these, a permanent collaboration is needed between data experts, scientists, decision-makers and sponsors.

Discussion.
The team is working with data that scientists have in their computers. It is unclear if the information provided directly by people as part of citizen network is included in the analyses and modeling.

Michael Obersteiner- Value of Information (VoI) from GEOSS.
The presentation addresses the motivations behind GEOSS and the principles of VoI. Historically, most stable civilizations have benefited from EO over the last millennium. Michael gave an example from historical Egypt. Back to current times, we create our own risks due to population being increasingly numerous. There are many tipping points in the Earth system (examples: ENSO triggering, India Monsoon triggering, permafrost methane outburst, numerous others. What would a tipping point early warning system or monitoring system look like? Other items need to be considered as well – for example an avian flu epidemic. We are not using the knowledge of prior ice ages because we do not monitor the environment sufficiently. UNFCCC suggests that we choose an atmospheric concentration target, which allows for the adaptation of eco-systems, food security, and economic development. The climate target is uncertain however, a trillion $ question. Michael then addressed the energy global situation. He focused on renewable energy allocation, and bio-fuels. Increased demand for bio-energy results in competition for land, with impact on wheat prices. In Africa, ethanol production areas overlap with malnutrition hot spots. There may be further impact on land resources from REDD+.

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In summary, the world in the 21st century is characterized by globalization, more scarcity of resources, and many unprecedented challenges and risks (new hazard types, and frequencies). We need to observe and focus on conscious learning, integrating systems and integrated assessment model. Observing systems need to be adapted to change through increased spatial and temporal resolution. We need to consider building a value chain of information systems. The modes of cost-minimized production of value of information include global cooperation, leading to economies of scale; GEOSS SoS leads to economies of scope. In conclusion, the Value of Information has been clear for the last millennium; we have been conducting planetary experiments but not learning from them; we have the EO technology and data storage, but global cooperation is very difficult to achieve socially. VoI studies can help resolve the dilemma.

Discussion.
Assessment of decision-making is linked to effectively engaging decision makers. Attributing better decision making to the information infrastructure can be specific to each problem. Also, the decision makers may not use the available information, or the information may not be good enough. As part of the workshop, can we identify one concrete proposal to address the VoI?

Molly Macauley – Valuing what we measure and measuring what we value.
We need to go beyond a collection of anecdotes. What can we collectively deliver and advance? Molly framed the problem by reviewing a number of publications focusing on the use of earth satellite observations in decision-making activities. Those included the NASA annual report ("science serving society"); Earth science and applications from space - national imperatives for the next decade (focus on meeting the demands of society); contribution of land Remote Sensing (RS) for decisions about food security and human health (stressing interdisciplinary and international collaboration); people and pixels-linking RS and societal science; achieving and sustaining EO - a preliminary plan based on strategic assessment by USGEO (what is at stake: our welfare and productivity; life on Earth; our lives and property); proceedings from the value of information conference from last year. Molly listed the usual approaches for describing benefits – mostly reports and studies. They vary in quality and are not well coordinated. Credibility is linked to the ability to isolate the attribution. Challenges focus on attribute of information; there is no systematic collection and accessibility of findings, and not much on best practices. There is not a lot of reward for doing that kind of research. The value of information is poorly understood, including the information quality. For example, it is difficult to count


Molly Macauley

the use of Landsat data, as the literature is not well referenced. Molly reviewed the general principles and technical underpinnings to the VoI studies; as an aside, there is a need for more rigour in VoI studies. She gave diametrically opposed examples regarding the VoI: in one case, the value was "not zero but not enormous either"; in the other case, the value was "worth whatever research investment was involved". Earth observations are about our natural and environmental resources and our human interactions with them. The World Bank, the United Nations, and many others label these resources as part of "the wealth of nations". There is a trade between the VoI (for example value of a forecast), and the error associated with the forecast (the curve is asymptotic). How much is good enough? An example from Bernknopf et al looks at the impacts of increased map resolution. Another example is the Soil Moisture Active Passive (SMAP) justification (level of detail for upcoming research). The Environment Protection Agency (EPA) attempted to put monetary figure on increased quality of life as a result of improved air quality. Molly provided several examples of methods for incorporating VoI analysis from the 2010 workshop: price and cost-based derivation; probabilistic approach; regulatory cost-effectiveness; economic modeling and estimation; simulation modeling and estimation. Molly concluded with a concept for a joint proposal (the VALUABLES initiative). The steps to use VoI to increase benefit and value include: demonstrating that the information is valued and ascertain what attributes are required. A list of near-term opportunities for horizontal (within our community) and vertical (extended beyond our community) activities were provided; those included collecting what we have already done; increased sophistication (Bernknopf as gold standard); outreach; best practices and methods; extension beyond community.

