



# **Report on the Fourth Meeting of the GOFC-GOLD Regional Networks**

as part of the  
GOFC-GOLD Symposium on Forest and Land Cover Observations

Friedrich-Schiller University  
Jena, Germany  
25 March 2006

Edited by  
M. Brady and E. Naydenov



**GOFC-GOLD Report No. 29**

GOFC-GOLD Project Office  
Edmonton, Canada  
March 2007

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>

## **Summary**

As described in its Revised Strategic Plan<sup>1</sup>, the panel for Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) carries out its programme through implementation teams that work closely with a series of Regional Networks. The Networks provide a forum for regional scientists, data providers, and operational users to articulate their information requirements and improve access to and use of the observations (Justice et al., 1999)<sup>2</sup>. The Strategic Plan notes that where possible GOFC-GOLD should form strategic partnerships with other networks and organizations, which share at least some of the goals of the organization, including START and the IGBP Regional Network.

The report describes the results of the 4<sup>th</sup> meeting of the GOFC-GOLD Regional Networks held on 25 March at Jena Germany. Three previous meetings of the Regional Networks were held in March 1999 at Washington, DC (GOFC-GOLD Report 5), March 2003 at Ispra (GOFC-GOLD Report 17), and April 2005 at Beijing (GOFC-GOLD Report 21). The work of the Regional Networks is also addressed in GOFC-GOLD Reports 6, 7, 9, 10, 18, 22 and 23.

The meeting addressed the following issues and recommended actions.

- GOFC-GOLD guidance for Regional Networks
- Calibration/validation test site networks
- Regional Network role in international environmental conventions
- Regional Networks role in implementation of GEOSS
- Linking network activities to national priorities and requirements
- Network sustainability and capacity building strategies

The regional network meeting also provided an opportunity to synthesize and apply the results of the GOFC-GOLD land cover symposium, which took place immediately beforehand.

---

<sup>1</sup> Townshend, J., et al. (2005). A Revised Strategy for GOFC-GOLD.

<sup>2</sup> Justice, C.O., F. Ahern, and A. Freise (1999). Regional Networks for Implementation of the GOFC Project in the Tropics, GOLD-5/START-4, Washington, D.C., 15-17 March 1999.

## **Table of Contents**

Summary .....	iii
Table of Contents .....	iv
1. Introduction .....	1
Regional Networks Overview .....	1
Development Approach .....	2
Questions Addressed at the Meeting .....	3
2. GOFC-GOLD Overview .....	3
Rationale .....	3
Strategic Guidance for Regional Networks .....	5
3. Roles of Regional Networks in Relation to GOFC-GOLD and to National Priorities .....	13
Eurasia Regional Network Activities and Recent Initiatives - NERIN .....	13
The Role of Regional Networks in Supporting National Priorities and Reporting Requirements - SAFNET .....	16
Regional Network Expectations of GOFC-GOLD - SEARRIN .....	20
South American Regional Network - REDLatif .....	23
Digital Asia and Sentinel Asia: Links to an East Asia Network .....	25
4. New Areas for Regional Network Collaboration with GOFC-GOLD Implementation Teams ..	27
Calibration and Validation of Land Cover Products .....	27
National Involvement in GEO and the UN Conventions .....	29
5. Resourcing the Regional Networks .....	32
SysTem for Analysis, Research and Training for Global Change (START) .....	32
United Nations Environment Programme (UNEP) .....	33
6. Organizational Issues, Opportunities and Planning .....	34
Scientific and Technical Opportunities .....	35
Planning .....	35
7. Appendices .....	37
Appendix 1. List of Participants .....	37
Appendix 2. Agenda .....	39
Appendix 3. List of Presentations .....	41

## 1. Introduction

Six sessions were included in the 4<sup>th</sup> meeting of the Regional Networks of the panel for Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD). The first provided an overview of the Regional Networks and the objectives of the meeting. The second session reviewed the new strategic directions, plans and requirements of GOFC-GOLD. Also addressed were panel expectations for the Regional Networks and the implications of the Jena 2006 Land Cover symposium workshop results. The third session involved discussions of the changing roles and responsibilities of the Regional Networks and national priorities. Five Regional Networks were reviewed, including their network expectations of GOFC-GOLD. New areas for regional network collaboration were reviewed in session four by two members of the Land Cover Implementation Team, while session five discussed resources available to support activities. The last session discussed thematic issues, opportunities and planning.

The meeting was opened by Michael Brady (Executive Director, GOFC-GOLD) and Murugi Larsen (Regional Network Coordinator). Each of the participants introduced themselves (listed in Appendix 1). Murugi Larsen reviewed the agenda of the meeting. Following a brief discussion, the agenda was approved (Appendix 2).

### ***Regional Networks Overview***

Murugi Larsen summarized the current status of the Regional Networks and questions for the meeting to discuss. Further details are in Presentation 1 (a complete list of presentations is in Appendix 3). The networks summary was based on reports from each Regional Network during the GOFC-GOLD Scientific and Technical Board (STB) meeting in April 2005, which can be viewed at [http://nofc.cfs.nrcan.gc.ca/gofc-gold/STB3\\_Report/GOLD\\_21.pdf](http://nofc.cfs.nrcan.gc.ca/gofc-gold/STB3_Report/GOLD_21.pdf).

It was also agreed that the meeting would identify action items during discussions and that these would form the basis for follow-up activities to the meeting. Actions are identified throughout the report and listed by responsible groups in Appendix 4.

There are seven Regional Networks collaborating with GOFC-GOLD located in Asia, Africa and South America. A new Regional Network in East Asia is under development.

***Miombo*** (Central and Southern Africa) was founded in 1995 under the auspices of the IGBP, LUCC and START. More than 40 scientists and natural resources managers are involved. Miombo's focus is on land cover activities.

***SAFNet*** (Southern Africa) was initiated in 2000 during a GOFC-GOLD regional network meeting. More than 60 members from 12 southern African countries participate in SAFNet's activities on fire.

***SEARRIN*** (Southeast Asia) was initiated during the Manila workshop in 2000. Activities have involved more than 60 scientists and natural resources managers. SEARRIN activities include both fire and land cover.

***NERIN*** (Eurasia) was initiated at the GOFC-GOLD Boreal Forest workshop in Novosibirsk, Russia in 2000. It has over 50 scientists and natural resources managers involved in fire and land cover activities.

***REDLATIF-Fire*** is a Latin American network based around interest in a regional burned area project. REDLATIF has recently initiated land cover activities.

**West Africa** network had initial discussions focused on land cover and is now discussing a joint collaboration with fire. The initial workshop took place in 2005.

**Central Africa** network was initiated at the GOFC-GOLD regional workshop in 2000. This network is linked to the GIS/RS lab at the University of Kinshasa, and is focused on land cover with some fire activities.

**East Asia** network focuses on both land cover and fire. The initial workshop was in 2005 and a follow up meeting took place in Mongolia in June 2006.

## **Development Approach**

The GOFC-GOLD Regional Networks typically rely on one or two regional champions, who are practitioners interested in helping develop and oversee the network, preferably with institutional backing.

An inventory of groups, active projects, and activities in the region should be developed. Some of the Networks have developed website, which include lists of projects with points of contact, links to the data provider's websites, and that identify the primary information users and stakeholders.

Organize an initial regional workshop. This helps to identify interested parties, potential players, and national points of contact. A workshop will also enable the identification and prioritization of regional requirements, needs and issues. GOFC-GOLD resource people should participate in the workshop to give updates on recent or planned developments. The workshop will help outline some initial activities for the network that are built around the prioritized requirements, such as improved data provision and access, product evaluation and validation, and training courses. Potential funding sources for the network should be identified and joint proposals should be considered.

A follow up meeting with a focused thematic workshop should be planned for within 12-18 months following the initial workshop. The focused workshop should seek to outline a science or application plan, identify potential funding mechanisms and sources, and increase participants as needed to support the program.

Following the thematic meeting a plan should be developed for continued support of network activities and workshops.

## **Co-benefits**

Benefits for Regional Network participation in GOFC-GOLD include technology transfer, access to international datasets, data sharing between members and countries, regional cooperation for harmonized regional datasets, focal point for science campaigns and investments, increased visibility of institutions and participants, participation in international research programs and opportunities for student exchange.

## **Regional network needs**

Regional Networks require training and capacity building, adequate funding for administration and program's, standardization of regional monitoring mechanisms and systems, improved access to earth observation (EO) data, improved dissemination of data to national and sub national levels, improved product validation based on standardized protocols, stronger program and scientific coordination with the implementation teams, improved internet access and capacity, and a better understanding of other EO projects in the region.

## **Key issues and recommendations from the STB meeting**

The 2005 STB meeting identified several issues and recommendations for Regional Networks. The STB recommendations included: 1) GOFC-GOLD should define minimum requirements for Regional Network participation; 2) participation should be fostered in the development of a calibration and validation test site network; 3) Regional Networks should become prepared to provide guidance and contributions to national carbon reporting in the post 2012 period (UNFCCC COP11 meeting); 4) Regional Networks should participate with GOFC-GOLD in the implementation of GEOSS and other international conventions; 5) network activities should be linked to national priorities and requirements; and 6) network sustainability and capacity building strategies should be developed and implemented.

## ***Questions Addressed at the Meeting***

1. How do we manage the balance between fire and land cover thematic interests of the Regional Networks in the future?
2. How do we engage the Regional Networks in the UNFAO FRA 2010 and the conventions?
3. How do we engage the Regional Networks in validation efforts?
4. How best to engage the Regional Networks in the tasks GOFC-GOLD is delivering to GCOS, GEO and other constituents?
5. How do the Regional Networks become more self-supporting and sustainable? While recognizing the continued need for and advantage of coordination and cooperation at the regional scale through:
  - core funding from large network proposals, and
  - regional projects supporting network activities.
6. What should be the future priorities for GOFC-GOLD Vice-Chair in regional fire and land cover network development?

## **2. GOFC-GOLD Overview**

Michael Brady provided an overview of the organization and activities of GOFC-GOLD and expectations for the regional Networks (Presentation 2).

### ***Rationale***

The need for reliable land cover information has never been stronger. Land cover information is a key in supporting international agreements, such as the Convention on Biodiversity and FCCC, natural resource management and sustainable development.

Scientific requirements include:

- carbon cycle;
- other biogeochemical cycles;
- hydrological cycle;
- understanding of vulnerability of human societies; and

- drivers of land cover change.

There are many uncertainties concerning land monitoring. National capabilities to monitor forests and land cover vary. Remote sensing data are often unavailable due to the cost and limitations in satellite acquisition strategies. Inconsistent definitions and protocols also create uncertainties.

