Report from the Regional GOFC-GOLD Workshop

OBSERVATIONAL DATA

in Support of

Northern Eurasia Earth Science Partnership Initiative (NEESPI)

Repino, Russia

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Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) is a coordinated international effort to ensure a continuous program of space-based and in situ forest and other land cover observations to better understand global change, to support international assessments and environmental treaties and to contribute to natural resources management.

GOFC-GOLD encourages countries to increase their ability to measure and track forest and land cover dynamics by promoting and supporting participation on implementation teams and in regional networks. Through these forums, data users and providers share information to improve understanding of user requirements and product quality.

GOFC-GOLD is a Panel of the Global Terrestrial Observing System (GTOS), sponsored by FAO, UNESCO, WMO, ICSU and UNEP. The GOFC-GOLD Secretariat is hosted by Canada and supported by the Canadian Space Agency and Natural Resources Canada. Other contributing agencies include NASA, ESA, START and JRC. Further information can be obtained at http://www.fao.org/gtos/gofc-gold

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Executive Summary

The regional GOFC-GOLD Workshop was held February 23-26, 2004 in Repino, near St. Petersburg, Russia as a step towards organizing a concerted region-wide effort to leverage extant *in-situ* and remotely sensed data resources for in support of NEESPI, other programs, and users in the boreal zone of Northern Eurasia. Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD; http://www.fao.org/gtos/gofc-gold/index.html) is a coordinated international effort working to provide ongoing space-based and *in-situ* observations of forests and other vegetation cover. Regional networks are an integral part of GOFC-GOLD and earlier workshops in the region supported the idea of organizing a regional information network in Northern Eurasia (Northern Eurasia Regional Information Network or NERIN).

The thematic focus of the workshop was shaped by Northern Eurasia Earth Science Partnership Initiative (NEESPI http://neespi.gsfc.nasa.gov/) that seeks to establish a large-scale, international, interdisciplinary program aimed at developing a better understanding of the interactions between ecosystem, atmosphere, and human dynamics in Northern Eurasia. A major factor in the success of NEESPI is the development of a network of scientists and institutions capable of addressing key science questions of global significance in Northern Eurasia. Due to the sheer size of Northern Eurasia region, remotely sensed satellite data are critically important, however their potential has not been fully used to date. This is in large part due to the difficulty in locating and accessing *in-situ* data sets and integrating them with remotely sensed data.

The presentations at the workshop informed participants of the main scientific themes of the NEESPI Science Plan, the availability of remote sensing and *in-situ* datasets, and strategies to encourage information exchange and interdisciplinary collaborative research among research teams active in the region. The geographical focus of the workshop was on the boreal region of Northern Eurasia. Several research and operational networks in the region continuously collect ground data intended to meet a wide range of national, regional, and local information needs. The workshop examined remotely sensed and *in-situ* data collected and archived by observational networks; datasets from individual projects and scientists were also included.

The workshop participants included representatives from the major known networks charged with collecting operational and scientific *in-situ* data, providers and users of remotely sensed data, scientists leading the development of NEESPI Science Plan, and representatives of agencies that support GOFC-GOLD and NEESPI. Russia, USA, Finland, Austria, Japan, Italy, and France were represented at the workshop. Prior to the workshop, the participants were asked to provide information about their data holdings by filling in the METADATA ENTRY FORM **http://wwwdata.forestry.oregonstate.edu/MDEDIT/teamform.aspx** . The summary of entries was presented at the workshop.

Presentations at the workshop provided a thorough overview of data availability in the boreal part of Northern Eurasia. These presentations can serve as reference material for a wide range of users while the data inventory is in progress. The presentations clearly demonstrated that many years of research and operational data collection in Northern Eurasia produced a large body of knowledge and data that can be available to support new research within the thematic range of GOFC-GOLD

and NEESPI. The workshop tentatively identified several major data needs, however a definitive evaluation and prioritization of data needs is contingent on building consensus within the NEESPI-NERIN community regarding the science priorities and objectives of NEESPI.