Discussion

The discussion centered on several themes. First, the distinction between information, data, and products, which are generated from data, was highlighted. Usefulness is a function of the end-user, be it scientist, decision-maker or citizen. It is important to identify who are the communities being addressed, to look at the way the decisions are made in reality, and to take politics into account. What are the valuable attributes? How much do they value do they provide? There is a lack of models regarding how to assign valuables and what the specific attributes are to be valued. Considering the EPA example on assigning a quantitative value to human life, there may be a distinction between wealthy and poor countries, and both need to be addressed. Lastly, in line with the VALUABLE initiative suggested in the presentation, it is important to give our work a "brand", and an identifier to use in publications, and when reaching out to other communities.

Tuesday July 12

Roger Longhorn

Roger Longhorn – EO Benefits as perceived by the coastal community.

There are many questions regarding value, such as: does data by itself have a value; how do you value

invaluable and intangibles; how does the value of GEO data relate to performing cost/benefit analysis? There is a lot of research on the value of intangibles. For decision-making, consider the value of services rather than the value of the data; one could also look at value of the analysis itself. The coastal community depends primarily on EO. They often require access to non-EO data (statistics, legislation, etc), but very few are involved in cost/benefit analysis. The marine/coastal decisio-making requires complex information integration; we need to combine EO with non-EO data, going across thematic areas, and integrating all of the data sources into a usable end product. Roger gave a list of marine/coastal EO programs: GOOS, EuroGOOS, coastal GOOS thru 2006; GMES marine core service (2007); MyOceans through 2012; EMODnet (European marine Observations and data network 2009). Benefits from the GMES marine core service were identified in a 2007 strategic implementation plan including benefits related to use of the data for climate research, environment protection, fisheries and eco-system management and others). A November 2009 Marine Data Infrastructure collected marine data costs and looked at the benefits of reducing uncertainty (example, cost of sea level rise). A study on the economic effects of maritime special planning in April 2010 focused on the direct economic effect of predictability and certainty. The EMODnet impact assessment (September 2010) considered barrier of applications of marine data such as uncertainty due to lack of effective data infrastructure. How do you account for the negative impact of these external items; does removing barriers add value? An assessment of Oceans Observing Systems (OOS) value was conducted in May 2011, in Canada. There was a list of potential benefits, but few OOS managers could identify the specific users or any actual benefits achieved to date. It is important to find out more about who is using the data; also, the infrastructure issue is the key to value of data collected. Roger did a keyword search regarding the value of data/information in documents from the above programs. Cost was nearly always related to services or equipment, not data.
Key challenges for the coastal community include: the same data being used by many communities for many different uses - the same service has different values at different time for different users; an overly expensive service is restrictive and may not generate an optimal value. We need an agreed to describable framework within which we can assess value from many different perspectives. In conclusion, Roger asked if we could engage with high-level decision makers in order to better understand how they use data or services – and thus how they assign value (or not) to these and how their perception changes with time and experience**.**

Richard Bernknopf – Evaluating the use of publicly funded scientific data for decisions-value of information component analysis.
The research reported on was a study of the value of information with and without satellite data. There were three parts: a macroeconomic analysis of a new hyperspectral scanner instrument contributed by M. Macauley (RFF), and two components, a user survey and a case study, conducted by USGS. In the context of this analysis, VOI research is about demonstrating why and how scientific data has economic value by informing decisions concerning the social cost and benefit of land

use. Questions such as: what is the value of publicly provided scientific information, can natural science information be integrated with socioeconomic information, can quantitative forecasts about future physical and ecological outcomes be developed to project outcomes associated with different scenarios and, how can uncertainty be understood and reduced to inform decisions with natural science? The value of Landsat imagery in the US was assessed. The macroeconomic analysis was based on expenditure analysis and showed that, given reasonable assumptions, a hyperspectral scanner would be cost effective. In the second component of the study, a survey of who uses imagery, and what value they assigned to the imagery was conducted. Snowball sampling was used. The median and mean willingness to pay was shown by sector and on the average ($256 for the median and $751 for the mean). The effect of the no cost policy was highlighted (increase in number of scenes downloaded, and decrease in cost expenditure). The third part of the project was a case study of the value-in-use of earth observations in a geospatial decision framework. Earth observations in eastern Iowa were linked with dynamic earth science models to evaluate the risk of exceeding a nitrate regulatory standard for adverse health impacts. The question addressed was as follows: Can policy makers be better informed by coupling earth observations with groundwater nitrate measurements to evaluate the potential to exceed an USEPA health standard and what would be the economic impacts? In the analysis, economic welfare, the VoI, is improved where earth observations identify areas that can sustain or increase agricultural production while not increasing the rate of contamination of nearby groundwater. An integrated assessment was performed using the moderate resolution land imagery. The study included 35 counties and numerous towns. Furthermore, the study demonstrated the possibility of using satellite data for regulatory analysis and review because the observations provide an archive of the population of land activities rather than a statistical sample. The model covered 9 years worth of data, looking at nonpoint source pollution well catchment zones and crop areas. The economic welfare implications included the regulation of non-point source pollution, potential land use changes to enhance total agricultural production and value, and the probability of income loss to farmers of exceeding water quality standards. A risk analysis tool is available for analysis of land use portfolio scenarios.

