

## NASA LCLUC/GOFC-GOLD/NEESPI International Regional Meeting on Boreal and Temperate Europe

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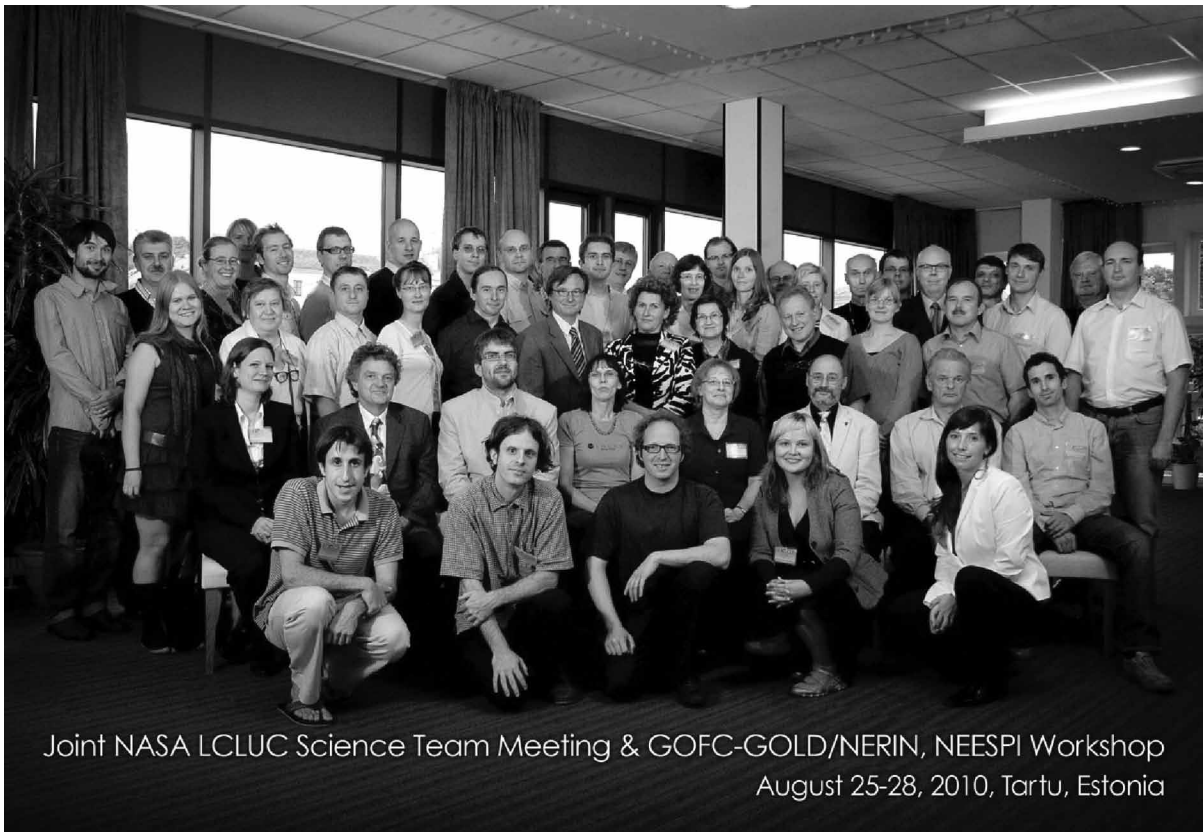
The NASA Land-Cover/Land-Use Change (LCLUC) Science Team Meeting was held jointly with the Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) Northern Eurasia Regional Information Network (NERIN) and the Northern Eurasia Earth Science Partnership Initiative (NEESPI) in Tartu, Estonia from August 25-28, 2010. Hosted by the Tartu Observatory, with contributions from the Global Change System for Analysis, Research and Training Program (START), ScanEx Research and Development Center, and NASA, more than 80 participants representing 14 nations in and around the Baltic region attended. The meeting provided an opportunity for scientists to present and discuss their research on monitoring processes related to land-cover and land-use change in boreal and temperate regions of Central, Eastern, and Northern Europe. Directly preceding the meeting (August 21-23), a training session on *Quantitative Research Methods in Human Dimensions of Environmental Change within Eastern Europe* took place that Vidzeme University in Valmiera, Latvia hosted. Detailed information on the meeting and training session, including presenta-

tions and posters is available on the LCLUC website: [lcluc.umd.edu/meetings.php?mid=15](http://lcluc.umd.edu/meetings.php?mid=15).