As a result of a series of GOFC-GOLD workshops and meetings focused on development of NEESPI Science Plan, NERIN has emerged as an informal network of:

a. scientists and other professionals,
b. institutions and observational networks,
c. projects within the thematic scope of GOFC-GOLD and broader scope of NEESPI
d. network of points of contact for data users.

It is important to have a system of network coordination and support within the region. Following the overall structure of GOFC-GOLD the network would have two components: (1) Forest Cover Characteristics and Changes and (2) Forest Fire Monitoring and Mapping.

To strengthen the network it is critical to maintain active network projects. The on-going fire-validation project distributed across the regions works on comparing and validating the moderate resolution active fire and burned area products (e.g. AVHRR, GBA, MODIS, Vegetation) using high resolution remotely sensed (e.g. ASTER, BIRD, Landsat) and *in-situ* data. A parallel activity for GOFC-GOLD Land Cover Characteristics and Changes Theme is clearly needed. A new pilot project was proposed with multiple sites distributed across the region. At each site 30m resolution data from multiple time periods and uniform classification and change detection procedures will be used. The study is to serve 3 goals: (i) provide a detailed study of the different types of land cover and land use change significant in different parts of Northern Eurasia; (ii) provide validation of the moderate resolution land cover and land cover change products; (iii) provide participants with image processing and team work experience.

Data sharing is consistently increasing within the NERIN community. Several impediments to further progress were discussed at the workshop, including the uncertainty of the formal status of NEESPI, complicated regulations of data ownership and intellectual property rights in Russia, dis-incentives built into the system of funding collaborative research, lack of funding for collecting and managing the data within the region.

A concerted outreach effort is needed to include additional countries from the Northern Eurasia region into the NERIN community. A follow-up workshop for the non-boreal zone can address that need and also cover several types of data that were not represented at the St. Petersburg workshop (soils, socio-economic data, tundra ecosystems, national-level forest health monitoring). In addition, planning meetings in small groups are important to reach additional teams and institutions working in the region.

The need for review and assessment of methods for linking various types of *in-situ* and remotely sensed data was stressed at this and at earlier GOFC workshops in the region. The co-leader of GOFC-GOLD Landcover Implementation Team Christiana Schmullius supported the idea; Tuomas Hame and Olga Krankina developed early plans for this workshop.

In conclusion, the workshop provided a thorough review of available data, identified several important issues that need to be resolved, and discussed actions that would serve as the next steps for the development of NERIN.

1. Background

Northern Eurasia (NE) is the largest landmass in the extratropics, the largest terrestrial reservoir of organic carbon, and an area of active land use changes and socio-economic transformations. This region is also a major source of uncertainty in many global-scale estimates, including the estimates of land-cover, carbon stores and flux. Observational studies and model projections indicate that changes in climate of Northern Eurasia are among the largest in the world. Understanding the role of NE in the global environment and projecting its future dynamics is critically important for developing comprehensive, policy-relevant knowledge of global change.

During the 1990s, NASA sought to encourage joint research programs with scientists from Russia and other countries of the Former Soviet Union, which occupy the bulk of Northern Eurasia landmass. Currently several research teams are supported by NASA Land Cover Land-Use Change Program to work with Russian organizations to quantify and understand the past, present, and future land-cover and land-use trends of this important, largely forested region (Bergen et al. 2003, Krankina et al. in press)). A broader set of studies was reviewed at a series of workshops convened in Russia by GOFC/GOLD (http://www.fao.org/gtos/gofc-gold/index.html): August 2000 in Novosibirsk, June 2001 in St. Petersburg, and August 2002 in Krasnoyarsk (see workshop summaries at http://www.fao.org/gtos/gofc-gold/). These workshops underscored the need for improved validation of data products with ground measurements and supported the idea of forming a regional information network (or networks) in Northern Eurasia. They also emphasized the importance of educating and engaging the user community, particularly in Russia and other countries of the Former Soviet Union. To address these goals and to encourage regional collaborative research, several follow-up workshops were planned, and the workshop in St. Petersburg was the first in this series.