Discussion.
A case study approach to move this area further was recommended. The focus could be urban or rural, using archival data. The research would look at income concentration, and change in access to various resources. The willingness to pay would be measured.


Alenka Poplin

Alenka Poplin – Geo-information transaction costs: why do they matter.
She is a surveyor and has an MBA. She started her presentation with an example. Ten years ago, she was trying to find for a simple street network data

set. It turned out to be very difficult. She now looks at an exchange of spatial data as a transaction; it involves parties e.g. the seller and the buyer who have to exchange information about the product. Trying to acquire data is a transaction which can be very costly. One also needs to ensure that the data is fit for the purpose. Alenka introduced the theory for transaction cost (TC), a part of new institutional economics, often ignored in cost/benefit analysis. D. North, in 1990, distinguished between measurement and enforcement costs. Alenka conducted a case study regarding quantification of acquiring geo-information; the user was an urban planning student looking for information about university buildings in 3 locations. On the demand/user side, the costs are related to data acquisition, such as searching, contacting, acquiring, and testing, and negotiation. On the supply/provider side, the cost is associated with explaining the complex rules of use of the data and complex pricing and licensing mechanisms. Only quantified tangible costs on the demand/user side were considered. There were also intangible costs (waiting time, frustration, etc) observed, but not quantified. How does that affect the value of geo-information? If the TC is too high, the transaction may not happen. There are many key challenges related to geo-information TC. A variety of methodologies for quantifying transaction costs exist, but we lack an overview and an estimation of applicability for geo-information. A close collaboration with providers is needed in order to be able to quantify the supply of geo-information transaction costs. Sometimes the users and the use of geo-information are not clearly defined. The intangible transaction costs are difficult to quantify. The role of languages in geo-information acquisition needs to be considered. In addition, the cost and value of quality is important. One needs to understand the characteristics of the transactions and the role of the organizations. The key element of a program would include building up a community (geo-value community), having a value lab or test bed for decision-makers use (virtual or physical), and gathering a collection of methodologies and associated study cases ("cook book").

Discussion.
Transaction costs (TC) are important to consider. When data is free (such as on Google), it is not really free due to cost of use and non-optimal quality. For example, part of the cost of data is related to access, especially in developing countries. TC could be a potential indicator for GEO/GEOSS regarding progress. The focus has been on articulating benefits; should we be looking at reducing TC as well? If there is agreement, we could take it to M&E group. Cost and benefits need to be both considered in parallel. For example, benefits for decision-making: what are data driven decisions, versus discussion driven decisions? The assessment needs to be put into a framework which includes the political debate. Quality is a function of fit for use; how you can make up your mind if the data fits your purpose.

Arnold Bregt - Geo-benefits are obvious, but how do we measure them?
The presentation covered perspectives in SDI assessment and lessons learned, key challenges, and proposed contributions. The methodologies are mostly the result of PhD research on topics such as clearing house, spatial data sharing, collaboration,

budget in SDI, use of information in society, role of Geo-information in impact assessment, information and marine assessment). The applications include the impact assessment of INSPIRE, impact assessment of space for geo-information, assessment of authentic registrations (NL) and overall assessment of Dutch GI sector (book). Lessons learned: diffuse impact but unexpected benefits justify the whole expenditure. There is a need for legal justification for government subsidies. Politicians are not interested in post-decision assessment. The scientific school approach takes the whole and divides it into its components (Cartesian), then looks at the whole complex adaptive system (SDI can be seen as a complex adaptive system). Arnold gave the example of an SDI multi-view assessment framework, taking into account knowledge, development, and accountability. Key challenges include going from ex-ante to ex-post impact assessment, transitioning from anecdotes to integral assessment, migrating from a single data-set to a chain or "constellation" of data-sets, and evolving from benefits for decision makers to benefits to society. Arnold's proposal highlighted the following: defining smart indicators for impact; performing extensive ex-post evaluation of the Landsat program; conducting life cycle analysis of data (integral over the years); focusing also on the drawbacks of EO, rather than only benefits; and finally analyzing the role of spatial data in spatial thinking.

Discussion.
Are there more general lessons to be learned showing why some of the approaches do not work? Looking at success and failure, long term funding at a stable level appears to be a key factor for success, as well as having a strong user oriented SDI development.


Danny Vandenbroucke

Danny Vandenbroucke – Assessing information infrastructures from the business processes perspective
Experience from the business processes perspective stems from a program on SDI for public sector innovation called SPATIALIST. The program started in 2007 and will finish at the end of 2011. The research team included 6 people in different disciplines (geomatics, law, economics, sociology, and public administration). The fundamental question focused on the technological, legal, economic, sociological and public administrative requirements to further develop an operational Flemish SDI consistent with international standards that is efficient, effective, flexible and feasible. The team sees SDI as a way to connect existing systems; they looked from a user perspective at the network environment in the public sector (in Flanders, there are over 500 nodes). There are different levels of interconnections, forming a barrier of access to data. A connectivity chart for 250 nodes illustrates parcels data; various indicators were collected (density, distance, …); the survey was repeated, looking for changing