Forests and other biomes in boreal and temperate zones comprise about a half of the world's vegetation cover. Boreal and temperate countries are primarily composed of forests and agricultural lands. Political and socioeconomic change in these countries over the last few decades has led to changes in a number of land-use practices. To address processes in these ecosystems related to land-cover/land-use change and climate interactions, the Science Team Meeting was organized around three themes:

1. changes in ecosystems, their composition, and structure;
2. carbon and water cycle; and
3. human dimensions of land-cover and land-use change.

The overall goal of the meeting was to review research being undertaken by NASA and regional scientists on these topic areas and discuss the availability of satel-



Joint NASA LCLUC Science Team Meeting & GOFC-GOLD/NERIN, NEESPI Workshop  
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lite data, products, approaches, and concepts for land monitoring in boreal and temperate ecosystems of Europe. Additionally, the meeting considered requirements for land-cover and land-use change characterization that address the needs of users in these regions and the community of scientists working on regional environmental issues.

### Opening Remarks

**Anu Reinart** [Tartu Observatory—*Director*] and **Tõnis Lukas** [Minister of Education and Science] began the meeting with an introduction describing the extensive strides that remote sensing has made in understanding Earth's systems and the various possibilities for the future of this discipline. Lukas pointed out the important role of satellite technology in understanding global and climate change, and the importance of scientific exchange. **Chris Justice** [University of Maryland—*LCLUC Program Scientist*] described the role of remote sensing in land-change science, highlighting the need to examine the relationship between both human and environmental elements, including how the various changes in economic conditions, demographics, climate, and politics interact.

### International and National Program Presentations

**Garik Gutman** [NASA Headquarters—*LCLUC Program Manager*] provided an update on the NASA LCLUC and NEESPI programs, highlighting the expanding program focus from forests to urbanization and agriculture. Gutman explained how NASA's global observations and data acquisition can help strengthen regional science and how regional science networks, with strong local expertise can strengthen global research programs. He emphasized one of the goals of the meeting—to improve regional and international networking in interdisciplinary Earth science research within Eastern Europe and the Baltic Sea region.

**Olga Krankina** [GOFC–GOLD/Oregon State University—*Regional Network Coordinator*] gave an overview of the international GOFC–GOLD program, stressing the importance of regional networks and their roles in providing the interface between global observations and data users in the region. Krankina stated that the primary roles of the regional networks include:

- Articulating and documenting regional Earth observation requirements;
- evaluating the utility of global satellite products for regional use;
- facilitating the use of remotely sensed data and products; and
- promoting lateral transfer of technology and collaborations within countries and regions.

Krankina emphasized the importance of defining requirements for land-cover and land-use characterization that address the needs of users working on regional environmental issues; exploring opportunities for coordination and collaboration among research teams; and ongoing projects for improved understanding of land-use and ecosystem change in boreal and temperate zones as well as their underlying processes and impacts.

**Matti Mõttus** [University of Helsinki—*Tartu Local Host Representative*] gave a brief description of LCLUC-related projects at Tartu Observatory, ranging from point measurements, to national, regional, and global studies. Of the 25 projects currently underway at the observatory, 15 are related to LCLUC. **Marcus Reckerman** [GKSS Research Centre—*International Baltic Sea Experiment (BALTEX) Secretariat*] provided an overview of the BALTEX program, working toward the development of comprehensive coupled regional models for the atmosphere, the land surface (including rivers and lakes), and the Baltic Sea (including sea ice), and capabilities for realistically modeling the water and energy cycles of the Baltic Sea basin. The program provides an arena for collaboration of more than 50 organizations and a steering group with representatives from all 14 countries in the region, producing frequent publications, program updates, and project reports.

### National Overviews

The first day of the meeting also featured national overviews from countries throughout the region.

**Urmas Peterson** [Estonian University of Life Sciences] described how the regional land management practices in Estonia range from conservative to innovative methods, and how conservation and preservation of forests and natural landscape are fundamental values for the region. **Ilmars Krampis** [University of Latvia] provided an overview of the current land-cover and land-use research in Latvia, including the European Commission (EC) CORINE land-cover project, national forest statistical inventory project, the Forestry Geographic Information Systems (GIS) project, and the Global Forest Monitoring (GFM) project. **Sergey Bartalev** [Space Research Institute, Russian Academy of Science] gave an overview of land-use and land-cover monitoring in Russia, showing recent work using the Moderate Resolution Imaging Spectroradiometer (MODIS) to develop regional burnt area-, arable land-, and crop-cover-classification maps for the country.

