Land/Vegetation Direct Readout Workshop

October 10-11, 2007
Mexico City, Mexico

Workshop Summary Report

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ACKNOWLEDGEMENTS

The Land/Vegetation Direct Readout Workshop would not have been possible without the participation and support of numerous people. The workshop organizing committee would like to thank the event co-sponsors including the National Aeronautics and Space Administration (NASA), the Global Observation of Forest Cover and Land Cover Dynamics (GOFC/GOLD), the National Commission for the Knowledge and Use of Biodiversity (CONABIO) and the USDA Forest Service Remote Sensing Applications Center. These organizations were instrumental to the implementation of the workshop and also provided necessary funding to make the event possible. The organizing committee also thanks the participants who attended the workshop from all over the world. Participants provided informative presentations on the first day of the workshop regarding the status of current land direct readout science algorithms and data applications. On the second day of the workshop, participants fostered valuable discussion and feedback in the break out sessions concerning current and future direct readout technical and programmatic issues.

The workshop organization committee would like to particularly thank CONABIO for hosting the event and coordinating workshop logistics. Additionally, the organizing committee also thanks the Unidad de Seminarios - Universidad Nacional Autónomia de México (UNAM) for providing its facilities for the workshop at the University Campus in Mexico City.

Land/Vegetation Workshop Organizing Committee:

Chris Justice (University of Maryland, GOFC/GOLD)
Ivan Csiszar (University of Maryland, GOFC/GOLD)
Patrick Coronado (NASA Goddard Space Flight Center/Direct Readout Laboratory)
Garik Gutman (NASA)
Rainer Ressl (CONABIO)
Alex Held (CISRO)
Tom Bobbe (USDA Forest Service)
Brian Schwind (USDA Forest Service)
Brad Quayle (USDA Forest Service)

EXECUTIVE SUMMARY

The Land/Vegetation Direct Readout Workshop was held October 10-11, 2007 in Mexico City, Mexico. The workshop was sponsored jointly by the National Aeronautics and Space Administration (NASA), the Global Observation of Forest Cover and Land Cover Dynamics (GOFC/GOLD), the National Commission for the Knowledge and Use of Biodiversity (CONABIO) and the USDA Forest Service Remote Sensing Applications Center. The workshop was hosted by CONABIO at the Unidad de Seminarios - Universidad Nacional Autónomia de México (UNAM) University Campus in Mexico City. This workshop is intended to be the first in a series of international land direct readout workshops providing a forum for the Land Direct Readout Community to meet to share experiences and coordinate their activities.

Direct broadcast/direct readout technologies provide near real-time access to imagery and derivative land/vegetation data products integral to numerous operational applications worldwide. Currently, there is a need for the continued prototyping, transition and implementation of additional land product algorithms into the direct readout environment. In addition, a number of other programmatic and technical issues regarding the use of high temporal, moderate resolution sensor data in the direct readout environment also exist. The Land/Vegetation Direct Readout Workshop was convened to discuss the current state and application of direct readout land science algorithms and other current/future land direct readout issues. This report is a summary of the workshop proceedings, and recommendations and action items initiated to address these issues.

The two-day workshop focused specifically on land and vegetation applications derived from current and future moderate resolution environmental sensors that support with direct broadcast capabilities (MODIS, AVHRR and VIIRS). Specific objectives of the workshop included:

- Presentation and discussion of:
  - Status of current and updated land science products and algorithms; feasibility and timelines for integration into the direct readout environment
  - Development and implementation of direct readout data processing and visualization technologies
- Establishment of necessary requirements to ensure continuity of current land science product algorithms and associated technologies with future sensor missions
- Technical exchange between direct readout data producers and scientists on land/vegetation science algorithms and applications
- Facilitation of regional/continental direct readout data integration networks to share data and maximize efficiencies.

Nearly 60 persons representing eight countries attended the two-day workshop. Workshop participants included land/vegetation scientists, government, academia, representatives of direct readout facilities, direct readout data users, as well as related commercial vendors. Day one of the workshop consisted of two presentation tracks. The morning track covered a programmatic overview of the current state of direct readout for land applications and future directions by several members of the direct readout community. The afternoon track included a review of current status of land products/algorithms for MODIS and AVHRR and their applicability in the direct readout environment.

Day two of the workshop consisted of concurrent breakout sessions focusing on the issues affecting land direct readout, specifically predicated on information presented in day one. Workshop participants attended desired breakout group discussions and provided valuable input and recommendations. Breakout group discussions fostered several recommendations and action items that are summarized in this report. In addition to the workshop meetings, a poster session was also held. Posters portraying current applications of direct readout data were available for the duration of the workshop.

Workshop Recommendations

The breakout groups and plenary discussions led to a number of recommendations form the workshop.

1. The first recommendation specific to the land DR user community focused on establishing and formalizing the International Land DR Coordination Committee (ILDRCC) whose objectives include a sustained effort to promote international DR dialogue, develop regional DR networks, and address and help resolve science and operational issues affecting the international DR community. It was proposed that this group be established under the auspices of GOFC/GOLD.

Specifically this international group would:

- provide advice to the space agencies on priority land products for transition to the DR domain and feedback on current land algorithms/code and instrument calibration.
- coordinate participation in regional community validation and calibration campaigns and initiatives adopting international standards and protocols.
- coordinate with other discipline groups concerned with DR algorithms and products.
- promote the development of regional Land DR networks following the Sentinel Asia model.
- promote the development of DR capability from the international moderate resolution assets.

