

Report of the 3rd Land Cover Implementation Team meeting

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

Held at the Dornburg Castle of the Friedrich-Schiller University Jena, Germany
23rd – 24th March 2006

Herold, M., Sambale, J. and C. Schmullius



GOFC-GOLD Report No. 28

Land Cover Project Office
Jena, Germany
January 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>

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Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD)
a panel of the Global Terrestrial Observing System of the United Nations (GTOS)

Land Cover Implementation Team Project Office

Report prepared by

Herold, M., Sambale, J. and C. Schmullius

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Executive summary

The GOFC-GOLD Land Cover Implementation Team Meeting, held 23-24 March 2006 in Jena, brought together more than 60 participants from 26 nations to discuss the status and progress for global and regional land cover observations. The objectives of the meeting have been driven by the recent revisions of the overall GOFC-GOLD strategy at the 3rd Scientific and Technical Board meeting in Beijing (2005), and the challenges posed by international activities on strategic and implementation level. Prominent participants include those from the Group on Observation (GEO), UN conventions in particular the United Framework Convention on Climate Change (UNFCCC) and the related implementation plan of the Global Climate Observing system (GCOS), and the development of the IGOS-P theme for Integrated Global Observations for Land (IGOL).

Strengthened by several new team members and a continued commitment from ESA for financial support of the land cover project office, GOFC-GOLD has made significant progress and has outlined an action plan towards operational forest and land cover observations.

GOFC-GOLD plays a key role in the development of IGOL. The IGOL report will be completed soon. This report addresses strategies for integrated land observations. The requirements raise the issue of continuity and consistency of observations in both the spatial, temporal and thematic domain. In particular, the current data gap and lack of coordinated fine-resolution satellite and in-situ data observations pose major challenges for implementing IGOL.

The GEO process can directly benefit from GOFC-GOLD activities. Building upon ongoing efforts, the GOFC-GOLD land cover implementation team will lead and contribute to several GEO tasks outlined in the 2006 work plan. Future activities include the GLOBCOVER project as GEO builds international cooperation on global land cover mapping, develops a consensus on specifications for fine-resolution land change datasets, evolves a GEO community of practice for forest observations, and partners with FAO Forest Resource Assessment 2010 on the earth observation providing consistent global forest and fire information.

The land cover implementation team has contributed to the implementation of GCOS with the UNFCCC for evolving standards in land cover characterization and validation. GOFC-GOLD has taken ownership for three land cover product specifications currently developed as an Appendix to the GCOS IP. The outlined joint harmonization and validation initiative provide the methodological and organizational framework to implement an operational and comparative global land cover validation and work towards a dataset of best available global land cover. As direct input for ongoing UNFCCC policy discussions, the land cover implementation working group on “Monitoring deforestation for reducing emissions from deforestation” has developed consensus on the technical protocols for implementing such an observing system in developing countries. Proper documentation will be developed and communicated to ongoing policy discussions.

Several European programs and projects for forest and land cover observations are currently ongoing or evolving in the context of GMES. This workshop has provided a clear incentive to link the European and global activities to benefit coordinated and efficient land monitoring. Key components of coordinated efforts will be the joint work on implementation GEO tasks (i.e. between EEA and GOFC-GOLD) and networking mechanisms within Europe to build upon GOFC-GOLD experiences.

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1 Background and objectives

The meeting of the GOFC-GOLD-Land Cover Implementation Team (LC-IT) followed the most recent workshops in Toulouse (2001) and Jena (2004), and the GOFC-GOLD Scientific and Technical Board meeting in Beijing (2005), where the overall strategy of GOFC-GOLD has been revised. Most prominently, the requirements posed by GEO(SS) and the GCOS implementation plan encourage and task the Land Cover team to work on the following priorities:

1. Encourage consistency, continuity, adequacy, and accessibility of coarse and fine resolution satellite and in situ land cover observations,
2. Establish international standards and specifications for the production of land-cover characterization maps and their accuracy assessment. The implementation is ensured through the joint international harmonization and validation framework,
3. Cooperate with ongoing international mapping to ensure the implementation of GOFC-GOLD requirements,
4. Engage in capacity building and regional partnerships and networks,
5. Implement land cover harmonization and interoperability case studies to make best use of existing resources and build user confidence for land cover products.

The purpose of the meeting was to report the progress of GOFC-GOLD and to discuss activities considering the objectives posed by the international community, the GOFC-GOLD Scientific and Technical Board, and the action items defined in the previous LC-IT meeting in Jena. The meeting agenda focused on the following topics:

- Requirements from the international community including GEO(SS), GCOS IP/UNFCCC and other conventions, and Integrated Global Observations for Land (IGOL)
- Observation data continuity and access,
- Evolving standards in land characterization and validation,
- Participation in ongoing and future programs for land cover characteristics and change assessment,
- GOFC-GOLD regional networks and capacity building,
- User involvement and confidence building.

In addition there have been some recent changes in LC-IT members and the meeting was used to introduce and incorporate the new members in the GOFC-GOLD activities.

	Tuesday, March 21st		Wednesday, March 22nd		Thursday, March 23rd	Friday, March 24th	Saturday, March 25th
Day	Workshop on Monitoring Tropical Deforestation for Compensated Reductions (Day 1)	Workshop on Monitoring Boreal Forest Ecosystems and Carbon accounting (Day 1)	Workshop on Monitoring Tropical Deforestation for Compensated Reductions (Day 2)	Workshop on Monitoring Boreal Forest Ecosystems and Carbon accounting (Day 2)	GOFC-GOLD Land Cover Implementation Team Meeting (Day 1)	GOFC-GOLD Land Cover Implementation Team Meeting (Day 2)	GOFC-GOLD Regional Network Meeting
Evening	<i>Dinner in the University Botanical Garden</i>		<i>Dinner at SCALA on top of Jena-tower</i>		<i>Castle Conference Dinner</i>	<i>Dinner</i>	<i>Adjourn</i>

The LC-IT workshop was part of a series of concurrent workshops held in Jena. The individual workshops reflected different GOFC-GOLD activities with different objectives and involved additional international experts and participants in each of the areas of interest.

The meeting was supported by several sponsors that are kindly acknowledged: GOFC GOLD, ESA, NASA-START, CFS, Jena-Optronik, GAF AG, Infoterra, HGS data solutions and the Friedrich Schiller University Jena.

2 Participants

The LC-IT meeting brought together members from the GOFC-GOLD LC-IT, representatives from several national and international organizations and space agencies (e.g. from ESA, DLR, CEOS, GTOS), and members of the scientific community and companies. Other participants represented Regional Networks and other major contributors to GOFC-GOLD related initiatives. The complete participation list is shown in Appendix A.

3 Agenda

The workshop included one day of presentations and one day of breakout group discussions. The presentations were organized in different sessions emphasizing different workshop objectives:

- Program Requirements and Global Initiatives
- Report from GOFC-GOLD LC-IT members
- European Land Cover Programs

Three breakout group discussions reviewed tasks and actions given to GOFC-GOLD and developed strategies for new products and activities in the fields of:

- BOG1: Harmonization and Validation
- BOG2: Pending Actions and Tasks
- BOG3: External Collaborations

A detailed agenda is shown in Appendix B. Documents circulated prior to the workshop are shown in Appendix C.

4 Summary of presentations and topics discussed

4.1 Status of Land Cover Implementation Team efforts

In its introductory presentation Dave Skole and Martin Herold reported on the status of the Land Cover Implementation Team and its activities. Dave Skole emphasized the role of GOFC-GOLD and the LC-IT in establishing a platform of communication and cooperation between data producers, data users and the science community in terrestrial observations. The team works cooperatively to improve observation, data products definition, assimilation, and dissemination. The central institution of the LC-IT is the Project Office (PO) in Jena. The PO represents an international focal point for land cover observations as a strong component of the GOFC-GOLD framework, to coordinate, promote and fulfill Land Cover implementation activities. The PO has been funded by the European Space Agency since 2004 and ESA will continue its support in the future.

Reviewing the outcomes of the previous LC-IT meeting in Toulouse (2001), Jena (2004) and the GOFC-GOLD STB meeting in Beijing (2005), the team has remained focused on its central objectives. They were adjusted to meet the new requirements of international drivers. Several important international initiatives include the GEO process, GTOS and related panels

including GCOS, different UN conventions (UNFCCC/GCOS impl. Plan), the IGOS-P theme for land: Integrated Global Observations for Land (IGOL), CEOS and the UN Global land cover network (GLCN). The LC-IT is participating, interacting or contributing to all these initiatives.