**Přemysl Štych** [Charles University—Prague, Czech Republic] explained that there had been a modest governmental contribution to remote sensing and land-cover and land-use monitoring in the Czech Republic. Charles University has recently embarked on a program



A national panel on research priorities convened during the meeting and included [from left to right] **Sergey Bartalev**, **Anu Reinart**, **Tuomas Häme**, **Eva Konkoly Gyuró**, and **Premysl Stych**.

of land-use change research, through analysis using the CORINE database, from 1990, and the Land-use Land-Cover Change (LUCC) Czechia database dating back to 1845. Štych emphasized the importance of social driving forces, considering that restitution, transformation, and redistribution of land have all been key to recent changes in the Czech landscape.

**Ivan Barker** [Forest Research Institute—Slovak Republic] showed how historical land use in the Slovak Republic had resulted in poor aggregation of agricultural lands that are increasingly abandoned because of poor accessibility, steep slopes, inferior soil quality, and urban migration. **Tuomas Häme** [Finnish Forest Research Institute] discussed the VTT Technical Research Centre in Finland, the largest multi-technology applied research organization in Northern Europe, conducting remote sensing research since 1973 as a non-profit organization collaborating with governmental institutions, private organizations, and local universities.

**Éva Konkoly-Gyuró** [University of West Hungary] highlighted a study using the CORINE database for land-cover mapping, comparing the Corine Land Cover (CLC) 50 to CLC 100 parameters and their utility in various analyses, including climatic effects, migration of species, and the biogeographic characteristics for Europe, including the Carpathian region.

#### Remote Sensing of Natural Ecosystems

A primary focus of this meeting was to improve the understanding of remote sensing technologies and to highlight current research on natural ecosystems. **Tiit Nilson** [Estonia Academy of Sciences] began the session with a discussion of the theoretical basis for monitoring vegetation, focusing on the contributions of Tartu scientists towards the understanding of radiative trans-

fer through turbid media. **Curtis Woodcock** [Boston University—*Landsat Science Team* and *GOFC-GOLD Land-cover Co-Chair*] presented an overview of contemporary methods and their applications for boreal and temperate forest monitoring. Woodcock highlighted various research projects focused on biome boundary shifts, affirming, “The Landsat archive, when combined with other remotely sensed and field data sources, provides a critical tool for characterizing climate-driven shifts in global vegetation patterns.”

**Fernando Sedano** [Joint Research Centre (JRC)—European Commission] discussed the methodology and results of the new JRC Pan-European Forest Type Map for 2006. The map provides data for regional analysis, and is valuable for policy makers, trans-boundary studies, as an input for large-scale modeling and fine spatial detail, and as a basis for deriving value-added products. This JRC product has been found to have 88% accuracy. It is available at the European Commission JRC website ([forest.jrc.ec.europa.eu/forestmap-download](http://forest.jrc.ec.europa.eu/forestmap-download)).

**Terhikki Manninen** [Finnish Meteorological Institute] gave a brief summary of field experiments and ground-truthing remote sensing research in Northern Europe, exposing the difficulties associated with cooler climates and significant snowfall. Specifically, Manninen presented results from the Snow Reflectance Transition Experiment (SNORTEX) campaign in Northern Finland that is directed at studying albedo changes of forested snow-covered areas under various conditions.

**Olga Krankina** [Oregon State University] and **Pekka Kauppi** [University of Helsinki] provided an overview of modeling forest productivity and carbon cycling under climate change and disturbance. Kauppi revealed that, spatially, deforestation has decelerated and forest seques-

tration has improved, and that changing forest management has been the dominant driver of these “transitions.” Both Kauppi and Krankina agreed that current and future monitoring needs to focus on stem-size distribution to improve the understanding of global forest systems.

### Human Dimensions of LCLUC

**Pekka Kauppi** and **Alexander Maslov** [ScanEx Research and Development Center, Institute of Forest Science of the Russian Academy of Sciences] gave an overview of forest exploitation in the Baltics and Northwestern Russia. They showed that forest carbon has expanded in all European Union (EU) countries except Estonia, as the forests are recovering from degradation—in Estonia, logging has been increasing leading to increased degradation. They showed that forest stocks in Finland have more than doubled in the last 90 years, highlighting the role of environment and management regime changes in forest transitions.

