

Joint NASA LCLUC Science Team Meeting and GOFC–GOLD/NERIN, NEESPI, MAIRS Workshop “Monitoring Land Cover, Land Use and Fire in Agricultural and Semi-arid Regions of Northern Eurasia”

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The Joint NASA Land Cover Land Use Change (LCLUC) Science Team Meeting and Global Observations of Forest Cover – Global Observations of Land Dynamics (GOFC–GOLD)/Northern Eurasia Regional Information Network (NERIN), Northern Eurasia Earth Science Partnership Initiative (NEESPI), and Monsoon Asia Integrated Research Study (MAIRS) Workshop was held in Almaty, Kazakhstan September 15-19, 2009. The workshop provided a forum for international scientific exchange on critical land use issues in Central Asia, facilitated coordination of satellite-based research and applications within the region, and strengthened research undertaken within the NASA LCLUC program. The workshop provided a follow-up on the discussions and research collaboration initiated in the 2007 Fall NEESPI/LCLUC meeting in Urumqi, China.

The National Center for Space Research and Technology (NCSRT) of Kazakhstan’s National Space Agency (KNSA) hosted the meeting. The NCSRT is the leading national institution in Kazakhstan and one of the leading institutions in Central Asia focusing on development and operational implementation of land monitor-

ing methodologies based on various remotely-sensed data sources. Equipped with its own ground-receiving station, the NSRTC processes and archives data from the U.S. Advanced Very High Resolution Radiometer (AVHRR) and Moderate Resolution Imaging Spectroradiometer (MODIS), Indian IRS-1C/1D and IRS P6, and Canadian RADARSAT-1 instruments. This capability enables NSRTC to support the operational needs of land management agencies as well as develop scientific data products.

A total of 184 scientists and land managers from 16 countries (representing Belgium, China, Germany, Iran, Italy, Japan, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Turkmenistan, Ukraine, United States, and Uzbekistan) attended the workshop. One of the goals of the workshop was to initiate the development of a regional Central Asian information network, which would sustain the regional exchange of information and satellite monitoring. The full agenda as well as presentations from the meeting are available at the LCLUC web site: lcluc.umd.edu.



Meeting participants gather on the first day of the workshop.

Workshop Framework

The workshop opened with the address from the head of the KNSA, Kazakh cosmonaut **Talgat Musabayev**. In his remarks, Musabayev emphasized the commitment of KNSA to support the needs of operational and scientific observations of land from space by preparing the launch of two high resolution satellites collecting data at 1-m and 7–20-m resolutions, respectively. He also noted that the role of KNSA in the global space program is expected to increase significantly in the near future once the Baikonur space launch pad becomes a major venue for human space-flight missions after the cancellation of NASA's shuttle program. Zhumabek Zhantayev, a member of the National Academy of Sciences of Kazakhstan and the president of NSRTC followed Musabayev and echoed his acknowledgement of the importance of the work undertaken by the participants of the workshop.

Brief presentations followed the opening remarks and described the existing international programs involved in monitoring and assessment of environmental change in Central Asia. They also outlined opportunities for regional and international collaborations within the framework of these programs.

Garik Gutman [NASA HQ—*LCLUC Program Manager*] summarized the LCLUC program and current areas of emphasis for NASA's Earth observation program. In his presentation, Gutman pointed out that synergistic use of NASA and commercial U.S. assets in optical remote sensing allows evaluation of various processes across different spatial (from 1 km to 1 m) and temporal (yearly to twice daily observations) scales. He noted that during its 50-year record, NASA launched a suite of systematic and exploratory missions collecting LCLUC-relevant information, with the Landsat program of particular importance with its unprecedented length of data record and resolution of imagery.

Environmental processes occurring within Central Asia fall within the area of interest of two large regional science programs. The MAIRS program, introduced by **Jianguo Qi** [NASA-MAIRS—*Program Scientist*] placed a strong emphasis on advancing the understanding of the interactions between human and natural compo-

nents of ecosystem functioning in the monsoon Asian region. These interactions are in support of sustainable development. **Multu Ozgodan** [University of Wisconsin] described the NEESPI program and mentioned that Central Asia is of particular interest because it covers many transitional zones (including forest-steppe, steppe-desert, and mountain systems), which frequently are vulnerable to internal and external change.

The collaboration of scientists within Northern Eurasia is supported through an established GOFC–GOLD regional network (NERIN), designed to provide the interface between producers of satellite data products and national level data users. **Olga Krankina** [GOFC–GOLD/NERIN—*Coordinator*] invited the regional workshop participants to join the newest data dissemination initiative in Asia in April–May 2010.