More specifically, key activities in recent years (2004-06) include working towards continuous and coordinated observations, in particular fostering fine-scale satellite data (Landsat-type) continuity. The LC-IT is involved in state of the art global land cover assessment through better data inventory and access, and land cover harmonization, validation and interoperability. The interaction between user communities and land cover map product applications are a key components for climate observations (GCOS implementation plan) and for interaction with the science community (i.e. carbon modeling, land change science, forest assessments, ecosystems and biodiversity). The LC-IT participates in ongoing mapping initiatives such as GLOBCOVER, capacity building, awareness raising, and ensuring regional implementation through maintaining GOFC-GOLD regional networks. New networks in development are located in East Asia and West Africa. GOFC-GOLD organized expert meetings, capacity building workshops, as well as special sessions and presentations at scientific conferences. All progress is being documented and made available through the GOFC-GOLD report series, the quarterly LC-IT newsletter, reporting to ESA, scientific publications and the webpage.

During the workshop the GOFC-GOLD LC-IT welcomed its new members Frederic Achard (JRC), Sergey Bartalev (IKI, Russia), Espen Volden (ESA) and Mike Wulder (CFS), as well as, Philippe Mayaux (JRC) as new vice-chair of GOFC-GOLD.

4.2 International initiatives and GOFC-GOLD contribution

4.2.1 GCOS implementation plan to the UNFCCC

The improvement of a consistent global perspective on land change dynamics and their impacts on climate for updating climate change estimates is embedded in the area of systematic research and observations fostered through the cooperation with the Global Climate Observing System (GCOS). The related GCOS Implementation Plan is the most advanced Earth Observation framework for implementing a UN convention. The plan emphasizes the need for operational observations for thirteen Essential Climatic Variables (ECV) in the terrestrial domain; among them land cover and fire. Initiated during the last LC-IT meeting Jena, the presentations of Philippe Mayaux, Michael Brady and Martin Herold addressed the contribution of GOFC-GOLD to the GCOS IP.

In general, the Global Terrestrial Observing System (GTOS) with its panel for Global Observation of Forest Cover and Land Dynamics (GOFC-GOLD) acts as an international agent to:

- Undertake the coordination and planning of systematic land cover and fire related climate observations, as identified in the GCOS IP,
- Produce plans for Parties to contribution to the global observing system for climate,
- Report progress (through the sponsors of GTOS) to Parties, and provide guidance on additional actions they need to take to address any identified problems.

GTOS with GOFC-GOLD has contributed to the progress made in land cover and fire observations. A report has been prepared in response to a request from the sponsors of the Global Terrestrial Observing System (GTOS) for inputs on a Progress Report to be submitted to the UNFCCC and discussed at COP 11. For land cover observations, the GCOS IP

specifies six action items. Overall, GOFC-GOLD's activities aim towards an operational terrestrial observation system with the key issues being the continuity and consistency in observations within an integrated framework, combining in situ measurements with fine and coarse resolution satellite data. These efforts go along with standardizing land cover characterization and validation, and complete international coordination.

The progress on actions for land cover observations in response to UNFCCC is reported below with all of the Land Cover actions (T22-T27) in the GCOS IP. The actions are linked and built upon each other, for example the development of a standard land cover classification system (action T22) is to be parallel with evolving common validation protocols (action T23). The availability of standards for land characterization (action T22), validation (action T23), and the continuity of fine resolution observations (T24) are essential for implementing the other actions (T25-27).

Action T22: Establish international standards and specifications for the production of land-cover characterization maps. Under the lead of FAO/UNEP, the UN Land Cover Classification Systems (LCCS) has been developed. Proposed to ISO TC211, and tested in national and international mapping initiatives; most prominently in the context of the UN Global Land Cover Network (GLCN). GOFC-GOLD has adopted LCCS as the most suitable and accepted international land cover characterization framework. The partners involved have provided strategies and resources (e.g. LCCS-software and documentation), and fostered capacity building and awareness raising for a consensus-oriented, international initiative to evolve and implement LCCS and jointly agree on a common set of land cover classifiers. GOFC-GOLD has contributed legend translations and harmonization case studies of existing land cover datasets as well as assisting in ongoing land mapping projects.

Action T23: Produce reliable accepted methods for land-cover map accuracy assessment. The CEOS/WGCV, working with GOFC-GOLD, has established standard validation protocols for land cover datasets (Strahler et al., 2006). The protocol emerged from an international consensus and specifies a set of core analysis requirements that should be routinely adopted as a baseline for reporting map accuracy. Such issues include required test data sampling approaches, standardized reference data acquisition, and accuracy reporting requirements to ensure transparent, robust, and independent accuracy assessments.

Action T24: Commit to continuous 10-30m resolution optical satellite systems with data acquisition strategies at least equivalent to the Landsat 7 mission for land cover. Fine-scale (Landsat-type) satellite data are an essential component of an integrated and operational terrestrial observation strategy (GOFC-GOLD report 4). An acquisition gap for fine-scale land observations will severely damage any evolved global data acquisition frameworks that provide continuous observations for land mapping, monitoring, and validation purposes. GOFC-GOLD has emphasized the importance of Landsat-type data continuity in many circumstances and has started to develop coordination among national space agencies for cooperative gap filling. Given the status quo, there is an obvious data gap coming for the second half of the 2000/10 decade. This situation is unacceptable to GOFC-GOLD as it undermines many key goals and initiatives.

Action T25: Develop an *in situ* reference network and apply CEOS WGCV validation protocols for land cover. GOFC-GOLD and CEOS/WGCV have developed a framework for operational global land cover validation. This framework builds upon evolving standards in land mapping and validation. The key is a new global set of land cover sites that provides statistically robust, consistent, harmonized, updated, and accessible reference information.

The political framework, the organizations for international cooperation, and the methodological resources to support an operational land cover validation framework exist or are being developed (Herold et al., 2006a).

Action T26: Generate annual products documenting global land-cover characteristics at resolutions between 250m and 1km, according to internationally-agreed standards accompanied by statistical descriptions of the maps' accuracy. GOFC-GOLD has contributed an integrated observation strategy for a concerted international activity to coordinate coarse resolution satellite observations (GOFC-GOLD report 3). Coordinated observations are the key for operational terrestrial monitoring given the suite of satellite observations available on this scale. Progress has been made towards standardized development and updating of land cover maps, and experiences have been gained from current challenges in coarse scale land cover mapping. Land cover products with 1 km spatial resolution are currently being refined and updated with more detailed land cover datasets. Most prominently, the ESA/JRC-GLOBCOVER products will provide global land cover observations for the year 2005 with about 300 m spatial resolution using ENVISAT MERIS data. It is intended that GLOBCOVER and the products produced by the MODIS land cover team will increase our understanding of global land cover change.

Action T27: Generate maps documenting global land cover at resolutions between 10m and 30m every 5 years, according to internationally agreed upon standards and accompanied by statistical descriptions of the maps' accuracy. The implementation of this action is least advanced, however, there is a suite of ongoing regional studies of land cover change in hot spot areas of climate-induced or anthropogenic changes in land cover (e.g. forest degradation). Furthermore, the GLCN and GTOS (in partnership with GOFC-GOLD) are developing strategies and gaining experience on how global scale fine-resolution land cover observations may be best implemented. Despite such progress, there will be no single global land cover map (10-30 m) that meets the requirements of the international community in the foreseeable future. If continuity of fine-scale satellite observations is provided, such land cover information could be available by the end of the decade if a focused effort was made. The successful implementation of these actions directly impacts the availability and quality of land cover observations.

However, the GCOS IP so far does not provide product specifications in a format readily useful to CEOS. GCOS (with WCRP) has started to draft an Annex to the GCOS IP setting out the satellite needs for climate and map product specifications (Table 1). The product specification sheets contain information about: benefits; required spatial, temporal and thematic characteristics; requirements for satellite instruments and satellite datasets; data archiving; calibration; product validation; adequacy/inadequacy of current holdings; actions, partnerships and advisory groups; link to GCOS Implementation Plan; non-climate applications; and products with significant overlap. The list of variables in table 1 may not be complete (i.e. need for a spec sheet for Vegetation Continuous Fields) but the definition of the three land cover product specification sheets were discussed during breakout group 2 of this workshop.

Table 1: List of product specification sheets in the context of terrestrial variables in the GCOS IP. The ones highlighted in yellow are of concern to GOF-C-GOLD.