Different definitions and protocols include:

- FAO 2005: tree canopy cover > 10%;
- many forest agencies IGBP: tree canopy cover > 60%; and
- forestry agencies: 35-40% but harvestable lands, actual or potential.

## GOFC-GOLD organization

GOFC-GOLD is a coordinated international effort to ensure a continuous program of space-based and on-the-ground forest and land cover observations for global monitoring of terrestrial resources and the study of global change. GOFC-GOLD is a network of participants implementing coordinated research, including demonstration and operational projects (Figure 1). GOFC-GOLD's vision is to share data, information and knowledge, leading to informed action and decision support. This effort is a long term process of building an improved match between observations, data products and user needs.

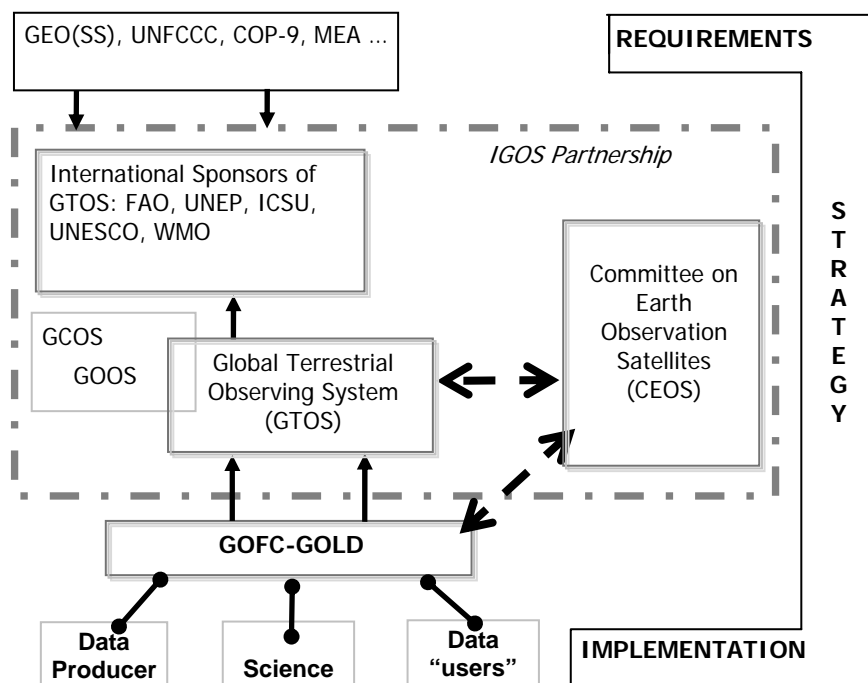


Figure 1. Context of GOFC-GOLD within Earth Observation community.

Regional Networks are a critical component of the implementation of GOFC-GOLD. Regional Networks provide the interface between the panel and national level data users and needs.



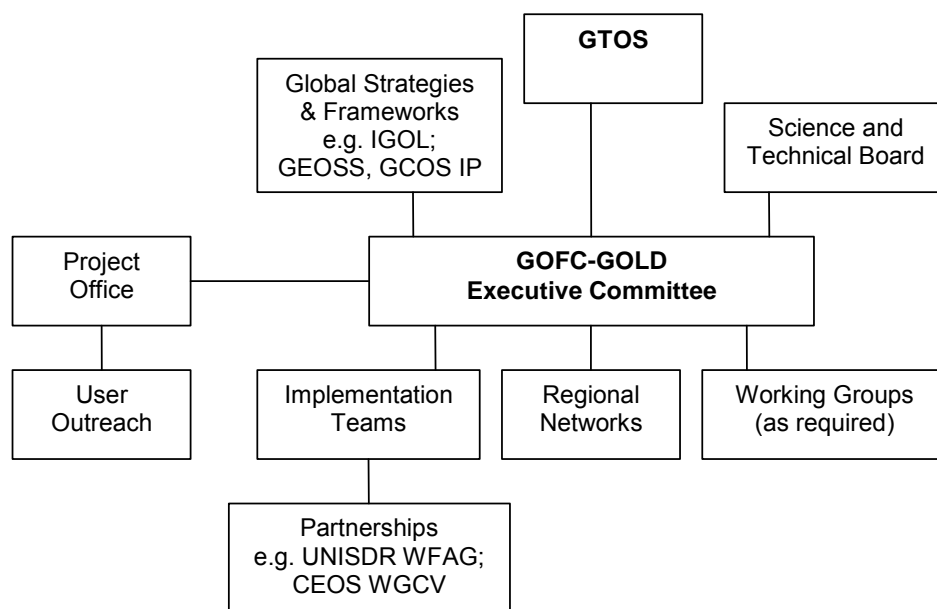


Figure 2. Regional Networks within the structure of the GOFC-GOLD panel of the Global Terrestrial Observation System (GTOS).

### ***Strategic Guidance for Regional Networks***

From the perspective of the GOFC-GOLD Scientific and Technical Board and Implementation Teams, the following guides have been identified for the Regional Networks and are explained below:

1. Amongst others, adopt the goals and functions of GOFC-GOLD
2. Establish membership throughout region
3. Minimize duplication with other networks in the region
4. Develop outreach strategy and promote achievements for mutual benefit
5. Become knowledgeable of GOFC-GOLD EO approaches
6. Maintain inventory of regional data sets and maps (land/fire)
7. Establish network structure and planning mechanisms
8. Articulate regional and national needs for EO information, advisory support and capacity strengthening
9. As able, participate in both GOFC-GOLD themes and IT activities, and ensure their relevance to the region.
10. Maintain regular communication with members, ITs and Executive Committee.
11. Define support required to strengthen network and participate in activities to foster such support, including joint proposals.

The background and link to the GOFC-GOLD functions are explained below for each of the guides.

### **Guide 1 - Amongst others, adopt the goals and functions of GOFC-GOLD**

GOFC-GOLD is a coordinated international effort to ensure a continuous program of space-based and on-the-ground forest and land cover observations for global monitoring of terrestrial resources and the study of global change. It is a panel of the Global Terrestrial Observing System (GTOS). By promoting and supporting participation on implementation teams and in Regional Networks, GOFC-GOLD encourages countries to increase their ability to measure and track forest and land cover dynamics.

GOFC-GOLD conducts pilot projects and develops products at regional and global scales in two thematic areas: Land Cover Characteristics and Change; and Fire Monitoring and Mapping. The 1999 Strategy was revisited in 2005 to ensure the global systematic collection of observations of land cover and fire. There are nine key GOFC-GOLD functions:

1. Specifying requirements for products.
2. Assessing algorithms and data assimilation procedures.
3. Ensuring the availability of observations.
4. Harmonization and the development of protocols and standards.
5. Ensuring that operational products meet accuracy requirements.
6. Capacity building and the role of Regional Networks.
7. Creating GOFC-GOLD products and services.
8. Providing information to support international assessments.
9. Advocacy role, especially in relation to the continuity of observations and validation.

The last function of advocacy is a particularly important role for the Regional Networks as EO issues and constraints to their use are likely to be different in each region and can be addressed effectively through regional cooperation. An example of an advocacy activity is the leadership role GOFC-GOLD is playing in the development of the Global Earth Observation System of Systems (GEOSS). In particular, in the work plan of the Group on Earth Observations (GEO) GOFC-GOLD contributes to a task, which advocates for establishing continuity for near real-time, 30-m (or better) resolution, multi-spectral remote-sensing coverage everywhere on the Earth's surface, including support for the launch of a Landsat-equivalent follow-on mission.

### **Guide 2 - Establish membership throughout region**

Regional Networks provide the interface between the panel and national level data users and needs. Thus it is important to establish national members throughout a region. National points of contact and participants will enable a robust identification and prioritization of regional requirements, needs and issues, such as improved data provision and access, product evaluation and validation, and training courses.

While the outcomes of Regional Networks should be based on the overall goals of GOFC-GOLD, the priorities should arise from the needs of regions as identified by members of the Networks. For some regions there may be more need for enhanced delivery of land cover products, whereas

in others the priorities might be fire products. Some regions may choose to have separate land cover and fire organizations or may wish to combine both in a single network structure.

Analysis of the needs and constraints of each network indicates that while the Networks have some areas of common interest, many have unique needs based on differing geography and national circumstances (Table 1).

Table 1. Comparison of needs\* of GOFC-GOLD Regional Networks.

Need	GOFC-GOLD Regional Network				
	Miombo	NERIN	OSFAC	SAFNet	SEARRIN
Training and capacity building	✓	✓	✓	✓	✓
Adequate funding for administration and programs	✓	✓	✓	✓	✓
Standardization of monitoring mechanisms and systems used in the region	✓	✓	✓	✓	✓
Improved access to EO data	✓	✓	✓	✓	✓
Improved dissemination to national and sub national levels			✓	✓	✓
Improved product validation based on standardized protocols		✓		✓	
Stronger program and scientific coordination with implementation teams	✓	✓			
Improved Internet access and capacity	✓		✓		
Better understanding of other EO projects in the region			✓		✓

\*As indicated by Networks at 3<sup>rd</sup> Science and Technical Board meeting, 19-22 April 2005, Beijing, China.

### Guide 3 - Minimize duplication with other networks in the region

The GOFC-GOLD Regional Networks collaborate with several other key international organizations and programs related to earth observations. Where possible the Regional Networks should also form strategic partnerships with other networks and organizations, which share at least some of the goals of the organization, including START and the IGBP Regional Network. For example, the current GOFC-GOLD Regional Networks have established numerous partnerships and working relations (Table 2).

Table 2. Status of GOFC-GOLD Regional Networks, including international linkages.