Science Issues

Concern about the environmental impact of global climate change on the Central Asian region was at the forefront of the meeting agenda.

The workshop focused on relating the observations of environmental and land-use processes directly to human well-being, thus linking the scientific research to operational land monitoring and decision-making support. The increasing demand for agricultural production and concerns about food security; natural disasters such as fire, drought, and flooding; degradation of land resources through soil erosion; and dramatic reductions in fresh water availability are the immediate concerns in dry lands of Central Asia. Remotely sensed observations and analysis play an important role in quantifying changes in these phenomena and informing land management decisions. The workshop covered the four major themes of land cover, land use/agriculture, water resources, and fire with the goal of reviewing the existing regional approaches to monitoring these processes and the availability of satellite data sources, products, and monitoring capabilities.

Zairulla Dyusenbekov [Kazakhstan] delivered a plenary overview of the historic perspective and present state of the land resources of Kazakhstan. He noted that currently only 52% of land resources in Kazakhstan are actively developed with 48% of the territory found in the "reserve" category. Agricultural land use (85% pasture



Meeting participants examine agricultural practices in Kazakhstan during a field visit.

and 10% croplands) comprises nearly two-thirds of the developed lands and exceeds by far other land-use types in the Republic of Kazakhstan. Dyusenbekov named desertification as the greatest threat to land resources of Kazakhstan. Many presenters echoed this statement.

Rashid Kulmatov [Uzbekistan] stated that land degradation due to overgrazing, overcultivation, poor irrigation and salinization of soil, and deforestation are primary threats to land resources of the Aral Sea Basin as well. Inefficient agricultural practices and poor condition of the irrigation network lead to widespread water-driven erosion of irrigated lands and waste of water resources.

Water quality and quantity are of high importance in this region of moisture-limited ecosystems. **Natalya Agaltseva** [Uzbekistan] and **Jiquan Chen** [U.S.] presented observations and modeling of Central Asian river discharge and surface water balance. These findings show an overall decrease of water discharge driven by a direct increase in water consumption and modification of land cover through reduction of woody vegetation and subsequent increase in grasslands and deserts. The presenters also expressed a rising concern about water availability in connection with observed and predicted changes in mountain glaciers. **Zamir Ahmed Soomro** [Pakistan] presented a national approach for capturing and storing rainwater within natural depressions in the landscape to increase water storage capacity and minimize water loss. Transboundary water issues are likely to become prominent and contentious within the immediate future and **Alexander Nikolaenko** [Kazakhstan] raised the importance of international cooperation in solving them.

Monitoring land and water resources is directly connected with the vital issue of short- and long-term food security and agricultural production. **Nadiya Muratova** [Kazakhstan], **Olivier Leo** [Italy], **Igor Savin** [Russia], and **Andrey Chernov** [Russia] introduced regional and national systems of satellite-based monitoring of crop production and forecasting of crop yields. All presenters emphasized the need to supplement the available moderate resolution observations with high and very high resolution imagery to improve the accuracy of agricultural monitoring.

Chris Justice [GOF-C-GOLD Fire, Group on Earth Observations (GEO) Ag—U.S.] invited regional scientists to participate in a Global Earth Observing System of Systems (GEOSS) Agricultural Experiment aimed at evaluating the applicability of a suite of Earth Observing (EO) data sources including very high and moderate resolution optical data and microwave observations.

The role of satellite observations in disaster monitoring is also well established in the region. **Oleg Arkhipkin**

[Kazakhstan] and **Magsar Erdenetuya** [Mongolia] presented regional and national systems of fire monitoring. Operational goals of fire monitoring dictate the need for near-real time data availability and thus they are more developed within countries with data receiving capabilities, such as Mongolia and Kazakhstan. However, globally available datasets described by **Tatiana Loboda** [U.S.] present a viable alternative for countries that currently do not possess a national fire monitoring capacity.

The workshop presentations and discussions stressed the importance of developing adaptation strategies to climate-induced changes in ecosystem functioning. **Lubov Lebed** [Kazakhstan] presented long-term meteorological trends indicating a consistent increase in temperature and decrease in precipitation between 1850 and 2000 and the potential changes in pasture biomass productivity under the projected scenarios of climate change. **Irina Vitkovskaya** [Kazakhstan] noted that under the observed climate change the transitional “steppe-desert” areas appear to have been shifting towards desert conditions between 2000 and 2008. Changes in economic situation further amplify climate-induced changes as **Dennis Ojima** [U.S.] and **Chuluun Togtohyn** [Mongolia] demonstrated. They showed that vulnerability of rangelands to climate and land-water use changes in Mongolia increased since the transition to a market economy in 1992.