Product No	Feasible today or Emerging (F/E)	Product Specification	ECV(s) addressed	Reference Action in GCOS IP
T.1	F	T.1.1 Gridded map of the areas of lakes (GTN-L) T.1.2 Regular estimates of lake level of all lakes in the GTN-L T.1.3 Gridded map of surface temperature of lakes in the GTN-L	Lakes	T5, T6, T8
T.2	F	T.2.1 Global map of the areas covered by glaciers other than ice sheets T.2.2 Regular update of the World Glacier Inventory T.2.3 Long-term measurements of ice sheet elevation changes	Glaciers and Ice Caps	T13, T14
T.3	F	Continuous gridded datasets of snow areal extent	Snow Cover	T11
T.4	F	Retrieve daily global directional hemispherical (black sky) albedo	Albedo	T21
T.5	F	T.5.1 Global, georeferenced maps of land cover type. T.5.2 Global georeferenced map of changes in land cover type T.5.3 Global, georeferenced maps of historical changes in land cover type	Land Cover	T24, T26, T27
T.6	F	Regular gridded georeferenced global maps of fAPAR	fAPAR	T28
T.7	F	Regular gridded georeferenced global maps of LAI	LAI	T28
T.8	E	Research towards global, above ground forest biomass map and forest biomass change	Biomass	T31
T.9	F	T.9.1 Georeferenced global maps of burnt area T.9.2 Global active fire maps (supplemental to burnt area) T.9.3 Fire radiated power (FRP) (supplemental to burnt area)	Fire disturbance	T33
T.10	E	Research towards global near-surface soil moisture map (up to 10cm soil depth)	(Soil moisture)	T37

4.2.2 GEO(SS) and 2006 workplan

The Group of Earth Observation has moved to establish a Global Earth Observation System of Systems (GEOSS, www.earthobservation.org). GEO has developed its organizational structure to include four standing committees and related terms of reference. Specific GEO actions are outlined in the GEO 2006 workplan.

In his presentation, Michael Brady emphasized that GTOS, through GOF-C-GOLD, is involved in land cover and fire related GEO activities. In general, the GEO 10 year reference plan emphasizes the need for improved land cover observations for all areas of societal benefit. GOF-C-GOLD has decided to lead or contribute to 8 tasks outlined in the GEO 2006 workplan. Of particular importance to the LC-IT is task US-06-02:

Initiate pilot communities of practice to identify and further refine users' needs, in particular on cross-cutting areas, building upon the initial experience of community of practice and on information provided by national, regional and project-level surveys.

GOF-C-GOLD is co-leading this task with Canada and Sweden to develop a community of practice to identify and further refine users' needs for forest observations. This community of practice has been proposed to the GEO user interface committee and is currently evolving. GOF-C-GOLD is further leading the implementation of the task AG-06-03:

Utilizing global and regional high resolution land-cover datasets (e.g. GLOBCOVER) and earlier 1-km resolution land cover data sets (e.g. Global Land Cover 2000); implement production of a high-resolution global land-cover change dataset and report. Propose

mechanisms for regular analysis and reporting on land cover change building on current efforts and promulgate the use of these products, especially in developing countries.

This task is co-lead with the US is directly linked with GOFC-GOLD participation in GLOBCOVER and the harmonization/validation initiative. GEO Task AG-06-04:

Initiate an international assessment effort on forests and forest changes utilizing ongoing land cover mapping projects (e.g. GLOBCOVER). Ensure the application of standardized classifications and harmonization of existing datasets.

This specifically points at cooperation between FAO and the Forest Resources Assessment (FRA). The GOFC-GOLD contributions to GEO have to be refined as part of this workshop and discussed in breakout groups 2 and 3.

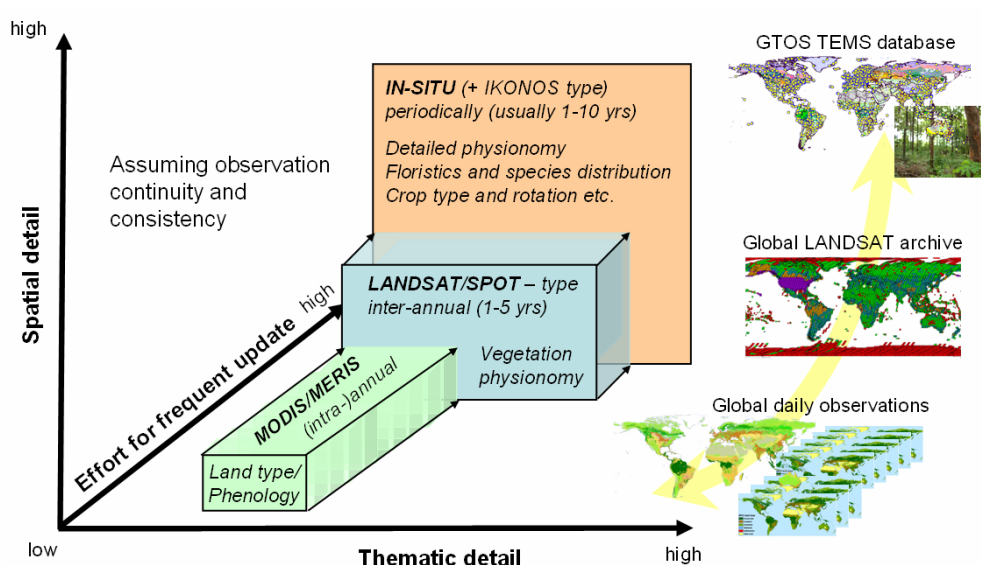


Figure 1: A conceptual framework for integrated land cover observations

4.2.3 IGOL

Since its creation in 1998 the Integrated Global Observing Strategy (IGOS) seeks to provide a comprehensive framework to harmonize the common interests of the major space-based and in-situ systems for global observation of the Earth (<http://www.eohandbook.com/igosp/>). Integrated Global Observations for Land (IGOL) is the land theme of IGOS and has the responsibility to design a cohesive program of activities which will provide a comprehensive picture of the present state of terrestrial ecosystems, and build capacity for long-term monitoring of those ecosystems (<http://www.fao.org/gtos/igol/>).

GOFC-GOLD is strongly involved in developing the IGOL theme. John Townshend presented recent progress of IGOS and the contribution of GOFC-GOLD to this initiative. The current IGOL aims at an integrated and operational land observing system (Figure 1) focusing on the following areas:

- Land cover, land cover change, fire
- Land use, land use change
- Agricultural production, food security, sustainable agriculture and forestry
- Land degradation and soils
- Ecosystems, ecosystem goods and services

- Biodiversity and conservation
- Human health, impacts of land properties on vectors
- Water resource management, water use for agriculture, human use
- Disasters (fires, floods, droughts), early warning systems
- Climate change impacts on land properties
- Energy (biomass, fuelwood)
- Urbanization and infrastructure

The IGOL documentation will be completed soon and will directly link the observation needs with the GEO areas of societal benefit.

During the discussion on remote sensing needs it was underlined that many necessary satellite systems already exist or will soon. Especially the field of optical systems of moderate resolution satellite observations is satisfactory to very good. However, Landsat observation has deficiencies in short to medium term. Due to a sensor failure other systems are to be used to complement or substitute for Landsat for several years, e.g. Aster, CBERS, IRS-1, and SPOT-HRV). For scaling and the assessment of human infrastructure very fine resolution systems are needed. There is still a need for Radar systems (i.e. INSAR) with appropriate acquisition strategies and Lidar systems for vegetation structure. Furthermore insufficient validation activities have been pointed out.

There are further key needs for in situ observation. Present global and regional in situ observational systems have a very limited geographic and thematic coverage. There is a lack of harmonization of observations, uncertainty about continuity of observations, and inadequate global coordination of reporting. Positive examples are systems like TEMS, LTER, ILTER, AI-TER, NEON and others.

4.2.4 ESA

Olivier Arino from the European Space Agency (ESA) presented several projects contributing to the Global Monitoring for Environment and Security program (GMES). This is a European joint initiative with the aim to further engage the use of earth observation (EO) data for the retrieving of spatial information needed for monitoring efforts (<http://www.gmes.info/>). Different GMES Service Elements (GSE) were created to implement the objectives of GMES. The ESA is funding and supporting the Service Elements for land, forest monitoring and risk EO.

The GSE Forest Service addresses objectives and users on different scales. It provides a pan European forest monitoring service and supports forest information updates and environmental monitoring on the national scale. For local users GSE Forest supports the management and reporting obligations of LULUCF Clean development mechanism. The Service Element for Land addresses the European Policies for impervious areas and sealing levels, inland water quality and irrigation/agricultural water consumption as well as the preparation of the European Urban Atlas. 83 user organizations from 20 countries ranging from local to regional, national and European level are involved. As part of its GMES commitment, the planned ESA Sentinel satellite mission 1 and 2 will provide continuity for moderate and fine resolution optical data. The missions will not be launched before 2012.

The GSE risk EO includes five independent services on Forest Fires and Floods based on a 2-year consolidation phase referring to the EU and national policies Burn Scar Mapping, Asset Mapping, Flood Risk Analysis, Flash Flood Early Warning and Rapid Mapping. The service addresses 37 users or groups of user organizations from 7 countries.

In the frame of its Earth Observation Envelope Project (EOPS) the ESA launched the data user element (DUE) with the mission to encourage the establishment of a long-term relationship between user communities and Earth Observation (<http://dup.esrin.esa.it/>). In the frame of DUE a number of projects are supported.