Regional Network	Countries included	Status	International linkages	Website
Miombo Network	Angola, DR Congo, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe	The Miombo Network was founded in 1995 under the auspices of the IGBP, LUCC and START. National level activities in: Malawi, Mozambique, S. Africa, Tanzania, Zambia and Zimbabwe involving over 40 scientists and natural resources managers.	IGBP, WWF-SAPRO, IUCN, ROSA, SADC RRSU, UNFCCC, NASA LCLUC, MEA, regional NGOs, START	<a href="http://www.miombo.org/">http://www.miombo.org/</a>
NERIN	Russia, Ukraine, others under development	Initiated at the GOFC-GOLD Boreal Forest workshop in Novosibirsk, Russia, 2000. Over 50 scientists and natural resources managers involved.  Developing points of contact in the region.	Russian Federal Forest Agency, NASA, START	<a href="http://www.fao.org/gtos/gofc-gold/net-nerin.html">http://www.fao.org/gtos/gofc-gold/net-nerin.html</a>
OSFAC	DR Congo, Congo (Brazzaville), Cameroon, Gabon, Central African Republic and Equatorial Guinea	Initiated at the GOFC-GOLD regional workshop in 2000. Network linked to GIS/RS lab at the University of Kinshasa.	CBFP, WSSD, COMIFAC, US, EU, regional NGOs, START	<a href="http://www.osfac.org/">http://www.osfac.org/</a>
SAFNet	Angola, Botswana, DR Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe	Initiated in 2000 during a GOFC-GOLD regional network. SAFNET has over 60 members from 12 southern African countries.	IGBP, UNEP – DEWA /GEF, BGCC, regional NGOs, WWF, AWF, APINA, UNFCCC, IPCC, GFMC, AEO-II, START	<a href="http://safnet.umd.edu/index.asp">http://safnet.umd.edu/index.asp</a>
SEARRIN	Thailand, Indonesia, Malaysia, Philippines, Vietnam, Laos, Cambodia	Initiated during the Manila workshop in 2000. Activities have involved over 60 scientists and natural resources managers.  Conducts research on LUCC and Forest Fire.	IGBP, IHDP, CGIAR, UNDP-GEF, Asia Pacific Network, START	<a href="http://www.eoc.ukm.my/searrin/">http://www.eoc.ukm.my/searrin/</a>
East Asia	China, N. Korea, S. Korea, Mongolia, Japan	Initiated during the GOFC-GOLD third STB meeting in 2005. Network under development.	START	
REDLatif		Under discussion, with initial focus on fire monitoring.		

#### **Guide 4 - Develop outreach strategy and promote activities for mutual benefit**

To be effective the Regional Networks must provide benefit to their member countries. An outreach strategy and plan is thus essential. An example of outreach is the key function of GOFC-GOLD to ensure the availability of observations through the use of data information systems and services (DISS).

Other examples of outreach include the establishment of regular contacts with national agencies for training, development of regional protocols and cooperation, user needs assessments, etc.

Regional use of GOFC-GOLD products should be increased by Regional Networks:

- using web sites (e.g. links to GOFC-GOLD-Fire and land cover websites);
- establishing regional data dissemination nodes;
- encouraging standardization and harmonization of regional products;
- hosting outreach workshops with regional practitioners and decision makers; and
- coordinating regional capacity building and user training.

The Networks can also promote lateral transfer of technology between countries within the region and between regions through training and workshops.

#### **Guide 5 – Become knowledgeable of GOFC-GOLD EO approaches**

Regional Networks should become knowledgeable of GOFC-GOLD EO approaches and determine their application within the context of their regional conditions. The most basic approach includes specifying requirements for land cover and fire products. Examples of requirements at the global level include the 1998 GOFC-GOLD reports three and four, which outline the design strategy for coarse and fine resolution products. The GCOS adequacy reports with a focus on Essential Climate Variables (ECVs), and the Implementation Plan outline further product requirements (Table 3). Other resources available to Regional Networks include the UNFCCC/SBSTA research and systematic observations; and several GEO work plan tasks.

Table 3. GOFC-GOLD Product Specifications for Terrestrial ECVs.

Variable	Product
Land cover	Land cover 250 m
	Land cover change 10 m
	Land cover change history
	Vegetation continuous fields
Fire disturbance	Active fire
	Burnt area
	Fire radiative power

Other approaches developed by GOFC-GOLD include procedures for harmonization of map products (e.g., Land Cover Classification System, FAO) and the development of procedures for global classification validation (e.g., Best Practices Guide, Strahler et al) and validation procedures for vegetation continuous fields starting (Hansen et al 2006).

Approaches including specifying requirements and best practices are included in the Report Series in the Document pages on the GOFC-GOLD website (<http://www.fao.org/gtos/gofc-gold/>).

### **Guide 6 - Maintain inventory of regional data sets and maps (land/fire)**

A key function of GOFC-GOLD is to ensure access to data sets and maps at the global and regional levels. This includes the provision of and access to the following Global Forest and Land Cover Datasets and Projects:

- AVHRR Global Potential Land Cover Products
- Continuous Fields Tree Cover Project AVHRR
- Continuous Fields Tree Cover Project MODIS
- GISS Global Vegetation Data Set
- Global Land Cover Map for the Year 2000 (GLC 2000)
- Global Land Cover Characterization Program (GLCCP& IGBP DISCover)
- Global Forest Resources Assessment (FRA 2000)
- Global Boreal Forest Mapping Project (GBFM)
- Global Rain Forest Mapping Project (GRFM)
- Global Potential Vegetation Data Base
- International Satellite Land Surface Climatology Project (ISLSCP)
- ISCGM Global Mapping Project
- MODIS Land Cover Products
- MURAI & HONDA World Vegetation Map from UNEP/GRID
- NASA Landsat Pathfinder Humid Tropical Forest Inventory Project (HTFIP)
- USGS Global Land Cover Characterization Program
- WCMC Global Forest Cover Data Set

The Regional Networks can support such access by providing electronic links to the GOFC-GOLD websites. They can also maintain inventories and portals for regional and local data sets and map products.

## **Guide 7 - Establish network structure and planning mechanisms**

The guiding principal in the organization of GOFC-GOLD is to take maximum advantage of existing organizations and capabilities and create a minimum of bureaucracy to meet GOFC-GOLD objectives. This principle applies as well to the Regional Networks.

An example for the Regional Networks to consider when establishing their own structure is the GOFC-GOLD Executive Committee. This is a small, active group of volunteers that takes the important actions necessary to ensure that the panel continues to make progress toward its objectives. The committee meets once per year in person and monthly through teleconferences. Between meetings, members maintain frequent contact by list server, email, and phone. The Executive Committee:

- works to form partnerships which lead to the initiation of project activity;
- helps to arrange sponsorship of projects;
- monitors program and project implementation and progress;
- ensures availability of project outputs and results;
- reviews proposals for inclusion in GOFC-GOLD against clearly stated criteria; and
- creates short term teams to address specific issues.

## **Guide 8 - Articulate regional and national needs for EO information, advisory support and capacity strengthening**

Regional Networks provide the interface between the panel and national level data users and needs. As such, the Regional Networks articulate and document regional earth observation requirements including:

- observations (measurements);
- derived products and their associated accuracy requirements;
- distribution systems; and
- regional data policy issues.

Regional Networks can also identify regional and national EO needs and requirements for capacity strengthening.

## **Guide 9 - As able, participate in both GOFC-GOLD themes and IT activities, and ensure their relevance to the region**

### **Land Cover Characteristics and Change Theme**

The Land Cover Characteristics and Change theme promotes the use and refinement of land cover data and information products for resource managers, policy makers, and scientists studying the global carbon cycle and biodiversity loss. GOFC-GOLD has proposed a program of coarse resolution earth observations, fine-scale land cover mapping, and integration with in-situ observations on global scales.

The Land Cover theme is carried out by an implementation team that works with the GOFC-GOLD Regional Networks to secure acquisition of quality land cover data and interacts with users and regional experts for the development and implementation of mapping standards, data

assimilation, and product dissemination. The Land Cover Implementation Team maintains a website, which is updated regularly (<http://www.gofc-gold.uni-jena.de/>).

#### Fire Mapping and Monitoring Theme

The Fire Mapping and Monitoring theme focuses on refining international requirements for fire-related observations and making the best possible use of fire products from existing and future satellite observing systems to support fire management, policy decision-making, and global change research. Key goals are to ensure enhanced operational fire monitoring from space and ground measurements, better access and use of data, and standard products of known accuracy.

The Fire theme is carried out by an implementation team that works with the GOFC-GOLD Regional Networks to bring together fire data providers and users to exchange information on capabilities and needs and to promote strengthening of regional and national fire activities.

Activities include assessing algorithms and data assimilation procedures (e.g., Global Geostationary Active Fire Monitoring Capabilities); creating products and services (e.g., Global Fire Danger Rating System); and providing information to support international assessments (e.g., Millennium Ecosystem Assessment). The Fire Implementation Team maintains a website, which is updated regularly (<http://gofc-fire.umd.edu>).

The Regional Networks participate in the Land Cover and Fire Teams by:

- refining user requirements;
- developing regional harmonized products;
- assisting in validation of products;
- assisting in the design and evaluation of data delivery systems;
- identifying regional and national GOFC-GOLD contributory projects;
- assisting with GOFC-GOLD project implementation;
- evaluating observing subsystems with an emphasis on forest and fire management; and
- providing an interface to national and regional operational users.

The Regional Networks evaluate the utility of global land cover and fire products for regional use (e.g. for regional assessment, national reporting, and natural resource/fire management) by:

- participating in regional product inter comparison and validation initiatives by providing local expertise; and
- providing feedback to producers.

### **Guide 10 - Maintain regular communication with members, ITs and Executive Committee**

The Regional Networks maintain a roster of active members and communicate with members on a regular basis. Face to face meetings should be held at least once a year. Members can receive information about the activities of the GOFC-GOLD Executive Committee and Implementation Teams, which are regularly posted on the respective websites.

Representatives of the Regional Networks are regularly invited to participate in thematic and strategy meetings and workshops organized by GOFC-GOLD. Some resources have been secured to assist with travel support to ensure participation.



### **Guide 11 - Define support required to strengthen network and participate in activities to foster such support, including joint proposals**

The Regional Networks must identify and communicate the resources and support required to strengthen their programs. This information is important for joint planning and proposal development for activities addressing both global and regional issues.

## **3. Roles of Regional Networks in Relation to GOFC-GOLD and to National Priorities**

The third session involved discussions of the changing roles and responsibilities of the Regional Networks and their links to national priorities. The programs and experiences were reviewed by representatives from the Regional Networks in Eurasia, Southern Africa, Southeast Asia and East Asia, including network expectations of GOFC-GOLD.

### ***Eurasia Regional Network Activities and Recent Initiatives - NERIN***

Recent activities and initiatives of Northern Eurasia Regional Information Network (NERIN) were presented by Olga Krankina (Presentation 3). In particular NERIN's structure (Figure 3), background and future network priorities were discussed.