The workshop provided a fruitful environment for the regional and international participants to exchange knowledge about environmental concerns in Central Asia and share methodological advances in monitoring various land-use and ecological processes using satellite data. The participants identified five research areas of greatest concern: 1) the quality and quantity of fresh water resources as the strongest case for a regional network activity; 2) crop yield estimation, crop monitoring, and agricultural use of fire in the context of ensuring regional food security; 3) land and soil degradation leading to reduction in land productivity over time and increasing vulnerability of the natural and agricultural systems; 4) climate change and variability in the context of concerns for adaptation of human systems’ different conditions, understanding processes, and informing policy makers; and 5) augmenting fire monitoring capabilities with regional fire ecology research in support of long-term fire management strategies.

At the end of the workshop, the participants voiced a unanimous consensus for better regional cooperation in addressing the issue of land monitoring in support of scientific research and decision making for resource management. The similarities in historical development of the region are now expressed in the similarity of the environmental issues across the region and potentially lead to trans-boundary tensions over resource availability. These tensions are particularly expressed in disputes

over fresh water quality and quantity between the countries sharing common watersheds. The shared challenges within the region and the diversity in economic and technological development have led to recognition that greater regional cooperation, both in terms of science and resource management, would be beneficial. Participants welcomed a decision to create the Central Asia Regional Information Network (CARIN) in the framework of GOFC–GOLD. CARIN will facilitate the continued flow and exchange of data and methodologies as well as scientific findings throughout the region. Representatives from all participating countries in Central Asia, including Kazakhstan, Uzbekistan, Tajiki-

stan, Kyrgyzstan, Turkmenistan, Mongolia, China, and Russia, welcomed and supported the network. A planning meeting for the network will be held in the spring of next year in Almaty, followed by a GOFC–GOLD Regional Network Workshop tentatively planned for 2011 to be hosted in Uzbekistan.

A two-day training session followed the workshop, with 63 meeting participants attending. The session aimed at informing the regional experts and decision makers about publicly available satellite-based datasets and introducing data processing methodologies necessary to ensure high quality of output. ■

ESIP Federation Elects 5 New Partners

On November 16, 2009, the Federation of Earth Science Information Partners (“ESIP Federation”) elected five new partners for full membership. Representing each type of ESIP Federation Partner, this new class of applicants demonstrates the continued interest in the ESIP Federation from the broad continuum of Earth science data and technology interests. The new partners include:

- *Chapman University, Schmid College of Science (Type II)*, **Menas Kafatos**, Orange, California;
- *Earth System Grid Center for Enabling Technologies (Type I)*, **Dean N. Williams**, Lawrence Livermore National Laboratory, Livermore, California;
- *ISciences (Type III)*, **Lisa Emmer**, Ann Arbor, Michigan;
- *NASA Planetary Data System (Type I)*, **Steve Hughes**, Jet Propulsion Laboratory, Pasadena, California;
- *Satellite Educators Association (Type III)*, **Paula Arvedson**, Pasadena, California.

“The ESIP Federation continues to attract Earth science data and information experts to its membership. Our diversity and ability to work across disciplines, sectors and federal agencies has enabled this community to advance in ways greater than the sum of its parts.” says **James Frew**, ESIP Federation President. “The ESIP Federation’s reputation is growing as the place for community-driven collaboration in the Earth sciences.”

Now in its second decade, the ESIP Federation has **115 partners** representing a wide range of Earth science data interests. ESIP Federation partners include Earth science data centers, environmental research groups, practitioners in the application of environmental data, educators, and technologists. Across these diverse interests, public, private, and non-profit organizations are represented.

The ESIP Federation is a consortium of Earth science data and technology professionals spanning government [NASA, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), U.S. Geological Survey (USGS)], academia, and the private sectors (both commercial and nonprofit). The organization is dedicated to transforming research data and information into useful and usable data and information products for decision makers, policymakers, and the public. Initiated by NASA in 1997, the ESIP Federation provides data, products, and services to decision makers and researchers in public and private settings. The Foundation for Earth Science provides administrative and staff support to the ESIP Federation.