The leadership and support of GOFC-GOLD was instrumental in planning these workshops. Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) is a coordinated international effort working to provide ongoing space-based and in-situ observations of forests and other vegetation cover for the sustainable management of terrestrial resources and to obtain an accurate, reliable, quantitative understanding of the terrestrial carbon budget. Regional networks are an integral part of GOFC-GOLD; they are crucial for sharing resources and expertise and perform an essential crosscutting role in the implementation of GOFC-GOLD's thematic components. The regional networks provide a forum for users and researchers operating in (or with an interest in) a common geographic area, and represent a link between national agencies and user groups and the global user/producer community. GOFC-GOLD leaders supported the idea of organizing a regional information network in Northern Eurasia (Northern Eurasia Regional Information Network or NERIN).

The development and implementation of Northern Eurasia Earth Science Partnership Initiative (NEESPI http://neespi.gsfc.nasa.gov/) shaped the thematic foci of the workshop. NEESPI seeks to establish a large-scale, international, interdisciplinary program aimed at developing a better understanding of the interactions between ecosystem, atmosphere, and human dynamics in Northern Eurasia. A major factor in the success of NEESPI is the development of a network of scientists and institutions capable of conducting the research needed to address key science questions of global significance in Northern Eurasia. The Draft NEESPI Science Plan notes that

monitoring and modeling change in terrestrial ecosystems requires a practical method to map land cover types, biomass stores, and other land surface attributes and processes in a timely fashion. Due to the sheer size of Northern Eurasia region, remotely sensed satellite data are critically important for studying these changes, however their potential has not been fully used to date. This is in large part due to the difficulty in locating and accessing *in-situ* data sets and integrating them with remotely sensed data.

Several research and operational networks in the region continuously collect ground data intended to meet a wide range of national, regional, and local information needs. These networks can benefit from using modern remote sensing technologies whereas *in-situ* data sets generated by these networks are potentially very useful for validation of remotely sensed products, including those designed to meet the needs of global change research. To facilitate the use of these *in-situ* data and their integration with satellite observations, it is necessary to discuss the issues of data ownership and accessibility. It is also important to evaluate existing *in-situ* and remotely sensed data resources and assess their utility for specific applications. While some of that work has been included in individual research projects, a concerted region-wide effort is clearly needed to develop strategies for leveraging extant *in-situ* and remotely sensed data resources for validation of GOFC/GOLD- and NEESPI-relevant products. The regional GOFC/GOLD Workshop was held February 23-26, 2004 in Repino, near St. Petersburg, Russia as a step towards organizing this effort.

The following report is the summary based on discussions leading up to the workshop, observations during the workshop, presentation materials submitted by participants, reports from session co-chairs, and follow-up discussions.

2. Workshop Objectives and Preparation

The overall goal of the workshop was to promote the development of research infrastructure in support of NEESPI (http://neespi.gsfc.nasa.gov). In particular, the workshop aimed to initiate the development of the Northern Eurasia Regional Information Network (NERIN) as a network of scientists and institutions capable of supporting NEESPI research agenda. In addition to this organizational objective, the workshop also included presentations intended to inform participants of the availability of remote sensing and *in-situ* datasets, evaluate several major operational and research datasets, encourage information exchange and interdisciplinary collaborative research among research teams active in the region. The geographical focus of the workshop was on the boreal region of Northern Eurasia; a separate workshop for the non-boreal region is planned for August 2004 in Rostov-on-Don, Russia. The workshop was hosted by the St. Petersburg Forest Academy that trains specialists and grants advanced degrees in different disciplines related to the forest sector. In this disciplinary field The Academy is the largest and the oldest academic institution in Russia.