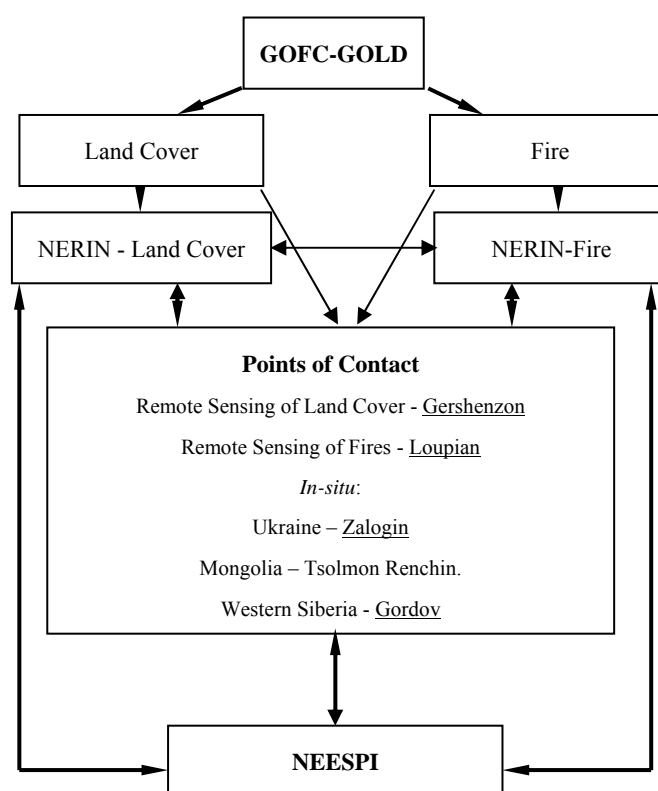


Figure 3. NERIN structure.

NERIN was organized through a series of planning workshops including:

- The Global Observation of Forest Cover (GOFC) Boreal Forest Workshop (Novosibirsk, Russia, August 2000)
- Regional workshop for Western Russia-Fennoscandia region (St. Petersburg, Russia, June 2001)
- Northern Eurasia Earth Science Partnership Initiative (NEESPI) workshops (April 2003; Yalta, September 2003)
- “Observational Data in Support of NEESPI”, St. Petersburg, Feb. 23-26, 2004
- “Observations of land cover and needs of research projects in Northern Eurasia”, June 18-19, 2005, St. Petersburg, Russia
- Workshop on July 8, 2006 in Tomsk as part of ENVIROMIS 2006 Conference

NERIN focuses on the following activities:

- Inventory of available data sets (METADATA)
- Land cover change pilot project (NELDA)
- Fire monitoring project, e.g., GOFC-GOLD Regional Fire Workshop, Moscow, November 2004
- Establishing multilateral support for the network activities

NERIN is working towards making its community aware of the available data resources. The number of available datasets has grown to include 180. These datasets can be accessed at <http://wwwdata.forestry.oregonstate.edu/MDEDIT/index.aspx> and <http://nerin.scert.ru>

### **Northern Eurasia Land Cover Dynamics Analysis (NELDA)**

NELDA consists of U.S. investigators and collaborators including OSU, GSFC, BU, and UMD; as well as collaborators from Russia and Ukraine involving 6 research centres. NELDA's objectives include;

- characterizing land cover and its change across boreal and temperate Northern Eurasia; and
- developing methods, data, and collaborations needed to monitor future changes.

The basis of the NELDA project is test sites that the participants have identified based on prior and ongoing research projects. The 14 test sites cover a wide variety of vegetation types, but there is a need for improvement as some parts of the region are not covered by this set. Each test site consists of a time series of Landsat or other comparable imagery and enough ground data linked to imagery to perform the following tasks:

- Establishing a network of test sites
- Cross-comparing and validating coarse-resolution land cover products
- Developing methods for continental mapping of vegetation disturbance
- Producing a new, updated land cover map for Northern Eurasia based on MODIS data

Fourteen additional sites have been proposed to cover additional vegetation types and regions within Northern Eurasia. NELDA is currently searching for non-NASA funding to support these additional sites. Future network priorities include:

- development of network projects;
- expanding the network to involve additional participants;
- harmonizing activities between fire and land cover components;
- synthesizing and coordinating projects within the NEESPI framework; and
- hosting workshops to focus on priorities, training and capacity building.

### **Comments on the future of Regional Networks**

Regional Networks feature prominently in GOFC-GOLD strategic plans, however there is no mechanism in place to support the expected contributions. There are two possible approaches to may help solve this problem. The first is an *aid narrative* that focuses on a top down flow of information. The second is a *two-way street* which adds a bottom up flow of information.

Aid Narrative:

- The issue: regions need help in using remote sensing to meet their monitoring needs
- Solution: provide training, data, logistical support, and expert advice
- Top-down approach to meeting global mapping needs plus standards in regional products

Two-way Street:

- The issue: need for global standardized and flexible land cover information of known accuracy for, among others, global change science and international conventions and initiatives.
- Solution: direct engagement of “regions” in developing global products as a framework for providing training, data, logistical support, and expert advice
  - Regions can contribute data and local expertise that is critical for global-scale mapping
  - Participation is sometimes preferred to receiving aid
- Regional mapping efforts are supported locally, with aid and through direct participation in global mapping effort, especially validation.

To address the needs of international conventions and initiatives, and to maintain the Regional Networks, it is important to find mechanisms to deliver the input from Networks to global and regional mapping efforts - NELDA project is one example.

### **NERIN – participation from Siberia**

E.P. Gordov of the Siberian Center for Environmental Research and training (SCERT) / Institute of Monitoring of Climatic and Ecological Systems (IMCES) SB RAS, Tomsk, Russia, provided comments on the NERIN from the perspective of Siberia (Presentation 4).

The main research of the IMCES is to investigate the scientific and technological basis for monitoring, modeling and forecasting of climatic and ecosystem changes under impact of natural and anthropogenic factors. The IMCES includes:

- Department of Geophysical Research
- Department of Ecological Research
- Department of Scientific Instrument-making
- International Research Center of SB RAS “Siberian Center for Environmental Research and Training”

The Siberian Center for Environment Research and Training (SCERT) is multidisciplinary research center comprising relevant efforts of several research Institutes of RAS and Universities from Tomsk, Barnaul, Irkutsk, Krasnoyarsk, Novosibirsk and Moscow in area of regional climate change monitoring and modeling, regional climate impact applications. (<http://scert.ru/en/>)

The SCERT has strong partnership with leading profile organizations in NIS countries (Belarus, Kazakhstan, Uzbekistan, Ukraine), which allows it operates in different level Projects as a coordinator for near 30 research and educational organizations in NIS.

Currently SCERT, with partners under mandate of the Siberian Branch of Russian National Committee for IGBP, is developing an Integrated Regional Study of Siberia environment. The programs and activities included in this study were reviewed.

The SCERT might operate as the regional focal point/center of the NERIN/GOFC-GOLD, and a provider of relevant data as well as a link with activity of the Siberian Branch of the Russian National committee on IGBP.

E.P. Gordov explained the needs of the SCERT, as a member of the NERIN Regional Network, as follows:

- stable support for targeted training and capacity building in the region;
- stable support of IT related activity (data handling, storage, dissemination);
- adequate funding for administration and programs;
- improved access to EO data; and
- organize in Siberia one of regional START network.

### ***The Role of Regional Networks in Supporting National Priorities and Reporting Requirements - SAFNET***

Pauline Dube of the Southern Africa Fire Network (SAFNET) presented an overview of the role Regional Networks play in national priorities, including support for monitoring and reporting (Presentation 5).

#### **National priorities**

In order to determine what the national priorities are, input is required from the members of the Regional Networks. The focus and resources available to the Regional Network, both tangible and intangible, will help determine how well national priorities are articulated.

National reporting requirements relate to country commitments to several well known international conventions including; biodiversity, desertification, climate change, and Ramsar. It is necessary to be conversant with these conventions (e.g. intangible resource). The expected national roles to fulfill these conventions must be known. As is the manner in which these

national roles are organized in each country. Once the existing national structures are identified the Regional Network can determine how best to assist.

Several examples of possible roles a Regional Network can play in supporting national priorities concerning GOFC-GOLD related goals include:

- Developing a forum for informed communication, providing direction for contacts, and access to resources.
- Early warning: the need for countries to find relevance and participate in ongoing global initiatives and products (e.g. validation and evaluation of satellite products).
- Facilitating links between national priorities and Regional-International activities by linking validation activities to national needs, and by facilitating national accuracy standards that are applicable at the international level.

Proactive networking is required to achieve these goals. It is useful to perform an assessment of relevant organizations. These likely include; government, academic, local and international non-government organizations, and community based organizations. Reviews are required of:

- fire and or land cover needs of these organizations;
- how these organizations can have a role in your network; and.
- how will links with these organizations support your working relationship with GOFC-GOLD.

The SAFNet, as part of its strategy, retains a limited structure to run the network at this stage and maintains an open, voluntary network system. The SAFNet steering committee is comprised of a coordinator, national contact points, and focus area team leaders.

The SAFNet strategy to meet national needs and international requirements is to establish itself at the international level as a GOFC-GOLD Fire Project Regional Network (Figure 4). While at the regional level, it is establishing itself as the Global Environmental Change Committee of the University of Botswana. The link that is emphasized will depend on who is approached. A local link provides easy access to most local organizations, but also some international ones including potential funding agencies. The GOFC-GOLD link has been useful for collaborating with satellite data providers, FAO, UN Disaster Agencies, amongst others.

The SAFNet focus areas have been defined to meet the wide interest of existing national-regional organizations and users of wildland fire information. SAFNet defines fire as a:

- land use tool – for socio-economic needs;
- ecological process - field data;
- hazard - National-regional-International; and
- factor in global processes – GOFC-GOLD, UN.

All these aspects of fire can benefit from earth observation satellite products and are factors in International Conventions. Hence, they have a role in the link to GTOS/GOFC-GOLD. The challenge is that this is a highly ambitious network, requiring the linking of community, national, regional, and international needs, while addressing management, policy, ecological and monitoring issues.

