

The NASA LCLUC Spring 2013 Science Team Meeting

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Introduction

The NASA Land-Cover/Land-Use Change (LCLUC) program held its annual spring Science Team meeting April 2-4, 2013, in Rockville, MD. The LCLUC program has become a truly interdisciplinary and international collaborative endeavor. Science Team meetings provide ideal venues for developing and implementing such collaboration and provide opportunities for NASA-funded scientists and program alumni to share findings and establish and further develop working relationships. Despite recent travel constraints, there were a record 150 participants—including scientists and graduate students from across the U.S. and several international participants—indicative of continued growth in interest about the science program.

This report presents a summary of the two-day meeting; full presentations and posters are provided at lcluc.hq.nasa.gov/meetings.php?mid=45.

DAY ONE

Opening Presentations

After a welcome message, **Garik Gutman** [NASA Headquarters—*LCLUC Program Manager*] presented a brief review of the program, highlighting internal linkages to other NASA programs within the Carbon Cycle and Ecosystems Focus Research Area, including the Terrestrial Ecosystems Program, the Biodiversity Program, and the Applied Sciences Program. He stressed the importance of LCLUC's links to other national programs, primarily that with the U.S. Global Climate Research Program (USGCRP).

Gutman then recognized the leadership that **Dan Brown** [University of Michigan—*LCLUC Scientist*] provided for a National Research Council (NRC) committee that conducted an assessment of land-change modeling¹. The special team was asked to assess the analytical capabilities and science and/or policy applications of existing modeling approaches, and to describe the theoretical and empirical basis and the major technical, research, and data-development challenges associated with each approach. The team also described opportunities to better integrate land-observation strategies (including ground-based surveys as well as satellite and remote sensing data) with land-change modeling to better fulfil scientific and decision-making requirements.

¹ This study was convened in 2011–2012 and was co-sponsored by NASA LCLUC and U.S. Geological Survey (USGS) through the USGCRP LULCC Interagency Working Group.

Gutman's opening remarks set the stage for the session on *LCLUC in Wetlands*. He emphasized that the wetlands component is rooted in the goals of the 1971 International Ramsar Convention on Wetlands, which sought to enable targeted assessment and collection of monitoring information, vital to ensure effective management planning for wetlands². Gutman also stated that satellite-based remote sensing is a critical tool for these assessments, as it provides synoptic information on types of wetland vegetation, water dynamics, and land-management impacts.

Gutman also reviewed the data aspects of the program, which adhere to NASA's policy on free and open sharing of data; these data are available via several NASA, USGS, and National Geospatial-Intelligence Agency (NGA) portals. Gutman went on to summarize the ongoing NASA Research Opportunities in Space and Earth Sciences (ROSES³) 2012 LCLUC solicitation round and solicitations from the Carbon Cycle Science and Interdisciplinary Science Programs. He noted that Support for Early Career Scientists (ECS) will continue, and that training will still be an integral part of each

² For more information, visit: www.ramsar.org.

³ For more information about ROSES, visit: nspires.nasaprs.com/externalsolicitations.



LCLUC Science Team meeting participants. Image credit: Lydia Prentiss

Table 1. Summary of presentations given during the *LCLUC in Wetlands* session.

Speaker	Institution	Presentation Title
Laura Hess	University of California, Santa Barbara	Land and resource use on the Amazon floodplain under evolving management systems and environmental change: fish, forests, cattle, and settlements
Marc Simard	NASA/Jet Propulsion Laboratory (JPL)	Vulnerability assessment of mangrove forests in the Americas
Kyle McDonald	City College of New York	Global-scale assessment of threatened river delta systems: Evaluation of connections between the continental land mass and ocean through integrated remote sensing and process modeling
In-Young Yeo	University of Maryland, College Park (UMCP)	Mapping and monitoring of wetland dynamics for improved resilience and delivery of ecosystem services in the Mid-Atlantic region
Mei Yu*	University of Puerto Rico	Vulnerability and adaptive management of tropical coastal wetlands in the context of land use and climate changes
Prasad S. Thenkabail	U.S. Geological Survey's Western Geographic Science Center	Remote sensing of inland valley wetlands of Africa and their pivotal role in Africa's green and blue revolution (Invited Presentation)

* See **Figure** on page 40.

international LCLUC Science Team meeting enhanced with the new Trans-Atlantic Training (TAT) Initiative⁴.