The Organizing Committee of the workshop included (alphabetical order, those who attended the workshop in **bold**):
Dr. **Alan Belward**, Joint Research Centre, Italy
Dr. **Sergey Bartalev**, Space Research Institute, Moscow, Russia

Dr. Valery Bondur, Space Committee of RAS, Moscow, Russia
Dr. **Donald W. Deering**, NASA Goddard Space Flight Center, USA
Dr. Congbin Fu, Institute of Atmospheric Physics, Chinese Acad. Sc, China
Dr. **Alex Georgiadi**, Institute of Geography, Moscow, Russia
Dr. **Vladimir Gershenzon**, ScanEx, Moscow, Russia
Dr. **Garik Gutman**, Manager, Land Cover-Land Use Change Program, NASA, USA
Dr. **Tuomas Häme**, VTT Information Technology, Remote Sensing, Finland
Dr. Herve Jeanjean, CNES, France
Dr. **Raino Heino**, Climate Finnish Meteorological Institute, Finland
Dr. Alexander S. Isaev, International Forest Institute, Moscow, Russia
Dr. **Chris Justice**, University of Maryland, USA
Dr. **Olga N. Krankina**, Department of Forest Science, Oregon State University, USA
Dr. Michael Brady, Natural Resources Canada, (GOFC GOLD Project Office)
Dr. **Jeffrey G. Masek**, NASA GSFC, USA
Dr. Chris Schmullius, FSU, Jena, Germany
Dr. **John Townshend**, GOFC Chairman, University of Maryland, USA
Dr. **Leonid A. Vedeshin**, RAS, Moscow, Russia

The workshop agenda (Attachment 1) covered the major thematic components of NEESPI Science Plan with particular relevance to the boreal region of Northern Eurasia (a separate workshop with non-boreal focus is planned for August 2004). *In-situ* datasets were presented in two sets of break-out sessions: operational datasets were presented in *break-out session 1* with groups split by data type: (1) Land Cover and Land Cover Change: survey data; (2) Hydrometeorology and other monitoring networks. Scientific datasets were presented in *break-out session 2* with groups split geographically: (1) Cold land and coastal zones; (2) Forest zone. Remotely Sensed data were presented at a special plenary.

The workshop focused primarily on remotely sensed and *in-situ* data collected and archived by existing operational and scientific observational networks, but datasets from individual projects and scientists were also included. In preparation for the workshop, the invited participants were asked to provide information about their data holdings by filling in the METADATA ENTRY FORM http://wwwdata.forestry.oregonstate.edu/MDEDIT/teamform.aspx . The summary of entries was presented at the workshop.

The list of invitees (Attachment 2) was developed to include representatives from the major known networks charged with collecting operational and scientific *in-situ* data, providers and users of remotely sensed data, scientists leading the development of NEESPI Science plan, and representatives of agencies that support GOFC-GOLD and NEESPI. The invited participants included representatives from Russia, USA, Finland, Austria, Japan, Italy, and France. Participants from Germany and China could not attend due to visa difficulties.

3. Overview of Presentations and Discussions

Oral presentations at the workshop were planned to address the specific topics outlined below. An opportunity to present posters was offered to all interested participants. Abstracts of oral and poster presentations were distributed at the workshop (Attachment 3).

Plenary Session 1: Setting the stage. The overview of NEESPI Science plan by Dr. Groisman emphasized the observed past and predicted future changes in regional climate, the large role Northern Eurasia plays in global carbon, energy, and water balance, and a set of processes with particular importance for Northern Eurasia (permafrost and peatland dynamics, fresh water transport to the Arctic Ocean, coastal erosion, aridization, and aerosol production). The presentation concluded with a set of objectives that included the integration of different types of observational data as a tool for addressing the science questions and to meet the society's needs for information, management, and mitigation of natural disasters. Dr. Deering provided an overview of NEESPI program and Dr. Justice presented an overview and status of GOFC-GOLD with a special focus on the significance of regional networks (as a forum for data producers and users to interact and assess current data availability and prioritize additional regional data requirements, as a forum for global change and resource managers to improve communication, as a mechanism for involving regional scientists and users in product accuracy assessment, as a mechanism for lateral transfer of technology and applications experience). These presentations gave a critically important introduction for participants who were new to these programs and set the stage for the workshop.