behaviors. Analysis of the business process was performed for flood mapping. The research design focused on access and distribution policy, and organization structures. They distinguished between set-up and performance; they asked if the SDI infrastructure was contributing to the process; they conducted interviews and looked for discriminating factors. Key challenges from the project perspective include, from a performance measurement standpoint, the lack of impact on society at large and difficulties in finding indicators to measure impacts on the citizen. There is also a problem of attribution (is the process getting better because of SDI?). SDI assessments should be integrated in overall assessment approach; from broader perspective, we do not know a lot about the user; we need to go beyond infrastructure (how we do things). Concrete proposals are to focus on work processes (real case for decision making process), to include data and the way in which it is made available; to use a "plugfest" concept with end users involved; and to show the results to document the scenarios.

Discussion.
It is very helpful to have the user of data formally describe how they use the data.

Max Craglia – What impact of SDI on innovations?
Experience from INSPIRE impact assessment and SDI studies shows that we need to learn from other disciplines such as social sciences, transportation, and economics. According to the Europe 2020 strategy on sustainable growth, innovations can lead to the development of services building upon infrastructure, thus creating jobs. Local and regional economics are very important. Most investment costs identified in INSPIRE are necessary at the local/regional level to build capacity. Clusters are geographic concentrations of related industries linked by pooled labor, and knowledge spillovers. Clusters are main mechanisms for fostering growth, innovation and competitiveness. There is a lot of research on clustering as a strategy to foster innovation in the context of industry and in the context of access to information. A figure illustrates the high number of patents per employees in strong clusters. One needs to ask to what extent data and information flows available through Regional SDI produce innovation for public and private sector in European regions. How do you translate manufacturing research into e-economy? Note that the e-economy includes book publishing and film industry for example. Also, are clusters relevant to the e-economy, and does geographical clustering occur or is it virtual clustering? Finally, how do you measure innovation? What are the levers available to regional governments to facilitate innovation and competitiveness of their economy in the e-society? Should one consider the risk of investing in infrastructure which creates benefits elsewhere? Max suggested the following research project proposals: survey active firms in Geo-information and EO sectors looking at clustering and opportunities for innovations; analyze the impacts on the regional e-economy of innovation achieved by those firms due to SDI.

Discussion.

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Originally, one of the benefits of IT was to reduce the number of people employed; now we argue that we create more jobs. This may be a paradox. Actually, we create replacement jobs. The transaction cost of providing data is high; if using SDI reduces people's time, employees can be freed for more innovative jobs. There are various paths to innovation; in the context of digital economy, what are those paths? Innovation appears to be more prominent in cities, in which case it is still done in clusters (around a cup of coffee). Think tanks have done research defining innovative regions, but this has not yet been linked to the work on clusters using SDI. Clusters such as Silicone Valley allow mobility however, virtual companies change the dynamics. Using patents to measure innovation can be misleading due to requirement for disclosure.

Sabine Fuss – The value of information, applications in the field of land-use
Sabine is an economist working for IIASA. Her presentation addresses the valuation problems due to benefits varying with user context and time, and the difficulties of ex-ante benefit assessments. Value varies with user, context and time. Looking at the user, a top-down social welfare view can be used and expanded for other layers. The overall value is not additive. It is instructive to look at one problem from multiple perspectives and using various methodologies. Looking at the context, step back, and consider the options; interrelations leads to different valuation. There are difficulties with ex-ante benefits assessment, especially regarding low probability but high impact events (benefits as undervalued when damage has been avoided). Value of information approach in land-use makes use of disagreement maps, showing the level of disagreements by regions, and highlighting hot spots. The method uses standard portfolio mitigation; Sabine gave the example of CO2 mitigation with 2 mitigation options (carbon capture and storage at constant cost, versus avoiding deforestation with increase in uncertainty and thus cost). The Global Biosphere Optimization Model (GLOBIOM) was developed at IIASA; its objective is to maximize producer and consumer surplus. In the current study it was used to assess the cost of avoiding deforestation with different land cover maps (one with more and one with less land available). Two scenarios were discussed, where there is uncertainty about which of the two maps is closer to reality. Scenario 1involves a risk neutral decision maker; amount of mitigated CO2 with avoided deforestation is shown; expected value of information is given as a function of land availability. Scenario 2 involves a risk averse decision maker. The variance in mitigation portfolio is shown as a function of risk tolerance. In both scenarios, it becomes clear that the avoided deforestation option is used to an increasing extent when we are more certain that the map with more land available corresponds to the truth. VoI or willingness to pay for better information is substantial and increasing with risk aversion, but decreases, the more certainty we have that one of the maps is closer to reality than the other one. In summary, VoI depends on context and user preferences. An example of how portfolio optimization can be used to derive the VOI in the field of land use and mitigation policy has been provided; the VOI is a fraction of the overall mitigation costs, but is very high in absolute terms; and finally, better land cover information can be very valuable with in situ measurements and

validation points available.