Chris Justice [University of Maryland, College Park (UMCP)—*LCLUC Program Scientist*] emphasized the importance of the LCLUC Science Team for research and communication and the impact of developing a strong U.S. *community of practice* for LCLUC scientists. He noted that community building is particularly important for ECS and students involved in the LCLUC research program. Justice then outlined the meeting objectives and session organization. He encouraged LCLUC scientists to look for opportunities and to apply to non-LCLUC NASA programs that include LCLUC impacts on climate, atmospheric composition, hydrology, and the carbon cycle. He posited that there is a broad shift in climate science to include adaptation, and stressed that land use is a key component in adaptation science.

Session Overviews

The remainder of the meeting was organized into technical sessions that included: LCLUC in Wetlands; Programmatic Perspectives and Initiatives; Synthesis of LCLUC in Northern Eurasia and Next Steps; Final Results on Agricultural Land Use; Monsoon Asia Regional Focus Projects; and two Rapid Discussion sessions, featuring five-minute poster presentations from ECS and IDS investigators, respectively. Each of these will be summarized, below.

⁴ TAT is a planned international activity to develop stronger awareness of new NASA and ESA products and to promote capacity building among recent university graduates and post-graduates in Earth-observation research areas.

LCLUC in Wetlands

Few areas are more vulnerable to anthropogenic change than wetlands. Estimates are that nearly half the world's wetlands have been altered by the activities of humans. The impact of LCLUC is thus an active area of research. **Table 1** summarizes the presentations included in this session, all of which are available at the URL provided earlier.

Programmatic Perspectives and Initiatives on LCLUC

A series of presentations followed that addressed cross-cutting, programmatic foci.

- **Dan Brown** gave a report on the previously mentioned NRC review of land-use models—see Garik Gutman's opening remarks.
- **Jim Irons** [NASA's Goddard Space Flight Center (GSFC)—*Landsat Data Continuity Mission*⁵ (*LDCM*) *Project Scientist*] reviewed the status of the LDCM. On March 29, 2013, the USGS posted a sample Level 1T product that showed a region of the Rocky Mountains on March 18.
- **Jeff Masek** [GSFC—*Landsat Project Scientist*] reported on Landsat 8, including a proposed collaboration with the European Space Agency's (ESA) Sentinel-2 program. If the efforts are successful they may expand to include other missions (e.g., the Indian Space Research Organisation's (ISRO) ResourceSat-2 spacecraft).

⁵ As of May 30, NASA handed control of the mission over to USGS, and it became known as Landsat 8.

- **Chris Justice** reviewed the use of high-resolution data for LCLUC studies, highlighting the need to streamline access to such data by LCLUC principal investigators, and establishing standard data-processing tools to reduce the processing burden on LCLUC users.

Rapid Presentations—Early Career Scientists

ECSs provided a series of five-minute presentations as an opportunity to provide a brief overview of their

research and draw attention to their posters. **Table 2** summarizes the presentations that took place.

DAY TWO

The second day's activities began with an overview by **Jack Kaye** [NASA Headquarters—*Associate Director for Research of NASA's Earth Science Program*], including recent and planned satellite missions. He described challenges currently facing the agency under sequestra-

Table 2. Summary of research presented during the Early Career Scientists' Rapid Presentations.