Plenary Session 2: Data Needs and Availability for Major NEESPI Thematic Components was described by the leaders of writing teams who developed the respective chapters for NEESPI Science Plan (See Agenda). While the presentations differed in their emphasis on science background and data needs, the following needs and gaps were brought up by the speakers:

1. Data on past and ongoing changes in landcover linked to data on processes and forces that drive landcover change, including physical, biogeochemical, and socio-economic processes.
2. Addressing known deficiencies of available *in-situ* data: lack of compatibility of definitions among data collected by different agencies, incomplete coverage, unknown accuracy and biases, obsolete data and classifications, changes in protocols over time, availability of some datasets in hard copy only, lack of organization and funding for sound quality control and data management
3. Maps of land-cover at high (sub-grid) resolution are critically important for simulating heat and moisture fluxes; high temporal resolution is also important for many research issues.
4. Data and methods for historic reconstructions and for continuous future space-based monitoring of land cover, snow/ice cover, vegetation function, and permafrost.
5. Data to improve understanding of interaction among climate, vegetation, and permafrost, in particular the thermal properties of soils
6. Data on species and ecosystem tolerance to the effects of climate change is necessary for projecting the ecosystem responses
7. Data for examination of complex interactions among multiple factors and feedbacks is often unavailable due to narrow disciplinary focus of the bulk of past research
8. Maintaining long-term observations is critically important
9. The lack of data on natural sources of aerosols, dry deposition of air pollutants, and routine monitoring of air quality outside the major cities limits progress in understanding the role of aerosols

Several speakers emphasized the importance of research that spans disciplines and spatial scales. Established international programs, projects, and networks including IGBP (International Geosphere-Biosphere Programme); GCTE (Global Change and Terrestrial Ecosystems) IHP (International Hydrological Programme); BOREAS (Boreal Ecosystem-Atmosphere Study) WCRP (World Climate Research Programme); WGNE, WGCM, CLIVAR, CliC, GEWEX, and corresponding MIPs (Model Intercomparison Projects); BAHC (Biospheric Aspects of Hydrological Cycle); CHAMP (Community-wide Hydrological Analysis and Monitoring Program); SEARCH (Study of Environmental Arctic Change) can serve as major sources of data relevant to NEESPI. The task of identifying critical gaps in data requires a major coordinated interdisciplinary research effort such as NEESPI.

Better understanding of available data resources is critical for planning new research and data collections. In preparation for the workshop, the inventory of available datasets was conducted. For purposes of this inventory, the data was categorized into remotely sensed and *in-situ*. The ***remotely sensed data inventory*** presented by J. Masek included "limited coverage" sources (Landsat, SPOT, SAR, etc.) for the territory of Northern Eurasia and links to global data sets relevant to NEESPI. The ***in-situ data inventory*** included 71 entries that varied from links to established observational networks to data from individual projects and sites. While the inventory of remotely sensed data was quite comprehensive and availability of data could be clearly defined in most cases, the inventory of *in-situ* data represented only the beginning of the effort needed to assess the available data resources. The issues of data availability and access were further addressed in discussions.

Breakout Session 1: Operational In-situ Data focused on existing **operational** observational networks, including forest and land inventory, hydrological and meteorological networks, and soil and peat surveys. These archives and existing capacity of operational networks to collect new data is of critical importance for global change research and for meeting the needs of continental-scale science programs including NEESPI.

Group 1 : co-chaired by S. Bartalev and C. Justice examined data sets concerned with *Land Cover and Land Cover Change.* Presentations covered the availability, characteristics and limitations of various sources of data for Russia only; similar data does exist in other NEESPI countries and needs to be included. Presentations and discussions covered forest inventory data, wild fire monitoring and reporting, a dataset on insect outbreaks for the St. Petersburg region, several datasets on peatlands, and historical maps and surveys. Additional types of operational *in-situ* data to be discussed were identified: cadastral data; socio-economic, census data, land tenure; biodiversity data; agrometeorological data. The group discussion stressed the need to clarify the issues of data access and management (policy/formats/metadata/distribution); however the group felt that finding solutions requires the involvement of the broader NEESPI community.