As an example the progress of the Globcarbon project has been emphasized. Since 1997, it aims to produce global vegetation and fire products for the carbon modeling community. All basic data processing for the years 1998 to 2003 are done and the products are available on the web (<http://geofront.vgt.vito.be>). The validation of the resulting products and the service assessment is currently in progress. Future steps include data processing of the remaining project years and the completion of the validation phase. The products and service quality are to be optimized and promotion of the Globcarbon data products will be increased.

4.3 Activities of Land Cover IT members

4.3.1 CEOS Cal-Val Working group and MODIS team efforts

Curtis Woodcock presented the Global Land Cover Validation Report and the status of MODIS land cover products. The report outlines “Best Practices” for accuracy assessment of global land cover maps is a consensus effort of 10 different authors from 4 countries, under the lead of A. Strahler and was published by the JRC (Strahler et al., 2006). The report underlines the importance that all global land cover maps should have statistically valid estimates of map accuracy. The given recommendations include methods which should be routinely applied in land cover mapping, like design-based inference, probability sampling and consistent estimators of uncertainty. Furthermore it recommends additional methods that may be included, like the validation during and after map production, the use of confidence-based quality assessments, the addition of fuzzy accuracy methods, and the use of qualitative and descriptive methods.

Current available MODIS Land Cover maps date from 2001 and are based on MODIS collection 4 data. More recent maps for 2002-2004 have been produced and should be available soon. Actual MODIS maps from 2005 are in production and should be available in summer 2006. The MOD12Q2 product (land cover change) is now available for several years. In collection 5, both MOD12Q1 and Q2 products will move to 500 m land cover mapping with the anticipated release of first 500-m maps in winter 2007.

It has been pointed out that the MODIS LC map has not been through a statistically valid accuracy assessment like those of the IGBP Discover and GLC2000 maps. It is desirable that GOFC-GOLD LC IT lead a continuing effort to validate land cover products. The key steps necessary to prepare for such an effort have already been completed, and include: the agreement on a land cover classification system and the “Best Practices” report on accuracy assessment.

4.3.2 Harmonization/validation initiative

Martin Herold from the GOFC-GOLD Land Cover project office in Jena presented progress of the harmonization and validation initiative. The background of this initiative are the needs from international drivers, i.e. those described in the GCOS IP to establish international standards for land-cover characterization (by 2005), production of reliable accepted methods for land-cover map accuracy assessment (see 4.3.1.), and development of in situ reference network and application of CEOS WGCV validation protocols for land cover (by 2009). The tasks masters are CEOS WGCV, GTOS/GOFC-GOLD and UN Global Land Cover Network.

The strategic, organizational and methodological framework has already been established. Examples are the UN Land Cover Classification System (LCCS) and the validation protocols described in section 4.3.1. The joint harmonization and validation initiative will involve all important actors for the best use of resources and experiences and combine harmonization and validation activities towards an improved usability of land cover products (Figure 2).

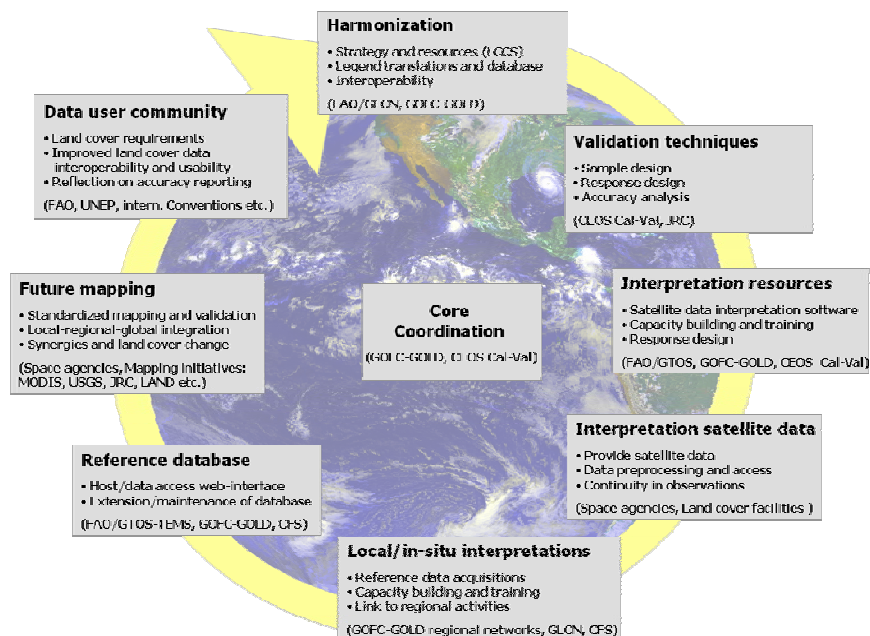


Figure 2: Conceptual framework for a joint international harmonization and validation initiative.

The next steps are to finalize the documentation for the GCOS IP, including evolving standards in land characterization (T22), validation best practices (T23) and a framework for harmonization and validation initiatives (T25). Specific actions on these have been discussed in breakout group 1 during this LC-IT workshop.

There have been a number of additional developments with LC-IT contribution. The first GOF-C-GOLD/CEOS Cal-Val workshop for validation Vegetation Continuous Fields products was held in October 2005 at South Dakota State University. Following the model for developing “best practices” validation protocols an additional workshop is needed to move ahead in this arena. There was an international Land Use and Land Cover harmonization workshop in February 2006, at FAO in Rome to start developing a “Land Use Classification System”. GOF-C-GOLD has been present and will continue to participate in this process. In addition the LC-IT has been organizing and participating in LCCS and land cover validation capacity building events involving the GOF-C-GOLD regional networks and UN GLCN.

4.3.3 Monitoring tropical deforestation for compensated reductions – Tropical workshop summary

Ruth De Fries presented results from the workshop on Monitoring tropical deforestation for compensated reductions, which was held from 21st-22nd March during the symposium. Background of this workshop is the submission by the governments of Papua New Guinea and Costa Rica wherein the Parties to the UNFCCC and to the Kyoto Protocol are called upon to open a dialogue to develop scientific, technical, policy and capacity responses to address emissions resulting from tropical deforestation. The COP invited Parties and accredited observers to submit their views on issues relating to reducing emissions from deforestation in

developing countries to the secretariat, by 31 March 2006. The aim of the workshop was to formulate a consensus reply for the secretariat on earth observation capabilities to monitor deforestation and forest degradation in developing countries.

A joint workshop with Environmental Defense on “Remote Sensing Analysis of Tropical Deforestation and Baselines for Carbon Crediting” held July 6-7, 2005 at Carnegie Headquarters, Washington DC (DeFries et al., 2005) led to the establishment of an ad hoc GOFC-GOLD working group to develop technical guidance on current and future capabilities for monitoring deforestation in the context of UNFCCC present discussions. During the workshop the different approaches were reviewed and discussed in break out groups. In general, there is common understanding and vision among the earth observation community that:

- Comprehensive experiences for monitoring tropical deforestation can measure forest cover and change in a consistent, transparent, and cost-effective manner;
- Forest changes can be monitored with confidence for assessing and comparing historical and future rates of deforestation (*Considering existing satellite databases and assuming continuity for future missions and processing capacities*);
- And consensus technical guidelines can be developed.

Multiple methods are appropriate at national levels depending on deforestation processes, costs, and capacities. The verification and the accuracy assessment is still a critical issue. A more efficient use of resources can be achieved through synergies among national, regional, and global efforts.

The outcomes of the workshop will be documented in an executive summary giving a summary statement on technical feasibility to be considered for the submission to the UNFCCC by March 31st. The ad hoc GOFC-GOLD group will continue its activities and develop a technical protocol and a workshop report. The outcomes will be communicated to policy-relevant discussions and fora.

4.3.4 African Observatory and Biodiversity

Philippe Mayaux from the Joint Research Center (JRC) presented the status of developing an African observatory. The EU delivers 60 % of its public aid to Africa. This budget will increase by 50 % in the next 4 years and reach the target 0.7 % of GDP. The real impact of this aid is not always clear. The institutions in charge of development asked JRC to provide scientific expertise, in particular to support civil security, food security and natural resources management.

The project “Observatoire des Forêts d’Afrique Centrale” is a large collaboration between all partners of the Congo Basin Forest Partnership, i.e. COMIFAC, donors, NGOs, private sector, international organizations. The objectives are the production and the circulation of reliable information on the Congo basin forests in order to improve the management, as well as capacity-building and appropriation. Satellite monitoring tools include the detection of deforestation, forest degradation, and pressures to biodiversity.

Both Philippe Mayaux and John Townshend emphasized the general importance of Earth Observation to support observations of biodiversity and threats. Of key importance to the success of the UN convention of Biological Diversity (UNCBD) is the commitment to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level by 2010. Some of these specific 2010 goals may have obvious benefits from Earth Observation including:

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

A fundamental contribution of land cover observations is regular monitoring of habitat extent, in particular forest area and forest conditions as well as their change and fragmentation.