Speaker	Institution	Research Focus
Inbal Becker-Reshef	University of Maryland, College Park	Developing an interdisciplinary remote-sensing-based method to forecast wheat production in the dominant export countries, and provide insight on the potential societal benefit of such information in terms of global wheat markets and civil unrest.
Gillian Galford	University of Vermont	Linking LCLUC to subsidized inputs, environmental controls, or socioeconomic factors, and examining how socioeconomic and environmental factors interact with subsidized inputs to change poverty status in Malawi.
Kathryn Grace	University of Utah	Examining the links between agriculture and human health in the context of climate change in three West African countries to determine if variation in food availability/stability corresponds to variations in fertility and maternal/child health outcomes.
Jason Julian	University of Oklahoma	Studying land-management impacts on water quality in New Zealand across political boundaries, with an initial task of detecting date, location, and extent of forest harvests and grazing events, and connecting this information with weather, water quality, and socioeconomic data.
Stephen Leisz	Colorado State University	Studying the impacts of the East-West Economic Corridor from Da Nang, Vietnam, to Khon Kaen, Thailand, on the changing landscape of central Vietnam, southern Laos, and eastern Thailand, and its influence on the region's LCLUCs and urbanization processes.
Jessica McCarty	Michigan Tech Research Institute	Examining the role of environmental, socioeconomic, institutional, and LCLUC factors to explain the patterns and drivers of anthropogenic fires in post-Soviet Eastern Europe—specifically, a case study comparison of Belarus, European Russia, and Lithuania.
Kelly Wendland	University of Idaho	Evaluating the impact of conservation strategies on LCLUC at a transboundary site between Guatemala, Honduras, and El Salvador.
Tatiana Loboda and Julie Silva	University of Maryland, College Park	Mapping, quantifying, and attributing LCLUC in the Mozambican portion of the Tri-National Park to socioeconomic causes.
Yuyu Zhou	Joint Global Change Research Institute	Understanding and simulating spatially explicit global urban expansion in the context of climate change.
Kelly Cobourn	Boise State University	Understanding how water-rights institutions influence agricultural decision-making in the face of climate-driven changes in water availability.

Table 3. Summary of presentations given during the *Synthesis of LCLUC in Northern Eurasia* session.

Speaker	Institution	Presentation Content
Pasha Groisman	National Oceanic and Atmospheric Administration/ University Corporation for Atmospheric Research	Status update on the recent activities and near-term plans for the Northern Eurasian Earth Science Partnership Initiative (NEESPI †).
Volker Radeloff	University of Wisconsin	Synthesis of studies on institutional change and LCLUC effects on carbon, biodiversity, and agriculture after the collapse of the Soviet Union—seeking to understand the impact of socioeconomic shock on LCLUC.
Kathleen Bergen	University of Michigan	LCLUC Synthesis: Forested land-cover and land-use change in the Far East of Northern Eurasia under the combined drivers of climate and socioeconomic transformation.
Hank Shugart	University of Virginia	Synthesis of forest growth, response to wildfires, and carbon storage for Russian forests using a distributed, individual-based forest model.

† Throughout its history, NEESPI has served as an umbrella program for 156 individual research projects. Over 750 scientists from more than 200 institutions and 30 countries have participated in NEESPI.

Table 4. Summary of presentations given during the *Final Results on Agricultural Land Use* session.

Speaker	Institution	Presentation Title
Dan Slayback	NASA's Goddard Space Flight Center	Assessing the impact of disappearing tropical Andean glaciers on pastoral agriculture
Michael Coe	Woods Hole Research Center	Linking historical and future land-use change to the economic drivers and biophysical limitations of agricultural expansion in the Brazilian Cerrado
Jack Mustard	Brown University	Rates and drivers of land-use/land-cover change in the agricultural frontier of Mato Grosso, Brazil
David Roy	South Dakota State University	Changing field sizes of the conterminous United States, a decennial Landsat assessment
Lahouari Bounoua	NASA's Goddard Space Flight Center	Satellite-supported inverse biophysical modeling approach for the detection of irrigated agricultural land and the determination of the amount of irrigation in arid and semi-arid regions

tion requirements and answered questions on the future of the program. Of particular note, Kaye recognized the unique role of LCLUC in the program since it includes social science.

Synthesis of LCLUC in Northern Eurasia

By way of background for these discussions, it must be noted that while climate change is a global concern, it is particularly acute in Earth's polar regions. For example, change is happening in Northern Eurasia at a rate faster than that found in many other locations. This session was organized to highlight the research investigating links between LCLUC and the changing climate of this environmentally sensitive region. **Table 3** summarizes the presentations that took place.