Group 2 : co-chaired by R. Heino and A. Shiklomanov examined hydrological, meteorological, and data from other monitoring networks, including a set of national networks in Russia and former Soviet Union that measure meteorological attributes, snow cover, soil temperature, soil moisture, urban air pollution, precipitation chemistry, aerosols, atmospheric electricity, CO2 concentration (a single station remains), ozone, solar radiation, heat balance (observations suspended in 1990's), wetland hydrology and other wetland attributes, hydrological attributes of

lakes and reservoirs, attributes of glaciers, surface evaporation and water balance. Many of these networks contribute to global networks and data banks (Global Soil Moisture Data Bank, AeroNET, World Glacier Monitoring Service, Global Run-off Data Center). Presentations provided thorough network overviews including the sets of measurements, frequency of observations, time intervals covered, network establishment and decline. After years of rapid decline in 1990's the networks appear to stabilize and the availability of data in electronic form increases over time. Nevertheless, many important (mostly specialized) datasets exist in paper copy only. To increase the visibility of network data and facilitate contacts between data holders and potential users the group suggested that the data sets are catalogued at NEESPI web site and the following information is provided: List of stations with attributes; List of measured parameters Contact information.

There is generally more operational data available than the capacity to analyze and manage it, some data were lost over time, some are currently at risk. The group discussions concluded that the major challenge for the NEESPI community is formulating the science agenda and framing research that takes advantage of observational data. This would bring attention and help in securing the resources needed for maintaining the capacity to continue the observations. The utilization of some historic datasets by active research programs may provide the much needed funds to ensure their preservation.

Plenary Session 3: Remotely Sensed Data was co-chaired by V. Gershenzon and J. Masek and included a detailed overview of data available from global passive optical observatories (high and coarse resolution), microwave, and other sensors. To quote the conclusions of Alan Belward, global land cover mapping is a reality: but the myth that up-to-date, accurate global land cover maps are easy to produce and always available persists; both thematic maps and biophysical products are needed on the global scale; the processes to guarantee this availability are beginning; these must be developed.

Poster Session: Research Data highlighted several important datasets collected by research projects and programs. Several posters provided additional details for datasets presented in breakout sessions.

Breakout session 2 – Research Data and Priority Data Needs focused on data collected by research networks and individual research projects in the boreal zone of Northern Eurasia.

Group 1 was co-chaired by A. Georgiadi and S. Victorov. It reviewed several international programs that produced extensive data collections (CALM, GAME/Siberia, SIBERIA, IGBP Arctic climate impact assessment (ICAI), proposed Environment Assessment Network for the Northern Russia, Siberia and the Far East). Some of these programs provide free data on their web sites and on CDs. There are also important data sets collected by national research programs, experimental stations, field campaigns and research expeditions; these data were published in part but access to un-published part is restricted.

Group 2 was co-chaired by Susan Conard and Nadezhda Tchebakova. Presentations provided a broad overview of International Partnerships including IGBP, IBFRA, other activities and Programs. IGBP activities include 5 high-latitude transects, which are discussed in IGBP Report

#37; two of these transects are in Russia; most data resides at Krasnoyarsk Institute of Forest. Other important programs include the Russian National Programs "Global Change of Environment and Climate" and "Russian Forests"; the EU funded projects CARBOEUROPE and TCOS SIBERIA. In addition, there is a number of major projects that can provide data for NEESPI: SIBERIA (SAR Imaging for Boreal Ecology and Radar Interferometry Applications) and SIBERIA-II, The Terrestrial Biota Full Carbon Accounting for Russia (IIASA & Russian Institutions), The Terrestrial Biota Full Greenhouse Gases Accounting for Russia (IIASA & Russian Institutions), projects funded by Japan in West Siberia and Russian Far East, projects funded by USA in European North-West, Central Siberia, and Russian Far East. The Siberian Center for Environmental Research and Training (http://scert.ru) developed web-based access to many data and information sources including ATMOS—portal for atmospheric data and models (http://atmos.iao.ru) and a less technical sites on Siberian environment (http://atmos.scert.ru/) devoted in particular West Siberia (http://west-sib.atmos.scert.ru/) and Lake Baikal (http://baikal.atmos.scert.ru/). One of them includes a distributed geographic information system (http://west-sib.atmos.scert.ru/gis/) giving an access to digital maps of Siberia. The center has good connections with other research centers (e.g. Krasnoyarsk) and cooperation between NEESPI and ongoing Siberian database initiative can be developed. An example of long-term sites is Ladoga Region Landscape Ecological Field Station established in 1991 to look at trends in vegetation, disturbance, human impacts in taiga landscapes (forest succession following fire and abandonment of farmland). Broad-scale estimation of the effects of fire in boreal forests requires integration of experimental data, field and remote sensing observations, and models. Scaling up to satellite data through a combination of data analysis and interpretation, field validation, intermediate-scale remote sensing, and modeling requires data at a range of scales and involvement of collaborators from a broad range of disciplines and expertise.