Discussion.
The above work assumes that there is a given target of 20Gt CO2, which need to be mitigated.

Onno Kuik - Assessing the value of EO for environmental management based on Bayesian decision theory and expert elicitation: challenges and opportunities.
Two case studies, one in the North Sea and one in Australia, were developed under the GEO-BENE project. The discussion focused on the 1st case study. In a certain world, information has no value, while in an uncertain world value is related to the expected utility of decision making. The problem is analyzed using a Bayesian approach, looking at states of the world and actions. In the water quality management problem in the North Sea, algal blooms pose a threat to mussel cultivation. A pay-off matrix is developed; there are 2 states (harmful algal bloom or not), and 2 actions (relocate the net or do nothing); the belief of state is the probability of algal bloom occurrence; in this case, "do nothing" is superior. As more information is added as the belief regarding the accuracy of the prediction (cost of false warning), additional information would bring benefit in this case.
Key findings: value of EO is larger for larger stakes and greater uncertainty. Based on past research, the knowledge of benefits of EO is quite limited among environmental managers; decision makers may be constrained by many factors (law, regulations, etc). It is difficult to frame the problem so that it is simple enough for analysis, but not so simple that it does justice to real-world complexities.
Recommendations include: acquiring a better understanding of the policy problem (complex, with large connectivity); performing laboratory style experiments to test basic assumptions; and doing ex-post assessments.

Discussion.
Ex-post assessments may not be welcome if the decision has already been made - no one wants to know the results of an analysis. This may however be a great way to improve research, or to learn how the organization can work better; for example, the weather community looks at past forecasting, but not at the decision maker level. Another area of discussion focused on the value of educating people about EO and the benefits of EO information. Lack of resources presents a constraint in this area for developing countries.

Kylie Armstrong – Australian economic benefit assessments pricing models and now socio benefits, delivering research for outcomes.
This presentation represents an SDI decision maker point of view. In general, there is a lot of money for infrastructure but little for SDI programs (where the support is very fragmented and inconsistent). The community needed to work together to have a say at the political table, by highlighting benefits of SDI. A specific report was generated on the economic benefit of high resolution positioning services. The

Kylie Armstrong

approach was to perform the assessment before asking for funding. Methodology: the economic value of productivity gains from applications of precision positioning system in the agricultural, mining and constructions sectors is modeled using a computable generalized equilibrium model. The MMRF model is a well-recognized multi-sectoral, multi-regional dynamic model of the Australian economy. Based on a scenario whereby a standardized network is rolled out across Australia, the model was used to forecast an increase in Australia's GDP by 2030 for the 3 sectors. The strategy is to pre-empt questions and provide answers. The next part of the presentation focused on spatial data pricing. Pricing and access policy is critical for the future sustainability of the spatial data industry. They focused on fundamental spatial data, looking for the best policy for long-term economic benefit for society.

Project objectives: consider a range of economic models and policies for accessing and pricing public sector spatial resources; analyze the costs across the whole value chain. This is an extension of prior work, building on previous studies.

The economic characteristics of the fundamental data follow a natural monopoly, with data typically produced by government land information agencies. They looked at alternative models, such as full price recovery, hybrid models, free fundamental data and determined optimal pricing models. It should be noted that the optimal model might vary according to government policy objectives. In conclusion, they recommend a move away from full cost recovery; however there is no uniquely optimal access and pricing model, when a range of practical and dynamic considerations is taken into account. Regarding answers to the policy questions, pricing depends on jurisdiction's policy objectives and funding; fundamental spatial data is a special case due to the high fixed costs, and recurring maintenance needs. Lessons learned include: justifying ones existence and creating a consistent story; providing methodologies that can be used cross-sector; being clear on scope and assumptions; and using economists to perform the economic assessment. The last part of the presentation focused on social indicators work which need to be leveraged. The research proposal includes the development of a dashboard to track progress, and the establishment of a research framework, which GEOSS researchers can leverage.

Discussion.

A precision was requested regarding the benefit study on precision agriculture – it was confirmed that steering is the biggest benefit. Regarding the interactions between scientists and decision makers, the biggest challenge is the ability to communicate what is needed in the future. Indicators are attractive for decision makers; it is suggested that the dashboard would track those indicators, measuring progress rather than outcomes. One needs to make sure that the right things are

being measured, so that you are not measuring progress in the wrong direction. Regarding fundamental spatial data and cost recovery, Australia does not have a SDI at the country level yet; cost recovery for spatial data is performed at the base agency doing titling; they have a very strict process and the ability to recover their costs.