However, delivering information on extent and fragmentation is more advanced than information on changes and their impacts on biodiversity. More specifically, to measure and monitor biodiversity with respect to the 2010 targets, several indicators have been developed. Some may directly benefit from Earth Observation:

1. Trends in extent of selected biomes, ecosystems and habitats;
2. Trends in the abundance and distribution of selected species;
3. Coverage of protected areas;
4. Change in the status of threatened species; and
5. Connectivity and fragmentation of ecosystems.

The indicators 1) and 5) may be directly served by remote sensing based land cover observations. For the others, satellite observations may not be a primary source of information but could be improved with remote sensing inputs.

For the headline indicator 1) Trends in extent of selected biomes, ecosystems, the UNCBD SBSTA identified the following eleven land types for monitoring:

- Forest and forest types
- Grasslands (natural)
- Dry and sub-humid lands
- Inland wetlands
- Peat lands
- Tidal flats / estuaries
- Coral reefs
- Sea grasses
- Croplands
- Urban
- Polar / ice

Satellite-based land cover observations and already available land cover maps are able to provide information on most of these categories in both extent and conditions.

4.3.5 Boreal forest monitoring for UN conventions – Boreal Workshop summary

4.3.6 Joint Research Center

Future plans for land cover and forest observation of the Joint research Center were presented by Frederic Achard. The JRC will concentrate on the improvement of existing global land cover products (1 km res.) by using medium resolution imagery (250-300 m) and using fine resolution imagery (20-30m) for estimating changes through systematic sampling. The joint ESA – JRC initiative “GLOBCOVER” will produce global land cover data for the year 2005

at 300m spatial resolution. Initial tests involved object-oriented classification with preliminary results over Madagascar. The JRC is further involved in the JAXA K&C project for regional scale assessment of forest resources in Eurasia and Africa.

The JRC will follow up in the TREES project tradition, and present future plans for forest monitoring using fine resolution (30m) imagery for estimating changes through systematic sampling. Forest area change will be estimated from a designed sample of high resolution satellite data over boreal regions and the pan tropical belt in the following phases:

- Phase I Boreal Eurasia and tropical humid forests 2000-2005
- Phase II Tropical dry forests 2000-2005
- Phase III All 1980-1990, 1990-2000

4.3.7 Canadian Forest Service and EOSD

Mike Wulder from the Canadian Forest service presented results from its project Earth Observation for Sustainable Development of Forests (EOSD). During the project an operational land cover mapping program for Canada has been established, based on Landsat 7 ETM+ data. Mapping started in 2000 and was completed recently. LCCS was applied to assure a national meaningful and internationally compatible legend and validation protocols developed and being applied. The map product includes land cover, land cover change and a biomass product. The products have been developed for public access and are freely available.

4.3.8 CNES

The CNES contribution to GOFC-GOLD (and GEO and GMES) was presented by Herve Jeanjean. CNES a research and development space agency with a technical and programmatic mandate for space infrastructures and ground segments and services. Following the success of SPOT HRV and VEGETATION, future earth observation programs of CNES will focus on high resolution observation. There are a wide range of requirements for land monitoring from space and data continuity is the top priority and rationale for ESA/sentinels. However, the need is for more tailored infrastructures than just recurrent ones. CNES believes in low cost access to EO-data. Users should pay for services and not for data. SPOT VGT data are open to the public and CNES has initiated an “Optimising Access to SPOT Infrastructure for Science (OASIS)” with free access to SPOT data for European scientific community.

4.4 European land cover programs and projects

4.4.1 EEA

The European Environmental Agency (EEA) is a key mandated organization within Europe focusing on land cover and land use observations. Chris Steenmans from the EEA informed the participants about ongoing land cover observation developments. A fast track service for land monitoring with the frame of GMES is currently in development. This initiative intends to deliver (from 2008 onwards) operational services for a frequent, coherent and cost effective monitoring of land cover information integrating global, regional and local monitoring. The funding is in place and the kick-off is anticipated for June 2006. The effort is building on the CORINE experience. The CORINE program provides European land cover and land use information for 1990 and 2000 and for related changes. The datasets are available free of charge and have been requested by a variety of user groups (Figure 3). The GMES fast track service will aim to update CORINE land cover changes using CORINE and new high resolution land cover data.

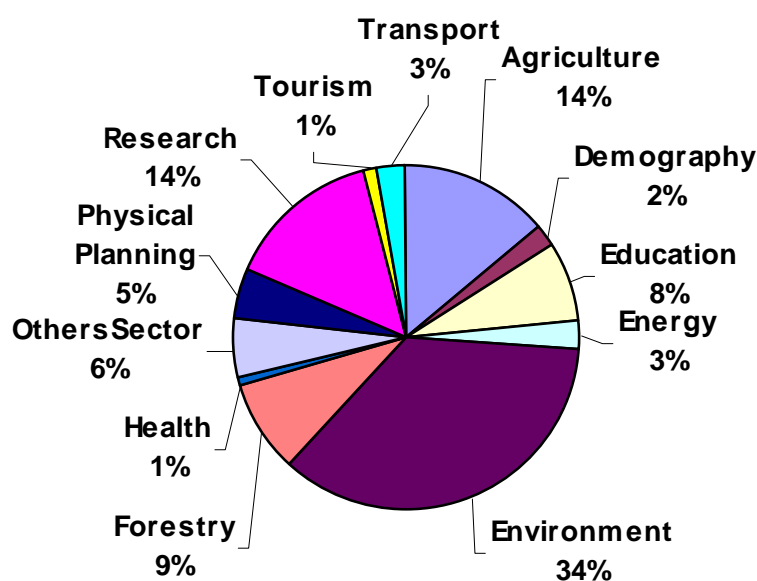


Figure 3. Breakdown by economic sector for downloads of the CORINE land cover/use dataset from <http://dataservice.eea.eu.int> in 2005 (based on 5600 downloads).

The EEA intends and has started contributing to several GEO tasks including the ones for land cover where GOFC-GOLD is involved as well. EEA is a key partner in the GLOBCOVER project. Ongoing collaborations with ESA and JRC will ensure that the regional European programs will benefit from the GLOBCOVER products.

Given the common interest of EEA and GOFC-GOLD, Mr. Steenmans proposed a strong cooperation with GOFC-GOLD with the following objectives:

- Strengthen exchange of knowledge with EEA as European/Regional user organization
 - To support streamlining of environmental reporting to international organizations / Shared Environmental Information System
 - To share experiences on harmonization, data processing standards, validation, in situ monitoring and data dissemination
- Ensure consistency of GMES Fast Track service on land monitoring with GOFC-GOLD objectives, i.e. forest cover product
- Collaborate on GEO/GEOSS activities related to land cover monitoring

More details on a proposed collaboration of EEA and GOFC-GOLD in the context of GEO and GMES have been discussed in breakout group 3.

4.4.2 GMES land monitoring services

The Infoterra GmbH and its partners have reported progress in the ESA GMES Service Element for land comprising the consolidated development of existing intermediate products from three previous projects - the GSEs SAGE, CoastWatch, and GMES Urban Services (GUS) - into marketable products (<http://www.gmes-gseland.info/>, Figure 4). Alexander Kaptein from Infoterra presented an overview of this GMES Land information consortium.

GSE Land Information Services are based on general space borne geo-information on Land Cover and Vegetation (LC&V). By integrating this information into existing infrastructure, models and management tools international and national public institutions should be enabled to fulfill their reporting and management obligations in an improved way. The overall goal is to implement a European service network to respond to the demands of international, national, regional and local user organizations.

Based on the policies the GSE Land Information Services portfolio has been structured in four service areas: European Urban Atlas, Impervious areas and sealing levels, Inland Water Quality and Contamination, and Irrigation and Agricultural Water Consumption. Further extension service options include a roll-out to more European MS and a "nature protection" service.