**Kirsten DeBeurs** [University of Oklahoma] presented her research using multi-scale trend analysis to evaluate climatic and anthropogenic effects on the vegetated land surface in Russia. Using data from the last two decades, DeBeurs showed the relationship between increasing temperature, increasing productivity, and longer growing seasons. Using MODIS data, she also showed that since 2000 there has been decreasing vegetation productivity associated with climatic related disturbances—e.g., fires, droughts, and insect invasions.

**Grigory Ioffe** [Radford University] discussed transformations in Russian agriculture, highlighting the contraction of farmland, population migration, and landscape fragmentation in Russia in general—but emphasizing considerable regional diversity. **Tobias Kuemmerle** [University of Wisconsin-Madison] presented his work exploring the socioeconomic transformations and land-use change patterns and processes in Central and Eastern Europe. He explained that LCLUC is not always gradual; at times it can be rapid and drastic, as is the case for Eastern Europe, due to the collapse of socialism leading to farmland abandonment, logging, and areas of forest regeneration in the region. Kuemmerle

found that land abandonment in the region has mainly been driven by marginality of farming and is often mediated by institutional factors. Logging rates were shown to be associated with the strength of institutions and land ownership patterns. However, there is large variability of land use within and among countries of the Baltic region across spatial scales.

A panel discussion was held on regional research issues and priorities; summaries of the discussion can be



The meeting included a land-use field trip to a sphagnum bog in Northern Estonia.

found at: [lcluc.umd.edu/meetings.php?mid=15](http://lcluc.umd.edu/meetings.php?mid=15). Although different countries identified specific priorities, a number of common themes emerged. In this region there is a strong emphasis on the application of satellite data to pressing problems of societal relevance and an increasing awareness by national governments of the potential role of land remote sensing. Several countries have limited capacity for using satellite data for science research and applications. There is a need for increasing investment in research infrastructure and a number of countries are looking for international cooperation. Global processes are driving national land-use change, and in the EU countries, agricultural and land-management policies are strongly influencing land use.

Differences between EU and non-EU countries exist in the extent of land abandonment, rural depopulation, permanence, monitoring, reporting, and impacts. In Russia, attention is focused on monitoring forests, agriculture, and peatlands, with particular attention to logging, changes in cropland, and peat mining. Finland makes extensive use of fine-resolution data for forest monitoring, with an emphasis on research into automated techniques and data fusion (using data in the optical and microwave regions). There is considerable

interest in the capabilities of the next-generation sensors from NASA and the European Space Agency (ESA) and their potential synergy.

### Closing Remarks

**Chris Justice** concluded the meeting with a summary of primary workshop deliberations with which to move forward toward planning and execution of regional goals. A major theme from the meeting was the abandonment of agricultural lands and the growth of urban areas. Although well recognized as a process within the region, an accurate and spatially explicit accounting of the extent of land abandonment through automated methods is of considerable interest. The causes of the abandonment are being studied, but relatively little work to date has been undertaken on the impacts of this type of land-use change on carbon cycle, water cycle, and livelihoods.

One possible means to improve research on ecosystem disturbance, climatic forest transitions, and agricultural

abandonment would be to conduct a data validation campaign in the area. This would help to harmonize the various data products so they could be more effectively used to monitor forest change over the entire region. In addition, the investigation of pattern to process “drivers” is essential, as is understanding the role of national and international policies on land-use change, and differences between EU and non-EU states with respect to environments, socioeconomic conditions, and strengths of institutions.

There is a need for continued basic remote sensing research on forest structure, peatlands, wetlands extent and change, and agriculture land-use change and production. Justice emphasized the need for data fusion with new technologies and next generation sensing systems. He finished by stressing the importance of collaboration, education, and outreach to enhance regional research, international collaboration, and institutional strength for the discipline and the region. ■

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spectrometer observatories that would be compatible with lower-cost launch vehicles (e.g., *Falcon 1e* and *Minotaur*). It also took advantage of block buys (e.g., common spacecraft bus and launch vehicle) to reduce costs. The reformulated mission design achieves the science objectives within the budget and schedule constraints.

**Stephen Sandford** [LaRC] finished the agenda with a discussion of potential partnering opportunities for CLARREO.

**Dave Young** [LaRC] wrapped up the meeting by thanking the attendees for the quality of the presentations and discussions during the four-day meeting, as well as for their valuable contributions during *Pre-Phase A*. He discussed plans for writing a *Pre-Phase A* science status report that will be used to document the science studies performed to date.

The meeting was a success and achieved all of its objectives. The CLARREO science has matured sufficiently to provide well-defined science objectives and mission

requirements for the upcoming Mission Concept Review (MCR) on November 17, 2010.

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