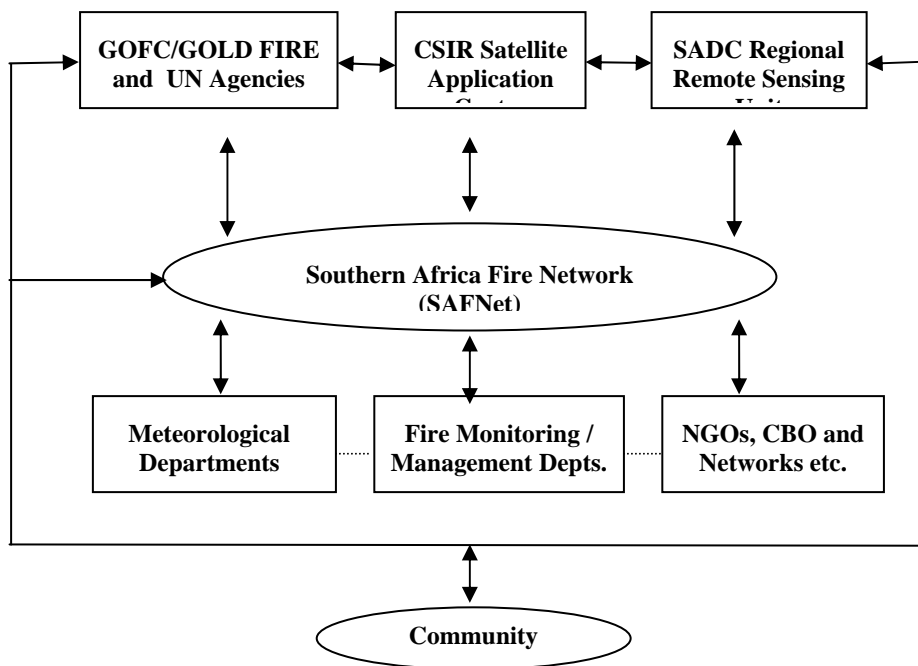


Figure 4. Inter-network interactions to meet national priorities in the SAFNet region.

Collaboration with relevant Government Departments is important for addressing national needs. As well, it is a challenge to determine which policy and management needs that can be addressed through the Regional Network. One area the Regional Networks can play a role is in validation and in helping to meet UNFCCC national reporting requirements.

In order to assist in this manner it is necessary to find and create links to the relevant departments. The majority of SAFNet members are from government departments, including: meteorology, forestry, range, fire, and remote sensing. This has helped SAFNet to:

- influence management and the revision of fire policies;
- participate in Government initiatives to meet UN Convention requirements, such as the National Climate change Committees;
- represent the Botswana government in IPCC assessment; and
- prepare a UNFCCC Report on Botswana's Green house gas inventories.

Government links in SAFNet facilitate easy access to SADC, which is a regional policy body. SAFNet has a strong link to the SADC Regional Remote Sensing Unit. This link enables SAFNet to bring fire to the SADC early warning units and participate in SADC training in the form of short-courses on geo-information systems. Through SADC SAFNet is also able to access an old Landsat archived data base.

Research Institutions are useful for information generation, evaluation, dissemination and networking. Universities provide a quick medium to achieve GOFC-GOLD related goals including validation and product evaluation, and addressing information needs of UN Conventions. Many other national research institutions are also engaged. For example, the SAFNet group in Zambia includes the National Institute for Science and Industrial Research.

## **Examples of collaboration and support**

With proactive networking there is an opportunity to influence national policies and assist in national reporting requirements from different angles. SAFNet has had a role in a number of UN agencies that influence national environmental policies. SAFNet collaborates with the Wildland Sub-Sahara Fire Network, which is linked to the Global Fire Monitoring Center. SAFNet has participated in the UN International Strategy for Disaster Reduction (ISDR) activities including training courses and the International Fire Summits.

The SAFNet has collaborated with the International Council of Scientific Union (ICSU) Office in Pretoria, South Africa. The SAFNet will participate in the planning of the ISCU disaster management activities. Through this activity SAFNet will link with other Networks including the Air Pollution Information Network-Africa (APINA).

The GOFC-GOLD MODIS Active fire products are used to disseminate information on available satellite data products for national fire management use. Regional Networks facilitate access and use of this data at national to sub-national levels for resource management and meeting international reporting requirements.

The SAFNet is establishing links to local data providers. One such link is with a local satellite data provider, CSIR Satellite Application Center (SAC) in South Africa. SAFNet members participate in the validation of the Advanced Fire Information System (AFIS), which is a collaboration among CSIR, UMD and ESKOM.

The AFIS Sensor Web Fire Mapper was introduced. The Mapper uses MODIS and MSG data, and offers SMS Fire Alert Emails, weekly and monthly reports, and notifications of information available on the website.

The Global Environmental Change and Food Systems (GECAFS) monitors land degradation and widespread fires that constrain food security in developing countries.

Fire and land cover issues are infused in the Southern Africa GECAFS Science Plan, which is currently being reviewed. The IGBP open meeting will take place in November 2006. There will be a special session on Global Environmental Change and Food Security in Africa.

National based organizations that might be relevant are regional to international based NGOs as they may have a strong science and monitoring program with a wide area of influence. Several SAFNet links include; World Wildlife Foundation (WWF), Africa Wildlife Foundation (AWF), and Conservation International. NGOs are important for reaching communities and accessing funding resources linked to community projects. A national NGO involved with SAFNet Botswana is the Kalahari Conservation Society.

Through validation activities SAFNet has developed strong links to national priorities, a strong built-in training component, access to satellite data, resources to work with this data, and has worked towards the integration of satellite information with field observations (Table 4). The next stage will be to assess the utility of satellite fire products within the SAFNet community.

Table 4. Validation of MODIS fire products in different land use and landscape systems in the SAFNet region.

Country	Land Use / Landscape System
Botswana	Game reserve and communal area's
Namibia	Etosha National Park and communal land users
Malawi	Forestry Reserve
Zimbabwe	Forest and communal land use
Mozambique	Forest Reserve
South Africa	Kruger National Park and communal land uses Trans-boundary wildlife management

### ***Regional Network Expectations of GOFC-GOLD - SEARRIN***

Views on the expectations of the Regional Networks towards collaboration with GOFC-GOLD were presented by Mastura Mahmud of the Southeast Asia Regional Information Network (SEARRIN) (Presentation 6). Discussions included Regional Network development, advantages, problems and needs.

The SEARRIN includes the following member countries: Malaysia, Philippines, Cambodia, Thailand Indonesia, Vietnam and Laos. Since its inception in 1999, it has fostered numerous international linkages (<http://www.eoc.ukm.my/searrin/>). Through these linkages, SEARRIN has participated in international activities including:

- Capable (capacity building)
- Global Water System Project (GWSP) of the Earth's System Science Partnership (ESSP)
- Monsoon Experiment and Climate Variability Research (SARCS-START)
- International Human Dimensions Programme (IHDP)

### **Establishment of GOFC-GOLD Regional Networks**

In 1999, GOFC-GOLD established links with independent research Regional Networks in Africa, Southeast Asia and Northern Eurasia. Regional Networks consist of researchers from a common geographic area with specific research interests pertaining to regional requirements. The Regional Networks consist of different research activities and functions with various needs, capabilities, facilities and limitations. The alliance with Regional Networks is on a voluntary basis, which should be beneficial to all involved.

Regional Network scientists inform data providers and operational users of their data requirements, which lead to improved access and use of observed data. Regional Networks can provide a mechanism for calibrating, validating and improving methods and algorithms. They provide a forum to test the integration of in-situ and remote sensing observations. Several



successful projects have been completed by SAFNet, Australian Fire Network, MIOMBO, SEARRIN, and OSFAC.

Regional Networks provide a forum for users and researchers operating in a common geographic area. They provide a link between national agencies, other user groups, and the producer community. Regional Networks provide a mechanism for the sharing of resources and expertise, and perform a cross-cutting role in the implementation and integration of GOFC-GOLD's thematic components. There are a number of advantages of GOFC-GOLD linking to Regional Networks including:

- This linkage makes it easier to engage with an existing organized network, for example an inventory of land based data.
- Trans-boundary issues can be tackled more easily through Networks.
- Communication and sharing of different expertise can be compared to one another.
- Funding for regional projects on environmental issues could be facilitated through the network initiatives.

### **General and organizational issues**

Organization: should it be limited to Regional Networks? Regional Networks are independent of each other. Some Regional Networks focus on LUCC, Fire Monitoring or both.

Resourcing of Networks: sustainability and dependence on GOFC-GOLD. Should Regional Networks be partially independent?

Data issues were discussed with the following observations:

- Data could be accessed through the Regional Networks; Networks can provide a backflow of data, validation and method development.
- Data acquisition as through a network allows access to better remotely sensed data, rather than data access obtained at a local level.
- Underprivileged countries lack the equipments and internet access for fast communications.
- Data should be shared and data standards harmonized both locally and nationally.
- Links between satellite and in situ data can foster interpretation of data for more local use.
- At the regional level local policy makers can be identified.
- There are big gaps in data use between researchers at the global level and those at the local level. The definition of products is too global oriented.
- There is no collection center where local users can provide feedback into the system.
- Link needed with wildfire and disaster management Networks ,or other global organizations (functional and practical?).
- Capacity building function is important.

The presentation was concluded with suggested management needs and problems faced by Regional Networks. These are summarized as:

- GOFC-GOLD support is desired to get research grants from new sponsors and other funding agencies.
- Stronger network involvement with GOFC-GOLD endorsed projects.
- Maintain and sustain Regional Networks on a long-term basis through research activities.
- Expand network membership to include researchers from LUCC and fire expertise.
- Strengthen the contact with lead agencies in each country for LUCC and fire activities.

### **GOFC-GOLD support for Regional Networks**

Once Networks exist it is easier to start new activities, as the overhead cost is already established, compared to starting a new network. The network can be expanded or divided into a separate network depending on the following factors:

- cost effectiveness and benefits;
- focus of network could shift in time;
- funding crucial to maintain Networks; and
- maintenance is through project grants.

Integration of existing Regional Networks into a global regional network has several benefits. Larger regions with common objectives and goals can be represented. Financial management is easier. Communication through updated websites with feedback, workshop coordination is important. The network would also have representation to national bodies. GOFC-GOLD can support Regional Networks through:

- More prominence and recognition in GOFC-GOLD as its reputation develops.
- Project support through help in finding funding sources, or providing the seed money to sustain Regional Networks for communication and administration (funded for 2005-2006).
- Endorse and give core support for projects.
- Improve integration and partnership with the global network of GOFC-GOLD Regional Networks.
- Develop mutually beneficial activities.
- Recognition by GOFC-GOLD and international scientific funding sources that Regional Networks can play a key role in EO and global change research.
- Help link the network with the CEOS sub-group on calibration and validation which would enable local sites to be a part of their global network.
- Hardware support can be provided to poorer member countries. Providing scientific advisors will also help the network.

Regional Networks can also be improved through capacity building training at regional workshops on:

- validation and calibration network;
- algorithm development;
- relevant modeling technique; and

- inter-regional network workshop.

An example was provided of support for Regional Networks where free EO data was provided during the 2004 Tsunami in Asia.

The question was asked of what can the Regional Networks provide to GOFC-GOLD? In addition to the strategic guidance by GOFC-GOLD (Section 2), regional Networks can provide the following:

- technical documents, reports, and presentations;
- value added satellite data for specific regions of the Regional Networks (SPOT, MODIS, Landsat);
- forest inventories, forest maps and other biophysical data, GIS data;
- socio-economic data;
- graphic maps and pictures;
- networking with users in the region (ASEAN, National and Federal Governments.); and
- training centres for regional scientists.