Nikolay Kabarov– value of EO: forest fires, earthquakes, and landslides

Nicolay Khabarov

The work was primarily done under GEO-BENE, with focus on 3 disaster areas, looking at possible improvements and benefits. The earthquake modeling is based on a grid, including the damage in each cell, the sensor information for each cell, and an overlay providing a rapid assessment. The efficiency of earthquake rescue can be quantified as the number of saved victims over total victims. The rescue efficiency curve is shown as a function of resources for various damage knowledge conditions. The landslide modeling makes use of rainfall precipitation data and slide threshold; a Monte Carlo simulation injects rainfall data error. The damage is calculated as a function of evacuation criteria and occurrence or non-occurrence of the landslide. A landslide expected loss graph is shown as a function of evacuation judgment for various rainfall measurement errors. The forest fires model used simulated weather data in Spain and Portugal. The addition of weather station into the grid showed a reduction in burned areas. The main challenges in assessing the VoI include the importance of new data to compare with what we already have, the need for existing data to improve the models, and the need good connections with practitioners for model result validation. The following key elements are suggested: create an expert panel to define pilot projects for new data acquisition, sharing of existing data for scientific purposes, and creation of a platform linking modelers and practitioners for validation purposes.

Discussion.
The USGS has a Southern California simulation data set. The simulation reflects physical processes, and includes a lot of data on earthquakes and landslides. It is a great data set, and the report can be provided.

Andrea Giacomelli –accounting for people in EO
This presentation's perspective draws on the consolidation from experiences in awareness raising project focused on culture, environment and free informatics, which took and are taking place in different contexts. These range from experience in large corporations and international settings, to small community-based projects in rural areas.. He was an environment manager and involved in GIS starting in

1993; he then became a project and staff manager. The context is the relation of people to landscape. The case history illustrates a movement from a public sector environment agency to SDI. In each of these projects, an Earth Observation component is often present; in general the issue of the co-existence of innovative information technologies with "day to day" practices is constant. A framework to evaluate where and how benefits may be found, which can be applied to very different contexts, is that of considering a list of stakeholders roles, based on the development of a person/citizen in different stages of his life. The example of the Dark Sky project involved measurement of pollution via multi band EO. A list of roles was provided (citizens, professional, retired, etc). The challenges include addressing problems at scales larger than cultural scales, and the fact that resources have not increased since 2008. Administrative boundaries should not be ignored. Data, tools, and processes are imbalanced. Suggested proposals: first of all, to clarify the what are socio-economic benefits for each of the workshop attendees (level I); once this has been clarified, the same question may be re-proposed (and answered) for/by a broader community of which a given attendee is part. Providing a concerted answer and sharing with "the rest of the world" would close this exercise (level II). A proposal on a third level would be to re-modulate research investments on socio-economic benefit evaluation, and finally stop new work for 5 yrs (level 3), so as to allow more resources, and more time, for the community to digest the current state of the art, and to investigate and better exploit past results.

Discussion.
Working with people, and considering perceptions, how can we capture some patterns, which account for the richness of the context? It depends on the level of complexity. One must go case by case.

A**lex Ruane** - The Agricultural Model Intercomparison and Improvement Project (AgMIP) and benefits of EO for agricultural applications Issues: World food prices, as provided by FAO, have shown increased volatility, and improvement in yield may not keep up with population growth. There is a need to understand weather extremes, as heat waves resulted in droughts in a number of locations (for example, drought in Russia in summer 2010 resulting in failed crops; also East African drought situation). The AgMIP leads and collaborators were identified. The elements of the project cover the climate scenarios and crop models that feed the agricultural economics models. Cross-cutting themes include uncertainty, aggregations across scales, and the development of representative agricultural pathways. AgMIP has a two-track science approach; track 1 focused on model inter-comparison and improvements; track 2 addressed coordinated future scenario simulations. Socio economic benefits of AgMIP include: improved scientific and adaptive capacity of major agricultural regions in the developed and developing world, such as building early warning systems, and understanding uncertainties; the development of a framework to identify adaptation strategies: the use of multiple models, in an ensemble approach, to explore uncertainties; and the ability to link to a lot of on-going efforts. NASA GISS has been looking at urban impacts. Items to

consider are scalability, political value, and inertia of established methods. Key challenges for use of EO in support of agricultural impact assessment are: trans-disciplinary cascade of inputs and outputs, unknown network of users with varying capacities, ethical aspects of information availability; needs to identify key sources of uncertainty to prioritize data collection. Proposed elements: focus on making information operational, and including benefits of increased data coverage that allows transfer of pilot project products across wider applications.

Discussion.
Social phenomena included in the model are focused on economic interplay at the farm level. They need field trial experiments to validate the models on several scales. They receive funding from UK DFID/UK AID, USDA, and potentially re-insurance companies and some support from Monsanto. The models need better phenomenology, and understanding of pests.

Hilcea Ferreira – Benefits of earth observation, a Brazilian perspective.
INPE, the Brazilian space agency, is 50 years old. The headquarters is based in San Jose Dos Campos. The remote sensing ground segment includes the Cuiaba ground station data center. INPE also does a lot of education and capacity building. The EO data is essential. Brazil cooperates with China on CBERS. Applications include a focus on forestry and agriculture. Examples of INPE projects using CBERS imagery include sugar cane mapping and monitoring of the Amazon forest. The data policy access changed (imagery is now free) and use went from 1000 images per year to 10,000 new users per month. Two surveys were conducted to assess the benefits of policy change; they showed impact on education, and increase in new businesses (number of projects and small companies using remote sensing). A possible case study could look at the effect of no-cost policy regarding Landsat and CBERS imagery.