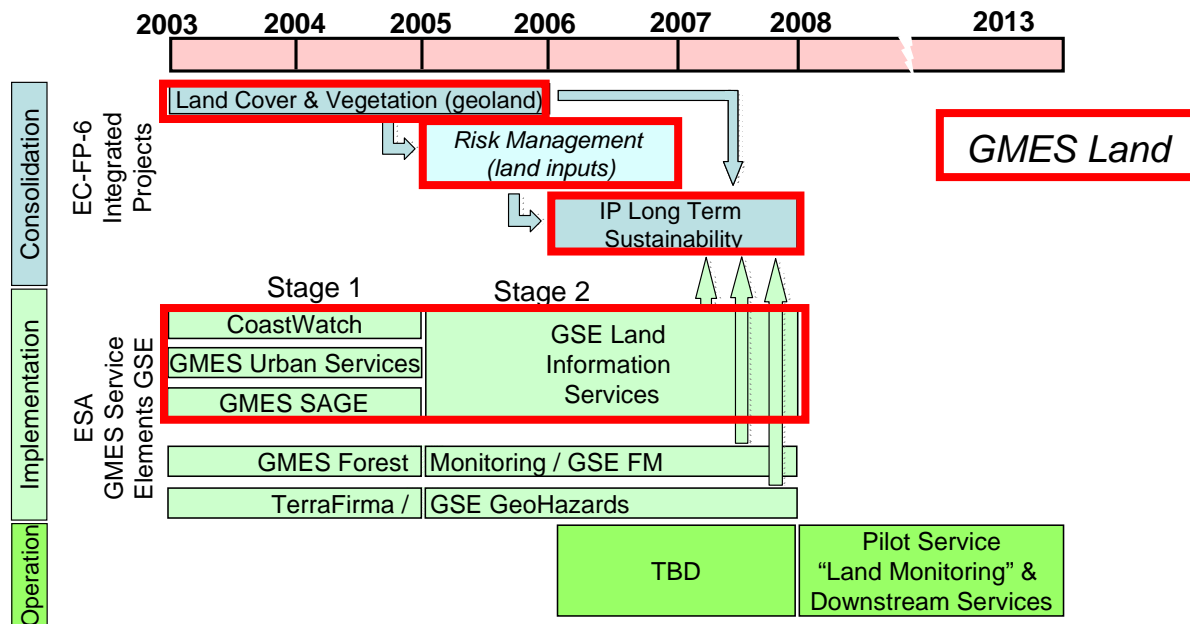


Figure 4: Development towards GMES Land

As an example the European Urban Atlas will provide a map of land use and land cover of European urban functional areas with 0,1 to 0,25 ha Minimum Mapping Unit (MMU) including all European agglomerations with more than 100.000 inhabitants. GSE Land will successively add service elements validated by Geoland programme, synchronization has been largely achieved. Joining forces with geoland, a common user platform (coordinated by ETC-TE) and a Service Provider Network will be set-up.

The envisaged goal is to build up a European Land Monitoring Database including the European Urban Atlas, European Land monitoring (with 1 ha and 5h MMU for urban and rural areas respectively) and Image database including medium up to very high resolution data. To establish this Fast Track Service the importance of standards concerning content and performance, data models and validation has been underlined. This is a major open issue for the FTS European Land Monitoring (e.g. discussion on LCCS, SIOSE, DECOVER).

Concerning observation data continuity and data access it was pointed out that continuity is not yet guaranteed. Within the very high resolution sensors the best cost/benefit is Spot-5 which will not operate until 2008. As the European Spot programme is not continued beyond 2008 and Sentinel-2 will not operate before 2012, there is a gap to be closed and it was questioned whether international missions are sufficient. Concerning data access a coordinated multi-mission data acquisition to ensure European coverage during the growing season has been identified as a bottleneck. The archive access is not yet a major issue.

4.4.3 Geoland

Marc Leroy from Medias-France presented the status and perspectives of the European project Geoland. As an integrated GMES project on land cover and vegetation it aims to develop and demonstrate a range of reliable, affordable and cost efficient European geo-information services, supporting the implementation of European directives and their national implementation, as well as European and International policies (<http://www.gmes-geoland.info/>). Geoland particularly addresses environmentally relevant issues such as water quality, nature protection and the Kyoto-process or food security issues on different scales. It leads to monitoring water and carbon fluxes on land, environmental stress, land cover and forest conversion as well as crop production and yield assessments. Therefore a wide range of parameters regarding vegetation, radiation and water are already available online through the Geolands Core Service for biogeophysical Parameters CSP, <http://www.gmes-geoland.info/>, on global and continental scale (Figure 5). The regional level focuses on Europe and aims to make harmonized, generic Land cover information available.

Product	Parameter	Space Coverage	Time Coverage	Space Resolution	Time Resolution	Sensor
Vegetation	LAI	Continent to Global	1998 - 2003	1 km	1 day to 10 days	VEGETATION
	Fcover					
	FAPAR					
	Burnt Area					
	Surface Reflectance					
Radiation	Surface Albedo	Continent To Global	1998 - 2003	1 km to 50 km	½ hour to 10 days	METEOSAT GOES - GMS VEGETATION AVHRR
	Downwelling Shortwave radiation					
	Downwelling Longwave Radiation					
	Land Surface Temperature					
Water	Precipitation	Continent To Global	1992 - 2004	1 km to 1°	1 day to 10 days	METEOSAT ERS/Scatt AMSR VEGETATION
	Soil Moisture					
	Evapotranspiration					
	Water Bodies					

Figure 5: Available parameters at the Geoland Core Service of biogeophysical Parameters at global or continental scale

The Geoland project has started to develop a perspective towards an operational “Global Land Monitoring” GMES Service. Technically, the products lines and the network of Service Providers in Europe are at a sufficient maturity level to start an operational production in some specific areas. At the institutional level, a principle agreement has been reached between a number of actors, including ECMWF, NMS, JRC, Eumetsat, ESA, EEA, and service providers benefit from national support (i.e., IM, VITO, MEDIAS, others).

4.4.4 GSE forest monitoring

The GMES Service Element (GSE) for Forest Monitoring is an integral part of the GMES Initiative that aims to provide a service portfolio for standardized spatially referenced, quality products and services around forest monitoring, for example forest and land use maps, biomass, and carbon accounting (Figure 6). These products are accessible and transparent to users and address the policy related demands for securing the ecological functions in the

forestry and land use sector, i.e. UNFCCC, Kyoto Protocol, the UN Convention on Biological Diversity and (<http://www.gmes-forest.info/>). This consortium is lead by the GAF AG Germany, the current status was presented by Thomas Häusler..

The GSE forest monitoring has been consolidated in Stage 1 from February 2002 until September 2005. The next stage will be implemented from Oct. 2005 to 2008. Objectives of the second phase are to demonstrate progress towards long-term sustainability for a set of GMES services and to deliver services and benefits to users on larger scales. It is intended to establish a durable, open and distributed GMES Service Provision Network as well as standards and working practices for GMES Services. During stage 2 the provided services will be scaled up to pan-European Scale. On the national level, support to national UNFCCC and Kyoto Protocol Reporting obligations in LULUCF sector is addressed, as well as forest information updates and the detection of natural and human induced forest disturbances. Local scale activities focus on support to management and reporting obligations of LULUCF projects.

An important goal is the co-ordination of related GSE's and other EO-Land Services programmes in Europe and internationally. This co-ordination for synergies is required to avoid duplication of services and products, catering to the same user-segments (policies) and to improve the cost-effectiveness by developing synergies in shared infrastructure, data etc. It was underlined that co-ordination with National/EU land cover programmes is essential. Complementary funding should be used to close gaps in missing service coverage. Existing land related GSE projects such as GSE Land, Geoland, GMFS and other international programmes, e.g. GOFC-GOLD should use synergies in infrastructure to avoid duplication.