The group discussion addressed several aspect of data access: restrictions for foreigners on using or collecting aerial data, the need to identify when and how it is appropriate to make data from research projects available (This can be solved at least in part with appropriate collaboration or agreements with data providers at higher levels, e.g. NASA data buys), data sets in Russia are mainly the property of institutions, but there are strict regulations about transport and exchange of data. Establishing what data are necessary to pay for and what are freely available is an important aspect of data inventory. Don Deering is working with the RAS to try to get permissions and umbrella agreement for the NEESPI project; in the interim we need to improve information exchange on current restrictions and regulations and look for ways to work together successfully. Major data needs include historical reference data bases, mechanisms to update currently available sets, development of a uniform set of ground truth information for all sensors, inventory of available map-based (spatial) information and data sources. A major dis-incentive to share the data is the current approach to developing collaborations with scientists in Russia and other countries in Northern Eurasia: the access of a scientist to unshared data is often his pass to international projects/support. Understanding of necessity to share environmental data is slowly developing, but establishing incentives to share data and otherwise meet the needs of scientists is important.

The *General Discussion* of plans for NERIN started with a presentation by John Townshend who outlined pluses and minuses of building a data and information network. He also emphasized a set of prerequisites for building a successful network (ownership of the network by those within the region, high-level "political" support, consensus among members on goals and priorities,

involvement of operational and scientific stake-holders, early "adopters" (both individuals and institutions) who are willing and capable to take on key network responsibilities, some additional resources for "network glue" must be available). The following immediate next steps and questions were offered for discussion:

- Several NERIN/NEESPI planning meetings – time for action.
- Based on NEESPI priorities initially
    - What data are currently available and accessible?
    - What are the key gaps in data requirements that can be filled simply by improving access?
    - What are the key gaps that need additional data collection?
- Who institutionally and/or individually is willing to be a founding contributor to NERIN?
- Where are the key opportunities for external funding?
    - What international partnerships need to be fostered to improve likelihood of success?
- What is the model (or models) of data sharing in the network to be adopted?

Workshop participants addressed these and several other issues. The following major points were made:

- there is a high level of uncertainty regarding the goals and the scope of the proposed network and of NEESPI;
- science goals should define priorities and requirements for data and products; to establish data priorities it is important to formulate science priorities first;
- it is important to coordinate with other working groups to avoid duplication; links to other active groups need to be established and maintained;
- a pilot project or projects and expanded collaborative research is needed to work out specifics of data sharing and to make more people comfortable with the idea; positive experience with fire network indicates that this can be done;
- for many scientists data sets sharing is problematic because of legal restrictions; high-level agreements are needed to overcome those;
- scientists from the Russian Academy of Sciences are willing to help resolve problems with data sharing by providing a legal framework for NEESPI, what is needed to make this happen is a concise set of tasks and priorities adopted by NEESPI community;
- many things can be done right away without waiting for official approvals; we can catalogue data and provide links to data holders and to data that is already available;
- the network can rely on established data centers; the following expressed interest in participation: IIASA, historic GIS collection at the Institute of History of Natural Sciences, Center for Environmental Research and Training in Tomsk, Transparent World (Scanex), meteorological data centers
- Data exchange starts with data awareness; getting the data out is a minimal but useful start
- Many scientists are very interested in sharing their data and finding new applications for it. It is important to engage data producers in research projects because full knowledge of the data is essential for its sound use.