Discussion.
The discussion primarily focused on ability to communicate when using EO. An example was given of the globamazonia program in Brazil, which targets illegal logging based on data provided by INPE. A camera crew would investigate the situation, thus providing motivation. The data has had 41 million users over one year. This shows to citizens the value of Earth observation, when supported by imagery. This example calls for a communication plan (radio, tv, video, contests, mashups…). There is a lot of interest in better communicating the value of EO; scientists are not the best people to communicate that information; success has been achieved from using communications experts. There are 2 other options to address the issue; 1) train the scientists; or 2) look for boundary organizations, which provide links between science and policy making. We need to understand our limits within our culture.
Citizens can also now provide/receive data using cell-phones, and social networks. This is different from Landsat, but is becoming more widespread. We tend to focus on the big stories rather than the very small changes, which when mutiplied by

millions have a significant impact. The use of citizens networks brings the issue of quality of the collected data and open software tools. The traditional approaches can be combined with citizens provided data, using twitter monitoring as an indicator. For example, JRC has started mining twitter and flicker for new added value information regarding fires in Europe.

During the last half hour of day, participants were asked to answer 2 questions: 1) what are 1 or 2 keys to success in the development and acceptance of socio-economic benefit/impacts studies; and 2) what are 2 key items you suggest as priority items for the program of activities.

To set-up for the next day's small group discussions, Lawrence Friedl reminded the attendees that the purpose of the workshop is to identify a program of activities to undertake during 2011-15 to support the development of capabilities internationally to determine, document, and quantify the social, environmental, and economic benefits from Earth observations/information and their use, including the benefits that can be achieved by GEO and other international bodies.

The agenda included discussions in several groups, where all groups addressed the same topic (looking for concrete specific items and prioritization/level of effort), followed by thematic groups, where each group addressed a topic in depth. Thematic groups include 2 groups on use cases and methodologies, and one on community outreach and reward.

Wednesday Afternoon
Reports from the groups

Group A (Steffen Fritz)
We need to develop an overall framework (portfolio of land assets) first, with goal of measuring changes in welfare. Involve the decision makers from the start. Develop case studies and apply the different methodologies. Include validation and verification.
Criteria for case studies: short term versus long term; urban or rural; can be funded; can be replicated; cases are complex enough but not too complex; there are systematic products. The case studies should be applicable to both developing & developed countries. Need case with risk.

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By 2015, the program should measure welfare change, bring together consumers and suppliers, develop methodology, identify concrete projects, and demonstration projects. Expand the community to a Community of Practice (CoP) involving decision makers.

Group B (Alex Ruane)
The team recommended a consolidation and review of literature including the creation of a new journal "Socioeconomic Benefits of Earth Observations". There are many potential options in forming a journal. . A strong special issue can build the research body quickly; they could have one generic issue on "Socioeconomic Benefits of Earth Observations"; issues on EO with many applications (Landsat, Envisat, Citizen obs – 2 issues by 2015); issues on applications with many EO (FEWS, Haiti, Gulf Oil Spill, agriculture, water, disasters, health, urban, energy, migration – 3 issues by 2015); same applications across problems (Bayesian analysis, etc. –number of issues depend on the methodologies that emerge in the meta-analysis).
Make use of websites to collect SDI literature (start with EuroGEOSS program, continuing with GEO-Bene site, and others); highlight and link websites with search capabilities (6 months to get started? 5-year repeating literature review?); need to include gray literature.
Perform meta-analysis every 2 years starting within 6 months.
Perform gap and transferability analysis: why are anecdotes of EO applications and benefits so different? What unique applications can be transferred for broader adoption? Can we extrapolate benefits from unique application across all countries? What are factors / barriers that prevent transferability (in situ networks, infrastructure, businesses, economic situations)? Where could small follow-on investments (advertising, training, etc., reduction in transaction costs) metabolize beneficial applications? The proposed program should include a workshop to start, multiple studies by 2013, and a symposium in 2013-2014.
Regarding community building and liaison, the team recommended building common practices, using a website including linking and an ability to facilitate meta-analysis.
The goals for 2015 include doubling of the community, creation of a new journal with impact and credibility, special issues highly cited, accepted scientific paradigm (Physical and social), equivalent of Environmental Impact Assessment (Information Impacts Investigation - III), familiarity and acceptance of SEB analyses as credible, proceedings of symposia, handbook on methodologies, number of Ph.D. dissertations, influencing the World Expo in Milan (2015) – Focus on Feeding the Planet, and contributions to IPCC.