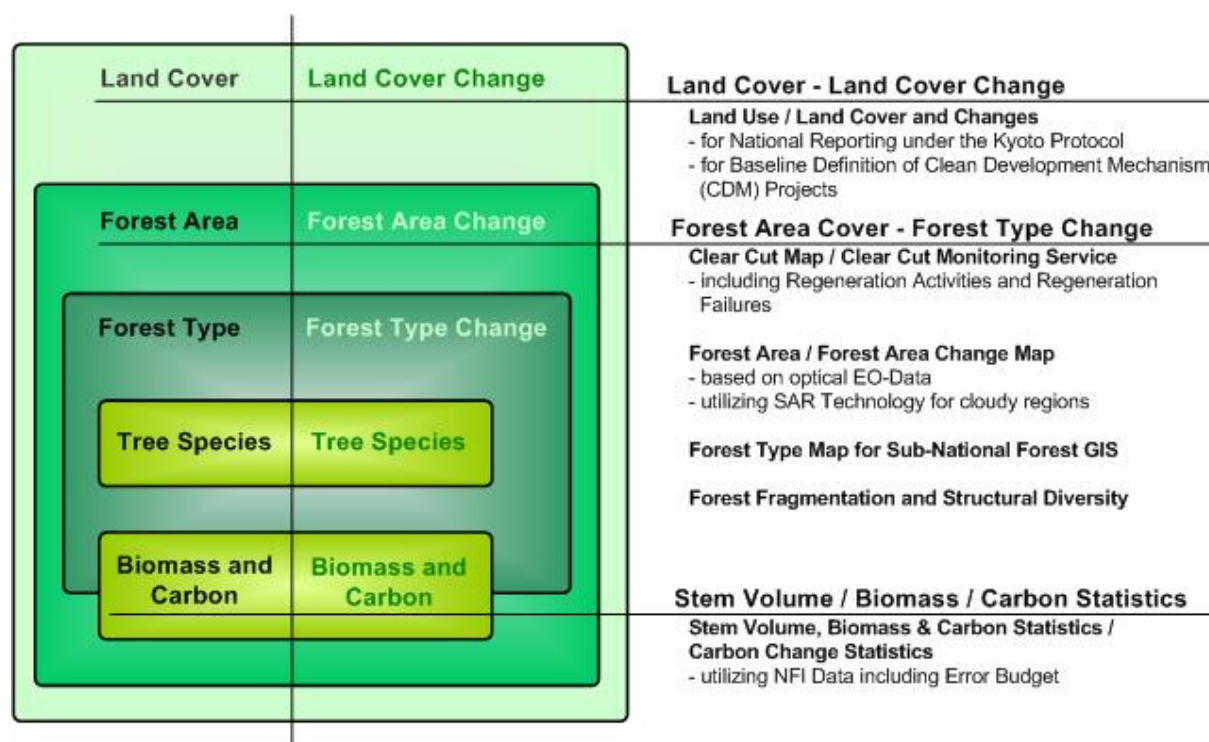


Figure 6: Product portfolio of the GSE Forest Monitoring

4.4.5 Globcover

The GLOBCOVER project builds upon an international network of partners working together with ESA over two years on the production of an global land cover map for the year 2005 (see also section 4.2.4). This project is taking place as a part of the Earth Observation Data User

Element (DUE) and participants include the United Nations Environment Programme (UNEP), the Food and Agriculture Organization (FAO), the European Commission's Joint Research Centre (JRC), the International Geosphere-Biosphere Programme (IGBP) and the Global Observations of Forest Cover and Global Observations of Land Dynamics (GOFC-GOLD) Implementation Team Project Office (<http://dup.esrin.esa.it/projects/summary68.asp>).

The objectives include the development and production of a global land cover map for 2005 at 300 m spatial resolution, based on MERIS data, using LCCS and building upon the GLC2000 experience. The validated product will be accompanied by monthly mosaics of surface reflectance composites. GLOBCOVER aims to deliver the hardware and software processing system.

Future steps include the completion of the monthly reflectance mosaics for Europe and at global scale. They will be provided until July 2006 as well as a draft version of the GLOBCOVER land cover map for Europe. The draft version with global coverage and the global monthly mosaics for full year 2005 are planned to be finished until the end of the year 2006 with the complete GLOBCOVER land cover map version 1 is projected for June 2007.

5 Breakout group discussions

5.1 BOG 1: Harmonization and validation

This breakout group addressed several subjects: the harmonization of LCCS, the GCOS Implementation Plan (IP), as well as best available data sets. Based on the discussion of these topics new actions for GOFC-GOLD were derived.

Concerning the harmonization of LCCS it has been agreed that further recommendations and enhancements have to be undertaken. O. Krankina and M. Wulder are responsible for the boreal zone wetlands. Next actions for the LC office will be:

- Finalize ongoing translation efforts on common global and regional legends (LC office)
- GLOBCOVER legend development, engage regional networks (LC office)
- IT assistance and guidance in legend translation and comparison (LC office)
- Further engage in LCCS capacity building for regional networks (LC office)
- Distribute LCCS manuals and resources to all people interested, a list was circulated during the workshop (LC-IT)

The GCOS IP and operational validation have been discussed in detail. It was pointed out that task 22 and 23 are already well established and as a next action the LC office and IT have to finalize a consensus document on task 22 (LC office). In the context of task 25 it was discussed how “in situ” field plots are reliable for operational validation. Using remote sensing data a finer resolution than Landsat may be needed for initial interpretation. SPOT 5 data was suggested. Landsat may be useful for revisiting known areas, detected changes may then be assessed using finer resolution data. Category III expenses need further discussions (?!).

The IT members agreed on the following actions:

- The operational validation implementation plan needs to be written (C. Woodcock, M. Herold, M. Wulder)
- The GLC2000 validation dataset has to be made available (P. Mayaux)
- Progress on VCF validation, follow up on second workshop (P. Mayaux, M. Herold)

- RN to play key role as local/regional experts in both map production and validation

Concerning the spatial sampling scheme it was agreed that a rigorous design is needed to respond to GCOS IP. Potential regional accuracy assessments should be considered in the framework.

Finally the requirements of a best available data set were addressed. It was generally agreed that LCCS is of key importance in this context. The data base should allow a varying degree of categorical and spatial detail and link to validation exercises.

Data delivery mechanism

Database design rather than combining

Entrance requirements and guiding principles on what is considered better

What about data from different years, is more recent better

Best characterization of the recent LC map

As next actions the preparation of an implementation plan (LC-IT) are envisaged as well as the discussion for the home of this database.

5.2 BOG 2: Pending actions and tasks

GOFC-GOLD and GEO contribution:

- GEO is not a funding agency and GOFC-GOLD contributions should be based on what is already ongoing and benefits the GEO process
- Additional resources are to be sought for implementation activities
- Land cover: How to produce global and regional datasets that are more relevant for national level?
- Existing inventories of existing national/regional level datasets?
- Change analysis: comparing two maps is the wrong way, especially when looking for spatially explicit change, perhaps works for general statements of area that changed
- Many GOFC-GOLD regional network countries are not GEO member states, so role for GOFC-GOLD to include them and make them profit from GEO process
- GEO and GMES point at need for establishing regional networks in Europe and North America
- GOFC-GOLD to coordinate with GTOS on GEO contribution
- GEO tasks with GOFC-GOLD lead or contribution have been identified, now start developing implementation with co-leads and contributing organizations

GOFC-GOLD and FRA 2010:

- FRA2010 will include more detailed and transparent global information:
 - Systematic global sample (10x10 km) for 13.000 Landsat scene locations and centralized assessment
 - Will include more thematic layers including fire
- GOFC-GOLD has received an invitation to participate in FRA2010:
 - GOFC-GOLD can play key role
 - Direct link to GEO workplan and 2006 tasks:
 - AG-06-04: Global forest assessment using EO data and standard methods
 - US-06-02: Development of community of practice for forest observations
- GOFC-GOLD contributions:
 - Advocacy role for land cover/forest and fire observations from space
 - “Global forest change and assessment framework” from GOFC-GOLD to assist FRA
 - Assist with sampling (global hot spots)

- Provide raw input datasets and consensus image analysis methods
- Need for Radar data for sampling locations with permanent cloud cover

GCOS IP land cover product specification sheets:

- GOFC-GOLD LC-IT to take ownership of the three land cover specification sheets:
 - Land cover change (10-30 m)
 - Land Cover (250-500 m)
 - Land cover change history
- First draft of spec sheets have been prepared
- LC-IT members have revisited the draft sheets during and right after the workshop to provide input, timeline:
 - TOPC meets 28th and 29th March where version 1.0 of the supplement will be finalized
 - GOFC-GOLD input is foreseen on the TOPC agenda
 - Version 1.0 goes for open science review via the GCOS web site at WMO on 1st April
 - GCOS will respond to reviewers comments in June and produce 'final' version for eventual submission by GCOS to COP12/MOP2, 6th – 17th November 2006 Nairobi
- Open questions: spec sheet for VCF and biomass!

UNFCCC-COP12:

GOFC-GOLD should sign up for 1 hour side event on the role of EO to support conventions with focus on tropical forest monitoring for compensated reductions to propose technical and methodological consensus developed during this workshop.

5.3 BOG 3: External collaborations

The break out group discussed ongoing GEO Tasks. In this context the question arose whether GOFC-GOLD should lead some GEO tasks or just contribute to it? It was agreed that the FAO is in a better position to lead. However GTOS/GOFC should be able to take a leading position for the scientific and technology committee. Alternatively, GOFC-GOLD could take on a contributor position. GEOSS is addressing operational systems, and is driven by a political dimension. GTOS/GOFC is a scientific adviser and provides recommendations.