4. Conclusions, Recommendations, and Follow-up Activities

The following conclusions and action items were proposed by Olga Krankina based on general discussion and additional suggestions from participants:

1. Many years of research and operational data collection in Northern Eurasia produced a large body of knowledge and data that can be available to support new research within the thematic range of NEESPI. The presentations at the workshop provide a thorough overview of data availability primarily in the boreal part of Northern Eurasia. These presentations can serve as reference material for a wide range of users. It is recommended that they be posted on the web along with this report and attachments. The workshop and the data inventory effort improved the understanding of available data resources and identified several major data needs. More focused and specific evaluation and prioritization of data needs is contingent on building consensus within NEESPI-NERIN community regarding the science priorities and objectives of NEESPI.
2. As a result of a series of GOFC-GOLD workshops and meetings focused on development of NEESPI Science Plan, NERIN has emerged as an informal network of:
    a. scientists and other professionals,
    b. institutions and observational networks,
    c. projects within the thematic scope of GOFC-GOLD and broader scope of NEESPI
    d. network of points of contact for data users.
3. As a first step towards a formal coordination of NERIN, regional inventory of observational data was initiated. Metadata on available data sets with associated links is to be provided on a Web site. It is important to continue the inventory to include the non-boreal region and data sets that were not included to date.
    a. As a follow-up activity, all the data sets presented at the workshop will be included in the METADATA
    b. To avoid duplication with other networks and data centers, those sets already documented and/or available on the web will be represented in METADATA primarily by links
4. To strengthen the network it is critical to maintain active network projects
    a. on-going fire-validation network project distributed across the regions works on comparing and validating the moderate resolution active fire and burned area products (e.g. AVHRR, GBA, MODIS, Vegetation) using high resolution remotely sensed (e.g. ASTER, BIRD, Landsat) and *in-situ* data
    b. Proposed land cover change pilot project with multiple sites distributed across the region can use 30m resolution data from multiple time periods and standard classification and change detection procedures. The objective of the study is to serve 3 goals
        i. provide a detailed study of the different types of land cover and land use change significant in different parts of Northern Eurasia
        ii. provide validation of the moderate resolution land cover and land cover change products
        iii. provide participants with image processing and team work experience
    c. Develop a network project for biophysical studies in parallel with the development of this component within GOFC-GOLD
5. It is important to have a system of network coordination and support within the region. Following the overall structure of GOFC-GOLD the network would have two components:

fire (POC (point of contact) E. Loupian) and land-cover (POC TBD, possibly separate for remotely sensed and *in-situ* data).

6. The workshop provided a forum for networking among participants, for planning interdisciplinary research, and expansion of global networks (e.g. Aerosol monitoring network)
7. Data sharing is consistently increasing within the NERIN community, further progress is constrained by the uncertainty of the formal status of NEESPI, complicated regulations of data ownership and intellectual property rights in Russia, dis-incentives built into the system of funding collaborative research, lack of funding for collecting the data within the region. Don Deering is currently working on obtaining formal recognition and support for NEESPI from the Russian Academy of Sciences.
8. A concerted outreach effort is needed to expand the NERIN community beyond Russia. Planned workshop for the non-boreal zone will address that need and also cover several types of data that were not represented at the workshop (soils, socio-economic data, tundra ecosystems, national-level forest health monitoring). In addition, planning meetings in small groups are important to reach additional teams and institutions working in the region.
9. The need for review and assessment of methods for linking *in-situ* and remotely sensed data was stressed at this and at earlier GPFC workshops in the region; the idea was also supported by co-leader of GOFC-GOLD Landcover Implementation Team Christiana Schmullius. Tuomas Hame and Olga Krankina developed early plans for the methods workshop; mid-2005 would be a good time to convene it.

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