Group C (Jay Pearlman)
The team brainstormed a program of activities to include: constructing an expert data base similar to IODE; developing a protocol of how to mine existing practices; generating an overview paper; mapping out what already exists (bibliography

starting with IIASA and GSDI) and define what you want to focus your effort on; encourage a student to do a review paper; performing a short quality assessment of methods followed by a summary of the paper; documenting good practices, normal and failure cases (use surveys and other tools to capture them and create a catalog); looking beyond Earth sciences.
The suggested program of activities also includes the following: creating a portal (starting with GEO-Bene); building thematic cores using Geographic Information Knowledge Network (you can become a member by invitation); seeing if INPE has an inventory; asking if the GIS program in NCAR can be involved ; focus on end users and stakeholders (who are the stakeholders), and go beyond the scientific community; focus on communication; makes use of indicators as a way of simplifying communication; in-depth protocol case studies with a lot of rigor; what are the practices and how can barriers be overcome regarding data sharing; facilitating attribution; setting a framework to measure success and what went wrong (performance); agreeing on a minimum set of definitions for socioeconomic benefit; ability to extend the work and make it operational; scaling up to the global community; development of capabilities in the socioeconomic assessment domain. A proposed prioritization into high, medium, and items for later was provided. High priorities included: review & consolidation of dispersed bodies of literature, experts base, best practices relevant to the assessment of impacts & benefits of geographic information/Earth observation; and the development of case studies including use cases.

The reports from the thematic groups follow.

Group Alfa – use cases and methodologies (Jay Pearlman)
The team addressed the questions from a societal standpoint. They did an inventory of case studies needed, leaving funding for a separate discussion (in parking lot). The following attributes of case studies were identified: multidisciplinary; end users who are fully engaged in the case study; societal relevance of information including value of information for each category of user (measure/indicators); attributes of information, look for high impact researchers; diverse portfolios of case studies; specify what we are looking for (breath of information, data drive studies, or different case studies); transferability; and expected societal impacts (benefits, costs) of case studies.

Case studies were considered in the 9 SBAs ; food security was included rather than agriculture; climate was thought to be too large. Tools under consideration included risk assessment, monitoring agricultural statistics using remote sensing, and watershed analysis. The focus for case studies was then narrowed to the following case studies or sub-case studies: bio-fuels (under food and energy security), water quality, air pollution and health, biodiversity management and information for society. One needs to make sure that the various methodologies can be distributed across case studies.

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Group Beta - Methodologies and Use Cases (Sabine Fuss)

The starting point is to look for a framework of methodology; focus on answering questions such as how do you measure a change in welfare, and how do you extrapolate to larger areas. The following suggestions came the team's brainstorming session: start from use cases with few indicators, few users, and expand beyond those; look into other fields to find analogies: e.g. road network expansion, climate modeling, weather forecasting; test multiple methods on one and the same use case. Concrete methodologies for SDI were identified including numerous existing methodologies and new gap filler approaches. Concrete applications included: ecosystem services, health (air pollution), agriculture (food production), disasters (fires in Portugal), typhoons, and heat waves in Russia. Those represent pilots, which could be applicable across multiple cases. It should be noted that those issues are interrelated and may have to be addressed more comprehensively. Possible locations for use cases included several in the developing world (Congo Basin, Amazon, Eastern or Sub-Saharan Africa); users in developing countries could include aid agencies, policy-makers, and citizens. Note that one needs to make sure there is connectivity with the people on the ground.

Group Gamma – Community outreach, and rewards (Lawrence Friedl)

A number of strategies were identified during a brainstorming session as follows: build upon the GSDI Association's tools and knowledge bases, develop a primer on Socio-economic benefits (SEB) for the EO/information community, create a wikipedias site on SEB of EO/information, create and nurture a Community of Practice, reach out through publications and conferences, videos for broad audience, webinars, workshops, town halls, media connections (mass media, radio spots), hand-outs and brochures on the activities and results, articles and information in trade journals (grey literature), contests and awards, games (e.g., video games), iPad apps, hold a special session at Association of Environmental Resource Economists, cultivate "high-level" champions, and finally give storytelling course for EO people so they can tell good stories and anecdotes.
Identify & brand for our collective activities using a website for coordination (suggested schedule: alpha version in July; beta version in October; gamma in January 2012), collectively developed terms of reference for the group (by end of August 2011?). Develop plans, a mission, a vision, etc. for the activities and a plan of action coming out of the workshop (developed by a steering group by approx. Aug 1, shared with everyone for comments by mid-September). Develop a logo via a contest (logo selection by October). Develop a communication plan addressing the audiences, message, mechanism, and schedule/budget. There are many existing plans that can be used as a model. More details were provided on concrete approaches for a library, webinars, and workshops.

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Lawrence Friedl – Wrap-up.
The teams have looked at potential plan of actions and outputs, but they did not talk about capacity building or decide a location for next year's workshop. Several discussions topics were not addressed: What is a good body of literature? What is the cost benchmark for case study (1$M for case study from Rich; Melissa 200 to 500K per year over 2 years); what is the valuation of data access? They did not discuss the involvement of the private sector. Looking at the funding for case studies, is it better to have 3 expensive ones versus 6 smaller ones?

Discussion.
What is the measure of success regarding a "rich body" of literature? It would include a number of average papers, which typically take about 6 months each to create, plus some unique papers which attract attention. The idea of a high impact paper was discussed.