Final Results on Agricultural Land Use

Agriculture and LCLUC are inexorably intertwined, as humans make space for agricultural fields by altering the land surface. Those alterations in turn impact the local—and even regional and global—climate, causing changes in precipitation patterns that may impact crop production. This session highlighted some of the ongoing research to better quantify the links between agriculture and LCLUC. **Table 4** summarizes the presentations that took place.

Rapid Presentations—Interdisciplinary Science (IDS) Program

After these discussions came a series of five-minute presentations that gave IDS program participants an

Table 5. Summary of research presented during the Interdisciplinary Science Program *Rapid Presentations*.

Speaker	Institution	Presentation Title
Son Nghiem	NASA/Jet Propulsion Laboratory	Mega urban changes and impacts in the decade of the 2000s
Soe Myint	Arizona State University	Understanding impacts of desert urbanization on climate and surrounding environments to foster sustainable cities using remote sensing and numerical modeling
Douglas Stow	San Diego State University	Urban transition in Ghana and its relation to LCLUC through analysis of multiscale and multitemporal satellite image data
Geoffrey Henebry	South Dakota State University	Storms, forms, and complexity of the urban canopy: How land use, settlement patterns, and the shapes of cities influence severe
Mark Friedl	Boston University	Four-dimensional modeling of the regional carbon cycle in and around urban environments: An interdisciplinary study to advance observational and modeling foundations
Lahouari Bounoua	NASA's Goddard Space Flight Center	Combining satellite data and models to assess the impacts of urbanization on the continental United States surface climate

Table 6. Summary of research presented during the *Monsoon Asia Regional LCLUC* session.

Speaker	Institution	Presentation Title
Ruth DeFries	Columbia University	Multi-sensor fusion to determine climate sensitivity of agricultural intensification in South Asia
Xiangming Xiao	University of Oklahoma	Quantifying changes in agricultural intensification and expansion in monsoon Asia during 2000-2010

opportunity to report on their research. **Table 5** summarizes the presentations that took place.

Monsoon Asia Regional LCLUC

Human activity has significantly altered the landscape in Asia from its native state. These changes in LCLUC have been shown to have significant impacts on the Asian monsoon, with subsequent societal impacts.

Table 6 summarizes the presentations.

International Activities

Tackling LCLUC-related complex issues of and determining their links to climate change requires developing effective means to foster global collaboration. This session highlighted activities toward this end.

- **Krishna Vadrevu** [UMCP] summarized the LCLUC Regional Workshop held in Southern India earlier this year.
- **Rama Nemani** [NASA's Ames Research Center] discussed the newly proposed South Asia Regional-science Initiative (SARI).

- **Giovana Espindola** [National Institute for Space Research (INPE), Brazil—*Global Land Project (GLP) Executive Officer*], representing the international GLP, gave an update on the GLP Second Open Science Meeting, to be held March 19–21, 2014, in Berlin, Germany, and an upcoming special issue of *Current Opinion in Environmental Sustainability on Land Transformation: Between Global Challenges and Local Realities*, scheduled for November 2013.
- **Premysl Stych** [Charles University, Prague, Czech Republic] reported on the GOFCC–GOLD⁶ South/Central European Regional Information Network (SCERIN) and the TAT initiative. Stych introduced the GeoNetWork for Capacity Building (GeoNetCaB) intended to create conditions to improve and increase GEO/GEOSS capacity building activities and framework, with special emphasis on developing countries.

⁶ GOFCC–GOLD stands for Global Observation of Forest Cover and Land Cover Dynamics, and falls under the auspices of the Global Terrestrial Observing System (GTOS)—www.fao.org/gtos/index.html.