### ***South American Regional Network - REDLatif***

Carlos Souza, a members of the Latin America Regional Network (Red Latinoamericana de Incendios Forestales REDLaTIF), presented on behalf of the network's lead representative, Emilio Chuvieco (Presentation 7). REDLaTIF is science driven and has initially focused on fire issues, however other topic are under consideration. SELPER (Sociedad Especialistas Latinoamericana en Percepción Remota) symposiums have been the recruiting environment.

The REDLaTIF network was created in Cochabamba, Bolivia in 2002. The network participated in the UN meeting on the role of remote sensing in reducing natural hazards: Floods and Fires held in Cordoba, Argentina in 2003. The network generated a regional project on burned land mapping using MODIS data for 2004 (referred to AQL2004). The REDLatif web page can be viewed at <http://mob.conae.gov.ar/redlatif/>.

The initial goals of REDLatif include:

- compilation of a list of Latin American experts working on remote sensing and forest fires;
- fostering the participation of Latin American scientists in global Networks related to the GOFC-GOLD fire program; and
- generation of thematic Networks for participation in fire related projects within the Latin American region.

### **AQL2004 Project**

As an example of a REDLatif activity, the AQL2004 project is described further. Its goals include: a) generation of a monthly burned-land map of Latin America for 2004 and b) strengthening the regional network.

The project operates on a voluntary basis (with support from START for technical meetings). All members participate in the method development, data processing and product validation. The AQL2004 project phases involve:

- kick-off meeting in Santiago de Chile in November 2004;
- common methods and validation protocols defined in Mexico in November 2005;
- assessment in June, 2006; and
- final report delivery in September, 2006.

Participants include:

Country	Participating Organization
Mexico	Conabio, UNAM
Brazil	INPE
Argentina	INTA, University of Lujan, CENPAT, Forest Service
Chile	University of Concepción
Venezuela	University Central
Ecuador	CLIRSEN
Colombia	University of Medellín
Paraguay	University Nacional
Spain	University of Alcalá, INIA

Nearing completion of the project, the following limitations of the network organization were discussed. Key limitations, which may provide lessons for other Networks included:

- Fund limitations constrained the scientific outputs.
- Input data needed more temporal frequency for Tropical regions.
- Additional image processing (BRDF, contextual-region growing) was required.
- Field validation was limited to visual analysis of HR data and fire records.
- Limited participation of end-users.
- Different level of participant's motivation and skills.
- The network is working, but needs regional input.

Future fire related activities will include:

- continuation of the same projects for a whole series (2000-2005);
- improvement of project with shorter composites;
- extension of activities into to burn severity; and
- fire danger estimations.

Other future activities will include extending the network to land cover and biophysical topics. Also, REDLatif will also be recruiting a new coordinator.

### **Questions for the meeting**

Should the Regional Networks be more science-oriented or end-user oriented? e.g., access to products, methods, data, knowledge? (e-access to technical journals).

Should the Regional Networks be just geographical regions, or also thematic regions e.g., Tropical forests?; a global approach versus an ecosystem approach?

### ***Digital Asia and Sentinel Asia: Links to an East Asia Network***

Hiromichi Fukui of Keio University and the Japanese Space Agency (JAXA) described Digital Asia and Sentinel Asia, and proposed that these systems could contribute to Internet-based Information Networks for GOFC-GOLD Regional Networks (Presentation 8). Hiromichi Fukui is involved in the initiation of an East Asia Regional Network.

### **Digital Earth: monitoring and modeling**

The Digital Earth Vision:

- a multi-resolution, three-dimensional representation of the planet, into which we can embed vast quantities of geo-referenced data;
- a “collaboratory” for research scientists seeking to understand the complex interaction between humanity and our environment.” and
- “a ‘user interface’ -- a browsable, 3-D version of the planet available at various levels of resolution, a rapidly growing universe of networked geospatial information, and the mechanisms for integrating and displaying information from multiple sources.”

(Gore,1998)

#### **Digital Earth Related Trends**

Over the last several years the digital earth activities have evolved from international symposiums to an International Society for Digital Earth (ISDE). In 1999 at the first International Symposium (CAS), Towards Digital Earth, in Beijing China an international steering committee for ISDE was established. In 2001 the second International Symposium, Beyond Information Infrastructure, was held in New Brunswick, Canada. The third International Symposium, Information Resources for Global Sustainability, was held in Brno, Czech Republic in 2003. The fourth International symposium, DE as the Global Commons, was held March 28-31, 2005 in Tokyo, Japan. In May 2006 at the International Society Board Meeting (tbd) in Beijing, China the ISDE was kicked off. For additional information on DE visit the Digital Earth website at <http://www.digitalearth.gov/>.

Keio University along with other researchers began a 5 year project in 2004 (Figure 5). This project has an operating budget of 700 M Yen over the 5 years. The project involves two types of Regional Networks:

Regional Network 1: Digital Asia: A platform for disseminating disaster information

- Project year: 2005-2010
- Coordinated by: Keio University and JAXA

- Objective: 5 - 6 web-servers per year in the region, exploiting open software, promoting Web access to large datasets, such as SRTM and Landsat
- GISTDA, LAPAN, Sri Lanka, VAST and ICIMOD (2005)

**Regional Network 2: Sentinel Asia: A satellite information distribution network for Disaster Management of the Asia-Pacific**

- Establishment using standard internet-based: 2006-2007
- Coordinated by: Asia Pacific Regional Space Agency Forum (APRSAF)
- Focus: Wildfire and Floods (firstly)
- Data: MODIS and ALOS (mainly)
- Platforms: Digital Asia, ALOS Rapid Response System, others
- Countries: Australia, Bangladesh, Brunei, Cambodia, China, India, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Thailand, Vietnam
- International Organizations: Asian Disaster Reduction Center (ADRC), ASEAN Subcommittee on Space Technology and Application (ASEAN SCOSA), Asian Institute of Technology (AIT), UN ESCAP, UNOOSA

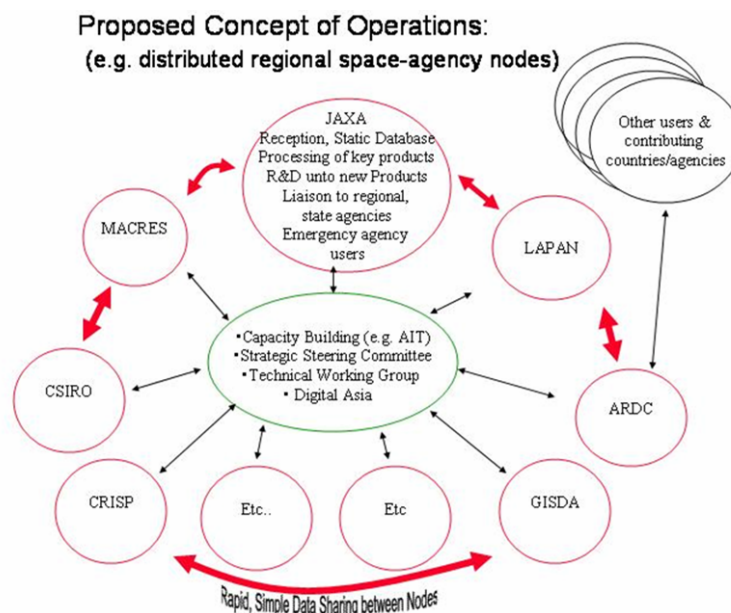


Figure 5. Digital Asia information platform.

## **4. New Areas for Regional Network Collaboration with GOFC-GOLD Implementation Teams**

Michael Brady reviewed the results of the 3<sup>rd</sup> planning meeting of the GOFC-GOLD Land Cover Implementation Team (23-24 March 2006) and implications for the Regional Networks. During the Symposium five new drivers were articulated for GOFC-GOLD, including:

1. International environmental conventions (UNFCCC, UNCCD, CBD, Ramsar, etc.)
2. GCOS implementation plan:
  - Establish international standards for land-cover characterization
  - Reliable methods for land-cover map accuracy assessment
  - Develop an in situ reference network and apply validation protocols
  - Generate annual products documenting global land-cover characteristics
3. GEO & GEOSS reference plan:
  - Land cover is important for all areas of societal benefit
  - Forest Community of Practice
4. IGOS-P Land Theme (IGOL)
5. Data continuity and effective acquisition policies

The new areas are further described in the Symposium report of the Land Cover Implementation Planning Meeting (GOFC-GOLD Report 28).

Two presenters discussed the potential roles of the Regional Networks in several of the new and emerging activities being initiated by the GOFC-GOLD Implementation Teams. These include 1) the need for calibration and validation Networks around the globe; and 2) supporting national involvement in GEO and the UN Conventions.

### ***Calibration and Validation of Land Cover Products***

Curtis Woodcock of the GOFC-GOLD Land Cover Implementation Team commented on the goals and activities of the Regional Networks (Presentation 9). He also proposed activities on validation of land cover products.

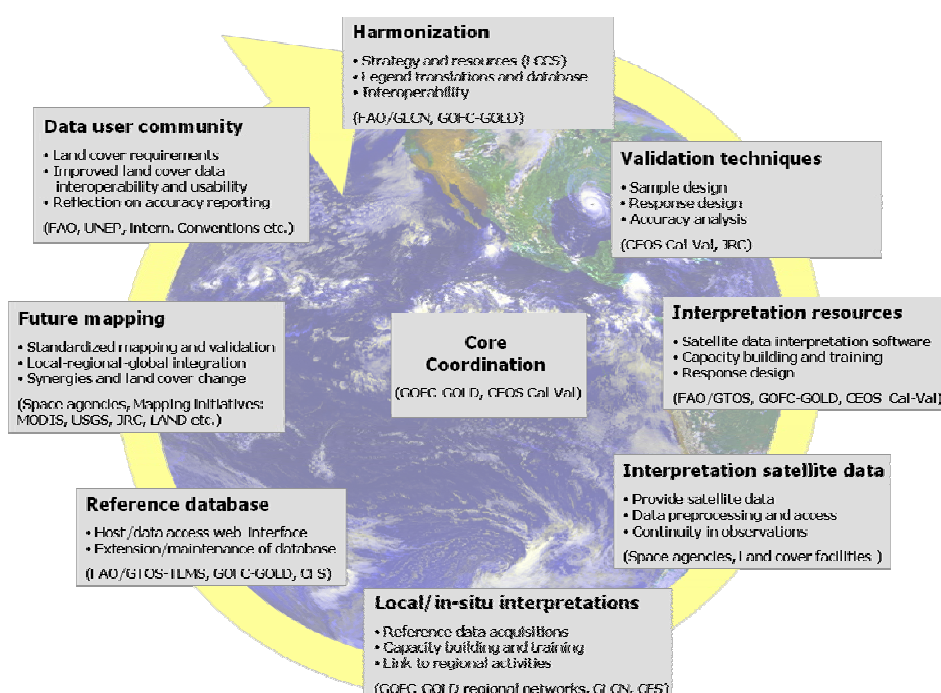
International conventions and global science are important, but not as important as national resource management. One of the starting points of the LC IT was to improve the land cover information available for regional/national resource management. The original focus of GOFC-GOLD was more specifically on forest information, and while that mandate has been expanded to include other land covers, forests are the key to GOFC-GOLD and we should not lose track of national scale forest information. GOFC-GOLD should help to seek international support for improvement of national level forest information.