- EEA collaboration potentials: issue is how the GMES fast track service fits into the global context
 - The difference between global and regional mapping initiatives (products, accuracy, classification systems...) is expected to decrease in the future: we need to anticipate the establishment of common standards.
- GMES-wide mode of collaboration, proposal/invitation to work with GOFC-GOLD: GOFC is the right forum for expressing scientific recommendations to be taken into account by GEOSS and GMES. GMES projects to be involved, but it is important to establish links at institutional levels (EEA, ESA, EC...).
- CNES/Spot initiative or request for developing countries: see group 1 recommendation. Provision of a set of data for validation (even regional land cover mapping exercise?). To be investigated by CNES for GOFC-GOLD. Role of regional networks for figuring out the requirements

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Appendix B – Agenda

GOFC-GOLD Land Cover Implementation Team meeting

Thursday, March 23rd at Dornburg Castle “Altes Schloss” (16th century)

INTRODUCTION/ WELCOME

09.00 - 09.15	Welcome from FSU Jena to the Dornburg Castle	Vice Dekan FSU
09.15 - 09.25	Opening comments and logistics	Schmullius
09.25 - 09.45	GTOS/GOFC-GOLD overview, objectives + drivers	Brady
09.45 - 10.10	Overview/history of LC-IT activities	Skole
10.10 - 10.30	Status and report from LC-IT office	Herold
10.30 - 10.50	Meeting objectives/rationale for workshop	Schmullius/Townshend

10.50 - 11.15 Break

SESSION 1: Programme Requirements and Global Initiatives (15 min present., 5 min discussion)

11.15 - 11.40	ESA support to GOFC through ATSR World Fire Atlas, Globcarbon, Globcover, GSE Forest, GSE Land and future Sentinel-2 and Sentinel-3	Arino
11.40 - 12.05	GCOS IP and GMES	Mayaux
12.05 - 12.30	GEO(SS) and Community of Practice on Forests	Brady
12.30 - 13.00	IGOL	Townshend

13.00 - 14.00 Lunch

SESSION 2: Reports from GOFC-GOLD LC-IT members (15 min presentation, 5 min discussion in break out groups on Friday)

14.00 - 14.20	CEOS WG CalVal and MODIS team efforts	Woodcock
14.20 - 14.40	Harmonization/validation initiative	Herold
14.40 - 15.00	Monitoring tropical deforestation for compensated reductions (Tropical workshop summary)	DeFries
15.00 - 15.20	African Observatory and Biodiversity (UNCBD)	Mayaux
15.20 - 15.40	Boreal forest monitoring for UN conventions (Boreal Workshop summary)	Bartalev/Schmullius

15.40 - 16.00 Break

SESSION 3: Agencies and their LC Programs wrt to UN Conventions (15 min present., 5 min disc.)

16.00 - 16.25	Future JRC plans for land cover monitoring and carbon accounting	Achard
16.25 - 16.50	EODS and land monitoring perspectives	Wulder
16.50 - 17.15	CNES and land cover observations	Jeanjean
17.15 - 17.40	EEA and land cover interests	Steenmans

17.40 - 18.00 Break

SESSION 4: Preparing GMES with PPPs (15 min presentation, 5 min discussion)

18.00 - 18.00	GMES services	Kaptein/Kuntze
18.20 - 18.40	Global GEOLAND activities	Leroy
18.40 - 19.00	GSE Forest Monitoring	Haeusler
19.00 - 19.15	Concluding remarks and tasks for next day	Schmullius

19.30 - 22.00 Workshop Dinner (Courtesy of Jena Optronic GmbH)

Friday, March 24th at Dornburg Castle “Altes Schloss”

SESSION 5: LC-IT: Synthesis and Organization

9.00 - 10.00	Synthesis of previous day and organizational issues, definition of breakout group topics	Schmullius/Skole
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10.00 - 10.30 Break

SESSION 6: Breakout group discussions I

10.30 - 12.15	Discussions in breakout groups: 1) Harmonization and Validation	all
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	2) Pending Actions and Tasks	
	3) External Collaborations	
12.15 - 13.15 Lunch (Courtesy of InfoTERRA)		
SESSION 7: Breakout group short presentation I		
13.15 - 14.15	Presentation of breakout groups, definition of action items	all
	Formation of new breakout group topics	
14.15 - 14.45 Break		
SESSION 8: Breakout group discussions II		
14.45 - 16.00	Discussions in breakout groups: 1) Land Cover IT group – business meeting 2) Regional Network meeting	all
SESSION 9: Breakout group presentations II/action items/summary		
16.00 - 17.00	Presentation of breakout groups, definition of action items	all
17.00 - 17.30	Synthesis, Wrap-up, Role of IT Members, Future Plans	Schmullius/Skole
17.30	Departure from Dornburg Castle	
19.00	<i>Evening event in Jena</i>	

Appendix C – Documents to be provided/circulated prior to Land Cover IT meeting:

GOFC-GOLD strategy:

The revised version of GOFC-GOLD strategy should be a guideline of presentations and discussion during the LC-IT meeting to ensure that the overall strategy is implemented by the different functional groups within GOFC-GOLD:

GOLD-24: [A Revised Strategy for GOFC-GOLD](#), J.R. Townshend and M.A. Brady, January, 2006

In addition, the results and action items in the previous GOFC-GOLD land cover meetings should be revisited and reconsidered:

GOLD-21: [Report of the 3rd Meeting of the GOFC-GOLD Scientific and Technical Board](#), M.A. Brady and M. Larsen, Beijing, China, 19-22 April 2005

GOLD-18: [Land Cover Implementation Team meeting report](#), M. Herold, K. Neumann and C. Schmullius, Jena, Germany, 2–4 March 2004

Land Cover product sheets:

The Committee for Earth Observing Satellites (CEOS), in response to decisions made by the Conference of the Parties to the UNFCCC is preparing a report for Parties concerning the use of satellites for climate studies. The variables (and associated actions) as set out in the [GCOS Implementation Plan](#) provide a starting point. But the CEOS agencies have requested more detailed specification. GCOS and CEOS are preparing a report on Systematic Observation Requirements for Satellite-based Products for Climate: Supplemental details to the satellite-based component of the "Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC". The report contains product specification sheets for the essential climate variable. GOFC-GOLD has been invited to refine the sheets for the land cover sheets. The sheets will be presented in a report from CEOS at the November 2006 submission to the UNFCCC SBSTA:

Land cover change (10 m)
Land cover change history
Land Cover 250 metre

The land cover implementation team chairs and office have revised and enhanced the respective sheets. During the Jena workshop we would like to ask the land cover team members and international experts to discuss and provide feedback on the current draft sheets. The goal is to have them fully endorsed by the land cover team and the international community.

Global Earth Observation System of Systems (GEOSS) activities:

The GEO secretariat has prepared a [GEO 2006 workplan](#) outlining specific actions for different areas of societal benefit. There is a regarding [task list matrix](#) for the 2006 GEO work plan. Note that the matrix identifies GOFC-GOLD as leading and contributing to 7 work plan tasks. The LC-IT meeting should discuss avenues to respond to these tasks.

GOFC-GOLD together with Sweden and Canada have proposed a GEO community of practice for forest observation ([ppt](#)), that we require further actions from the GOFC-GOLD land cover team.

UNFCCC and COP 11:

[GCOS implementation plan](#) with the section on land cover as essential climate variable (see pages 99 and 100). GOFC-GOLD has submitted a [progress report to GTOS](#) on the individual land cover related action items.

The UNFCCC COP11/SBSTA decision concerning "research and systematic observation" (Montreal 2005 summit) contains two items with concern to GTOS/GOFC-GOLD. The full draft decision can be found here:

<http://unfccc.int/resource/docs/2005/sbsta/eng/117.pdf>

The most important points are:

6. The SBSTA welcomed and accepted the offer from the CEOS, on behalf of the Parties supporting space agencies involved in global observations, to provide a detailed report on a coordinated response to the needs expressed in the GCOS implementation plan at SBSTA 25 (November 2006).

7. The SBSTA welcomed the efforts by the GTOS secretariat to develop a framework for the preparation of guidance materials, standards and reporting guidelines for terrestrial observing systems for climate and encouraged GTOS to continue its work. It also called on the GTOS secretariat to assess the status of the development of standards for each of the essential climate variables in the terrestrial domain. The SBSTA invited the GTOS secretariat to report on its progress by SBSTA 26 (May 2007).

Land Cover products and specifications:

Overview of existing land cover datasets

Global Land Cover Validation: Recommendations for Evaluation and Accuracy Assessment Of Global Land Cover Maps, Report of Committee of Earth Observation Satellites (CEOS) - Working Group on Calibration and Validation (WGCV), Strahler, A., Boschetti, L., Foody, G. M., Fiedl, M. A., Hansen, M. C., Herold, M., Mayaux, P., Morisette, J. T., Stehman, S. V., Woodcock, C. (in press).

A joint initiative for harmonization and validation of land cover datasets, Herold, M., Woodcock, C., Di Gregorio, A., Mayaux, P., Belward A., Latham, J. and C. C. Schmullius (2006), IEEE Transactions on Geoscience and Remote Sensing, in press.

GOLD-4: Global Observation of Forest Cover: Fine Resolution Data and Product Design Strategy workshop report, D. L. Skole, W. A. Salas and V. Taylor, Paris, France, 23-25 September 1998, 405kb

GOLD-3: Global Observations of Forest Cover: Coarse resolution Product Design Strategy workshop report, T. Loveland, Y. Yasuoka, B. Burgan, J. Chen, R. Defries, H.G. Lund, T. Lynham, P. Mayaux, and J.-M. Gregoire, Sioux Falls, USA, July 1998,