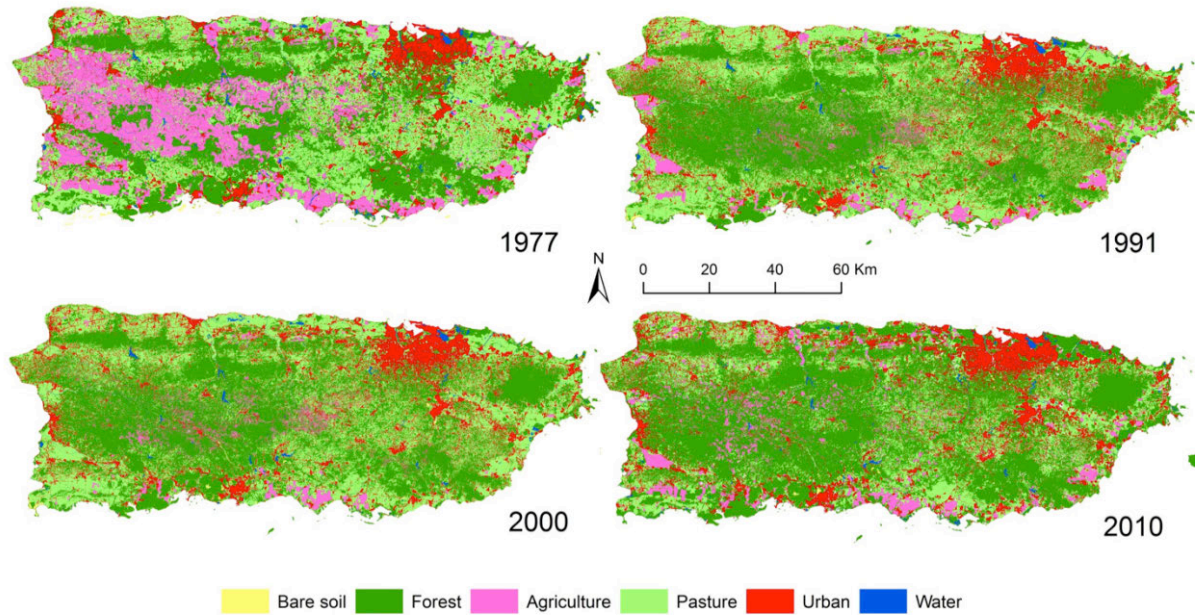


Figure. These maps summarize annual land-cover changes in Puerto Rico for 1977, 1991, 2000, and 2010. The study shows extensive urbanization in the San Juan area between 1977 and 1991 but no major changes between 1991 and 2000, and between 2000 and 2010. Agricultural land greatly reduced between 1977 and 1990. While some agricultural land was reclaimed by the forest during that time, there has been no significant change since 1991. Total areas of both forest and vegetated wetlands have increased with reduced fragmentation in vegetated wetlands. **Image credit:** Mei Yu [University of Puerto Rico]

Concluding Discussion

Chris Justice led a final discussion on the future of LCLUC and how synthesis is an important part of the research program. **Garik Gutman** closed the meeting, stating that LCLUC will continue international efforts facilitating continued collaborations with ESA, INPE, ISRO, and GLP. He pointed to the current priorities of the program, emphasizing that social science remains

an integral part of LCLUC studies and that the program will continue to balance activities thematically and geographically; foster generation of global land-use products for models; promote LCLUC products internally and externally through the program's web site, the Facebook page, and LCLUC brochures; keep LCLUC proposal calls on a regular annual basis; and continue the twice-a-year Science Team meeting structure. Gutman concluded by encouraging the LCLUC community to use the aforementioned avenues to foster collaborations and strengthen the community. ■

Anne Douglass Wins William Nordberg Memorial Award



Anne Douglass from the Atmospheric Chemistry and Dynamics Laboratory at NASA's Goddard Space Flight Center (GSFC) was selected as the 2013 recipient of the *William Nordberg Memorial Award*, which is GSFC's highest award in the area of Earth science. Douglass, was honored for her many years of satellite mission leadership, studying atmospheric composition, and her pioneering work in using measurements to test models.

Specifically, Douglass was recognized for her discoveries using data from the Upper Atmosphere Research Satellite (UARS) and from instruments on NASA's Aura satellite, and emphasizing their impact on providing a physical basis for models to represent observed atmospheric processes.

The staff of *The Earth Observer* wishes to congratulate Douglass on this achievement.