Curtis Woodcock proposed that the role of Regional Networks should be expanded to include participation in the production of land cover products. There should be a growing link and collaboration between global and national mapping efforts. For example, can global mapping efforts produce national or regional maps with more detailed legends better suited for use within the region/nation?

Or, can global mapping efforts provide organized datasets ready for use by groups within regions/nations for production of their own land cover related maps? A suggested activity of the Regional Networks is to perform a comprehensive review of existing land cover products for various regions of the world with a focus on available national and regional products.

## Land Cover IT proposed activities on validation of land cover products

GOFC-GOLD and CEOS Cal-Val are involved in coordination of the following tasks and associated actors:



Curtis Woodcock provided an overview of the recently completed report on Global Land Cover Validation: Recommendations for Evaluation and Accuracy Assessment Of Global Land Cover Maps (2006, by Alan H. Strahler et al). The document presents the findings of the Working Group on Global Land Cover Validation, a topical group within the Land Product Validation (LPV) subgroup of the Working Group on Calibration and Validation (WGCV) of the Committee on Earth Observing Satellites (CEOS). The document summarizes the issues involved in global land cover validation and identifies recommended approaches and techniques. The report recommends that all global land cover maps should have statistically valid estimates of map accuracy. The core methods that should be routinely applied include: design-based inference, probability sampling and consistent estimators. Core methods may be extended to include:

- validation both during and after map production;



- use of confidence-based quality assessments;
- addition of fuzzy accuracy methods; and
- use of qualitative and descriptive methods.

He provided an overview of a presentation by Phillippe Mayaux related to the accuracy assessment of the GLC2000 land cover map. This illustrated some of the methods that are anticipated.

Curtis Woodcock concluded that now is a good time to agitate to make sure that the roles of the Regional Networks includes national interests. He requested that the Regional Networks accept the LC IT invitation to participate in the effort to validate land cover products.

### ***National Involvement in GEO and the UN Conventions***

Martin Herold of the GOFC-GOLD Land Cover Implementation Team discussed the Regional Networks in the context of the Group on Earth Observations (GEO) and the UN Conventions (Presentation 10). Specifically, the land cover challenges, GEOSS tasks, forest community of practice, and the role of Regional Networks in GEO/Conventions were discussed.

### **Land cover challenges**

Land observations are not operational in a weather forecasting sense and the terrestrial observation domain is least developed. There are difficulties when dealing with heterogeneity including; the land surface itself, mapping standards, and users of land information. Earth observation challenges include:

- observation continuity and consistency;
- coordination, integration, harmonization, flexibility, and accessible information;
- adequacy and advocacy for applications;
- moving from technology driven to operational observations;
- raising awareness and capacity building;
- integration through interdisciplinary research; and
- earth system, geographic information, and land change Science.

International bodies are effective in provide context and standards, but are less effective in actual implementation e.g., the WMO collects no data. The regional/national level is most effective for actual applications, service to users, reporting obligations, raising resources and standardized mapping. This makes local data globally available and global data locally relevant (Tom Loveland, LC-IT).

### **Global Earth Observation System of Systems (GEOSS)**

GEOSS and areas of societal benefits were defined in 2005 by the Group on Earth Observation (GEO), involving 69 countries and 46 organizations, to include:

Water	Agriculture	Health
Weather	Biodiversity	Energy
Ecosystems	Disasters	Climate

GEOSS focuses on earth observation for societal benefits. GEOSS can serve as an instrument for scaling up local and regional observations to the global scale. GEOSS promotes capacity building in EO. GEOSS must be built from Regional Networks or national institutions working on ecosystem monitoring.

GOFC-GOLD is contributing to eight GEO tasks in the current work plan. Specifically, task EC-06-07 builds upon existing initiatives to develop a global network of organization-Networks for ecosystems, and coordinate workshops to strengthen observing capacity in developing countries. Two such initiatives include ANTARES in South America for oceans and GOFC-GOLD Regional Networks for terrestrial domains will help. The task will be initiated by 2006. Regional Networks will play a capacity building role.

Another task relates to improving user engagement. GOFC-GOLD is working with Canada, Sweden and Finland to create a Forest observation community of practice. The goal is to create a community of practice with broad representation of producers and users of forest data and information. This community will work on the following objectives:

- Identify, gather, and seek agreement on user community requirements for forest observations, their present status and gaps to be filled.
- Promote consensus-building among producers and users about the highest priority forest observation needs.
- Cooperate in activities with existing forest observation initiatives where GEOSS can add value (e.g., FAO-FRA, etc.).
- Facilitate outreach in support of the above objectives.

Regional Networks can play important advocacy and participation roles in the community of practice.

### **Global Climate Observing System – Implementation Plan**

The GCOS IP is working towards standardized land cover observations through the following activities:

- discussion and adoption of evolving mapping standards: land cover “language” (LCCS);
- assessment of user requirements and flexibility;
- resources and capacity building;
- link with existing mapping programs;
- link with in situ data, validation protocols and standards; and
- investigate possible tradeoffs.

The Regional Networks can play an advocacy, participation and implementation role.

Task 25 of the GCOP IP is to develop an in situ reference network and apply CEOS WGCV validation protocols for land cover. Initiatives such as these will provide much needed capacity-building and offer a framework for acquisition of in situ observations to support the satellite image-based monitoring (GIP land cover ECV). Regional Networks will play a participation, capacity building and implementation role. Benefits will include:

- comparable land cover observations: among scales, applications and between countries;
- continuous updating and land change assessment: e.g. carbon accounting and reporting;
- optimal use of resources: avoiding duplication and data heterogeneity; and
- informed user community: adequacy of map products, flexibility and transparency, and a robust assessment of accuracy.

## UNFCCC

UNFCCC has asked for technical and scientific input on the use of EO and reducing emissions from tropical deforestation. The GOFC-GOLD community has formed an ad hoc working group to outline an earth observation solution. Developing nations should follow a common understanding on technical issues. The approaches taken should be flexible and regionally focused. Regional Networks will play an advocacy and participation role.

## UNCBD

The key UNCBD 2010 goals with potential benefits from Earth Observation include:

Goal 1	Promote the conservation of the biological diversity of ecosystems, habitats and biomes.
Goal 5	Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced.
Goal 7	challenges to biodiversity from climate change, and pollution.

Regional Networks can play an advocacy and participation role, however efforts are evolving. The role of Regional Networks in GEO and the Conventions can be summarized as follows:

Role	Details
Advocacy	Promote EO and related products and services, and national actors are mandated organizations
Participation	Vertical: Local - region – global Horizontal: regional networking
Capacity building	Benefits from international community Impact ongoing mapping programs and projects
Implementation and demonstration	Data acquisition, assimilation and dissemination

## 5. Resourcing the Regional Networks

GOFC-GOLD provides limited resources and support to the Regional Networks through several sources, including the START program and the Canadian Forest Service<sup>3</sup>.

### ***System for Analysis, Research and Training for Global Change (START)***

Kathleen Landauer of the START organization described support activities to the GOFC-GOLD Regional Networks (Presentation 11). The START mission is to:

- develop Regional Networks of collaborating scientists and institutions;
- enhance scientific capacity in developing countries; and
- mobilize the resources for activities in developing countries.

The START mission is outlined in; Global Change System for Analysis, Research and Training (START). Report of the Bellagio Meeting. Edited by J.A. Eddy, T.F. Malone, J.J. McCarthy and T. Rosswall. (1991).

The START Regional Networks and Centers/Secretariats are located around the world.

Regional Network	Regional Centre / Secretariat
Southeast Asia (SEA):	
Regional Center	The Environmental Research Institute, Chulalongkorn University, Bangkok, Thailand
Secretariat	National Central University, Taiwan
Temperate East Asia (TEA)	Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China
South Asia (SAS)	National Physical Laboratory, New Delhi, India
Oceania	University of the South Pacific, Suva, Fiji
Pan-Africa	University of Nairobi, Nairobi, Kenya
Mediterranean	MEDIAS-FRANCE-CNES, Toulouse, France

Recent publication describing START activities include: GOLD-5/START-4: Regional Networks for Implementation of the GOFC Project in the Tropics, C. Justice, F. Ahern and A. Freise, Washington, D.C., 15-17 March 1999.

---

<sup>3</sup> The START program receives its substantial funding support for GOFC-GOLD from the National Aeronautical and Space Agency (NASA). The Canadian Forest Service receives its substantial funding support for GOFC-GOLD from the Canadian Space Agency (CSA).

START – GOFC-GOLD activities from 2000 to 2006 have included, among others:

- regional coordination meetings;
- implementation team meetings;
- thematic meetings, e.g., Cal Val; and
- compilation of regional data.

Activities are generally organized to:

1. promote and support the participation of developing country and US-based scientists in thematic, regional, and team implementation workshops held by the GOFC-GOLD Regional Networks;
2. facilitate the distribution of data, materials, and documents through web portals, and to develop and improve communication among network participants on network activities; and
3. support the packaging of data for developing country users.

More recently, activities conducted under these tasks are being designed to improve the accessibility of regional data and metadata on land cover and land use within developing countries. The foundations will be laid for operational regional web-based systems, providing key data sets and services relevant to regional needs. They will also be capable of distributing data in hard media. The architecture will be open and flexible allowing other functionality easily to be linked to or made a part of the system. This will also facilitate access to regional data sets by scientists. Regional Networks will be encouraged to obtain and distribute regional data sets.

## ***United Nations Environment Programme (UNEP)***

Michael Brady presented, on behalf of Ashbindu Singh, the United Nations Environment Program and relations with the GOFC-GOLD Regional Networks (Presentation 12).

The United Nations Environment Program (UNEP) was founded by the United Nations in 1972. UNEP is an international organization with offices all around the world. UNEP helps to make and enforce rules to protect the environment. Its mission is to provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations.

UNEP has three key roles. The first is to monitor the state of the world's environment. The second role is to identify solutions, by international agreements and voluntary initiatives. Finally UNEP plays a role in implementing these solutions.

The global UNEP headquarters is in Nairobi, Kenya. Being based in Africa gives UNEP a first-hand understanding of the environmental issues facing developing countries. UNEP is represented across the globe by six regional offices in Africa; Asia and the Pacific; Europe; Latin America and the Caribbean; North America and West Asia. UNEP carries out its activities through the following eight divisions:

- Early Warning and Assessment
- Policy Development and Law
- Environmental Policy Implementation
- Technology, Industry and Economics

- Regional Cooperation
- Environmental Conventions
- Communications and Public Information
- Global Environment Facility (GEF)

Of particular importance to GOFC-GOLD is UNEP's early warning and assessment mandate to keep the state of environment under review. The UNEP flagship assessment is the Global Environment Outlook (GEO), produced in cooperation with a network of national, sub regional, regional and global partners. UNEP also assesses the environmental consequences of armed conflict, and provides clean-up and mitigation guidance.

Millennium Declaration Goals (MDGs) include a framework of 8 goals, 18 targets and 48 indicators. The indicators to follow-up the implementation of the Millennium Development Goals include Goal 7, which is to ensure environmental sustainability. This is done by integrating the principles of sustainable development into countries policies and programmes and reversing the loss of environmental resources (Target 9). Indicators include the proportion of land area covered by forest (FAO), and the land area protected to maintain biological diversity (UNEP). The geographical context of events and actions in sustainable development planning is often missing.

### **The synergy with GOFC-GOLD Networks**

GOFC-GOLD Networks should provide policy relevant scientific information to support decision making. The Networks should contribute to monitoring of MDG indicators on a regular basis, including changes in forest cover of a country, and changes in the status of habitat in protected areas (12.5% of the land surface).

## **6. Organizational Issues, Opportunities and Planning**

Michael Brady reviewed the results of the 3<sup>rd</sup> planning meeting of the GOFC-GOLD Land Cover Implementation Team (23-24 March 2006) and implications for the Regional Networks. During the meeting, the following recommendations were forwarded for discussion by the Regional Networks:

STB Representation - The Vice Chair of the GOFC-GOLD Executive Committee should provide, among other responsibilities, strategic overview of Regional Network involvement in the panel. This includes addressing Regional Network considerations during regular Executive Committee discussions of thematic activities.

Committee Representation - The GOFC-GOLD Executive Committee should include a member from a Regional Network, who acts as a representative of all GOFC-GOLD Regional Networks.

Test Sites - With support from the GOFC-GOLD Implementation Teams, the Regional Networks should establish test sites for validation of operational land cover and fire monitoring and mapping EO products.

Standardized Formats - To facilitate better Regional Network participation and funding a standardized template should be developed for technical proposals and plans.

Regional Network Implementation Plan - The Executive Committee should guide and support the development of a Regional Network implementation plan, which compliments those of the STB and Implementation Teams.

### **Selection of a network representative**

Regional Networks representative at the monthly Executive Committee teleconferences. The duties are to keep track of and report on Regional Networks activities, and provide a Regional Networks perspective to the Committee

Olga Krankina was nominated by the network representatives to represent the Regional Networks on the Executive Committee.

### ***Scientific and Technical Opportunities***

The Regional Networks agreed to promote involvement in the following three activities of GOFC-GOLD:

1. GEO involvement – Regional Networks plan a strategy on their involvement in GEO. This will require an association with national governments in the region.
2. Validation and calibration activities.
3. Facilitate the distribution of data, materials, and documents through web portals, and develop and improve communication among network participants on network activities.

### ***Planning***

The participants agreed that the Regional Networks should work together over the medium term in two areas of common interest. One is the preparation of a Regional Networks strategy document. The other is the development of outreach materials with a common look and feel. These are described in further detail below.

### **Regional Networks strategy document**

Utilize the results of the 4<sup>th</sup> meeting to prepare a common strategy, which addresses:

- Regional Networks interaction and collaboration; form a framework for working together;
- links and collaboration between global and national mapping efforts. (e.g. can global mapping efforts produce national or regional maps with more detailed legends better suited for use within the region-national. Or can global mapping efforts provide organized datasets ready for use by groups within regions-nations for production of their own land cover related maps.);
- land cover and fire themes both included;
- mechanisms for two way communication;
- identify regional and national projects that contribute to Regional Networks;
- capacity building and points of focus;
- involvement in international events;
- identify organizations that can provide support e.g. UNFCCC, UNEP;
- sustainability of Regional Networks - Need to identify funds that are available;
- inter regional collaboration; and
- communication between Regional Networks and GOFC-GOLD project offices.

## **Outreach material**

Prepare outreach materials with a common look and feel, including:

- joint material;
- Regional Networks material to include GOFC-GOLD logos;
- enhance Regional Networks visibility by posting events on GOFC-GOLD websites; and
- develop web pages if not yet on line; and include on GOFC-GOLD website.

## **Internal organization and coordination**

Collaborate with the GOFC-GOLD Project Offices to:

- provide an update on members, their contacts and activities;
- promote universities and institutions in related fields for capacity building;
- provide access to data after completion of a project – GOFC-GOLD to assist with guidelines; and
- ensure publication and production of research materials.



## 7. Appendices

### ***Appendix 1. List of Participants***

<b>Name</b>	<b>Representing</b>
<b>Executive Committee</b>	
Brady, Michael	Ex-officio: Exec Director GOFC-GOLD
Schmullius, Chris	Ex-officio: Co-chair Land Cover IT
Gutman, Garik	NASA
Herold, Martin	Land Cover IT office
Neumann, Kathleen	Land Cover IT office
Sambale, Jacqueline	Land Cover IT office
Larsen, Murugi	GOFC-GOLD project office
<b>External board, sponsors, and participants</b>	
Fukui, Hiromichi	Keio University Research
<b>Land Cover IT members</b>	
Bartalev, Sergey	Academy of Science, Russia
Woodcock, Curtis	Boston University, USA
<b>Regional Network representatives</b>	
Gumbo, Davison	Miombo Network
<i>Kwesha, Dominick</i>	<i>Miombo Network</i>
Gumbo, Kolethi	Miombo Network
Devers, Didier	OSFAC
Lawrence, Nsoyuni Ayenika	OSFAC
Dube, Pauline	SAFNet
Kanyanga, Joseph K.	SAFNet

Krankina, Olga	NERIN
Gordov, Evgeny	NERIN
Landauer, Kathleen	START
Mbow, Cheikh	West Africa
Roswintarti, Orbita	SEARRIN
Mastura, Mahmud	SEARRIN
Di Bella, Carlos	South America
Chuvieco, Emilio	South America
De Souza, Carlos	Imazon - Inst. do Homem e Meio Ambiente da Amazônia, Brazil
Tsolmon, Renchin	Mongolian National University

## Appendix 2. Agenda

<b>GOFC-GOLD Regional Networks Meeting</b>		
<b>Saturday, March 25th Location:</b>		
<b>SESSION 1: GOFC-GOLD: New strategic directions, plans and requirements</b>		
<b>INTRODUCTION/WELCOME</b>		
9:00 – 9:15	<i>Start of Workshop/ Organization Issues/Logistics</i>	<i>Neumann</i>
9:15 – 9:35	<i>Meeting introduction, objectives and overview of the Regional Networks</i>	<i>Larsen</i>
9:35 – 10:00	<i>New strategic directions of GOFC-GOLD, implications of the symposium workshop results and expectations for the Regional Networks</i>	<i>Brady</i>
10:00 – 10:20	<i>Overview on Regional Network activities and recent initiatives</i>	<i>Krankina, NERIN</i>
<b>10:20-10:40 Break</b>		
<b>SESSION 2: Regional Networks : Changing roles and responsibilities as relates to GOFC-GOLD and national priorities</b>		
10:40 – 11:00	<i>Role of Regional Networks in supporting national priorities and reporting requirements</i>	<i>Dube, SAFNet</i>
11:00– 11:20	<i>What Regional Networks expect from GOFC-GOLD</i>	<i>Mahmud, SEARRIN</i>
11:20 – 11:40	<i>South America Regional Networks</i>	<i>Chuvieco</i>
11:40 – 12:00	<i>Digital Asia and Sentinel Asia. Internet- base Information Network</i>	<i>Fukui</i>
12:00 – 12:20	<i>Cal/Val Networks</i>	<i>Woodcock, LC-IT</i>
12:20 – 12:40	<i>GEOSS/Conventions</i>	<i>Herold</i>
12:40 – 13:00	<i>Resourcing the Regional Networks</i>	<i>Landauer, START/Singh, UNEP</i>

13.00 - 14.00	<b>Lunch</b>	
<b>SESSION 3: Thematic issues, opportunities and planning</b>		
14:00 – 15:00	<i>Role of Regional Networks in international conventions and initiatives to assist nations</i>  - <i>planning session</i>  - <i>selection of a Regional Networks representative</i>  - <i>Regional Networks outreach material</i>	tbd
15:00 – 15:30	<i>Development of a Regional Network implementation plan and representation in GOFC-GOLD</i>	<i>Larsen/Brady</i>
15:30	<i>Conclusions and Close of meeting</i>	<i>Schmullius</i>

### ***Appendix 3. List of Presentations***

<b>No.</b>	<b>Title</b>	<b>Author(s)</b>
1	Background of the Regional Networks and Questions for the Meeting	Murugi Larsen
2	GOFC-GOLD Overview and Regional Networks	Michael Brady
3	Northern Eurasia Regional Information Network: activities and recent initiatives	Olga Krankina
4	NERIN – view from Siberia	E.P. Gordov
5	Role of Regional Networks in supporting national priorities and reporting requirements	Pauline Dube
6	Expectation of Regional Networks from GOFC-GOLD's collaboration	Mastura Mahmud
7	RedLaTIF, the Latin American Regional Network of GOFC-GOLD	Emilio Chuvieco
8	Digital Asia and Sentinel Asia: Internet-based Information Network for GOFC-GOLD regional Network	Hiromichi Fukui
9	Comments on the Regional Networks in relation to CalVal activities	Curtis Woodcock
10	Regional Networks in the context of GEO and the UN Conventions	Martin Herold
11	SysTem for Analysis, Research and Training for Global Change	Kathleen Landauer
12	United Nations Environment Programme and GOFC-GOLD Regional Networks	Asbindu Singh