It was agreed that Tom Bobbe (USFS RSAC), Craig Smith (Geoscience Australia), and Rainer Ressel (CONABIO) would co chair the group and develop the initial activities of the group.

2. The second set of recommendations focused on near term programmatic developments for the Land DR community. It was recommended that:

- The NASA Direct Readout Laboratory (DRL) should serve as a central portal for land algorithms/code and data products from MODIS and VIIRS and a formal linkage should be established between the VIIRS Direct Readout Mission and the IPO Algorithm Division.
- The DRL should work with the International Land DR Coordination Committee to help coordinate the development of priority DR products which are currently unavailable in the DR domain e.g. burned area, live fuel moisture, leaf area index, evapotranspiration, net primary production.

- It was recommended that the International Land DR Coordination Committee hold an annual coordination workshop. Workshops may be held in association with one of the major international remote sensing conferences. Future possible international venues for the group to meet were identified including the, the ISPRS, Beijing (August 2008) and IGARSS 2009. It was agreed that the group would meet next at the upcoming International EOS/NPP Workshop in Bangkok Thailand (March 2008).

Although it was recognized that this first workshop focused on continuing the success of the MODIS Land DR activities into the NPOESS era, future workshops would try and engage the international space agencies in providing Land Direct Readout capability for their moderate resolution instruments.

Other Land DR groups interested in joining the ILDRCC should contact one of the following co-chairing entities.

Brian Schwind
USDA Forest Service RSAC
Salt Lake City, Utah USA
801-975-3765
bschwind@fs.fed.us

Rainer Ressl
CONABIO
Mexico DF, México
++52 55 50044986
Rainer.Ressl@conabio.gob.mx

Craig Smith
Geoscience Australia
Canberra ACT, Australia
+61 2 6249 9111
CraigJ.Smith@ga.gov.au

WORKSHOP OBJECTIVES

Workshop Objectives and Relationship to the Land Direct Readout Community

Numerous direct readout stations throughout the world leverage direct broadcast/direct readout technologies to acquire near real-time imagery from the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Advanced Very High Resolution Radiometer (AVHRR). Geospatial "land" products generated from direct readout data are integral to operational applications worldwide including natural hazards monitoring, disaster management/response and environmental monitoring and natural resource management.

The application of land direct readout products has increased significantly during the EOS MODIS era. The land direct readout community, however, currently needs to resolve several programmatic and technical issues to efficiently meet operational objectives. These issues include, but are not limited to:

Land product algorithms/code

- Algorithms are commonly developed by the space agencies are intended for use by the science community and the associated standard products are generated on centralized processing systems. Therefore, implementation of land science algorithms into the direct readout environment is not a primary responsibility for product science teams. Consequently, only a select number of land products have transitioned from mission-specific, operational data product processing systems into the direct readout environment.
- Obtaining timely updates of existing land direct readout algorithms after revision for the standard product.
- An efficient mechanism to provide feedback to science teams on product algorithm/code is non-existent.

Communications

- The land direct readout community is highly diverse (academia/research, government, NGOs and the private sector) and wide spread throughout the world.
- Direct readout ground stations often have similar goals and needs. Need to identify priorities and leverage common goals and interests.
- There are currently few opportunities for land direct readout stations to interact, share customized algorithms for regional adaptations, share technologies and experience base.
- There are currently few opportunities and no structured mechanism for the land DR community to communicate with the land science teams, NASA-DRL, and NOAA-IPO programs.

Available sensors

- The land direct readout community utilizes a range of sensing systems. High resolution Landsat direct readout users traditionally coordinate through the Landsat

Ground Station Operators Working Group (LGSOWG). The moderate resolution MODIS and AVHRR direct readout practitioners concerned with land applications currently do not have a forum dedicated to their community.

- A complete assessment of other satellite sensors that are being utilized for land direct readout applications has yet to be developed, and there is a need to communicate with space agencies in order to identify other potential sensors that could be utilized for land direct readout applications (JAXA, ESA, ISRO, etc.).

Regional networks/Data sharing

- Successful regional data networks with focused application (fire detection) or multiple application objectives (fire, floods, emergency response/support, etc.) have been established (e.g. Sentinel Asia). GOFC/GOLD has developed an number of regional networks of data providers and data users to increase the availability and utility of satellite data. e.g. the Southern Africa Fire Network (SAFNET). The land direct readout community needs to investigate similar, scalable networking opportunities to better support and enhance regional land applications.

Future sensors/Product continuity

- Both EOS MODIS instruments have exceeded their planned mission life of five years and will be followed in 2010 by NPP/NPOESS VIIRS. Planning and preparation amongst the direct readout community for the NPOESS era capability is needed.
- Data collection overlap with MODIS is a primary concern for those operational users that need to address issues of product continuity.
- Need to maintain continuity between MODIS land products and similar VIIRS environmental data records (EDRs). Some MODIS land products are not VIIRS EDRs.

The specific objectives of Land/Vegetation Direct Readout Workshop were 1) assess the current status of the land direct readout community; and 2) initiate community activities to improve communication and information sharing 3) develop and implement recommendations and protocols that address the identified issues currently affecting the land direct readout community.

CURRENT STATUS OF LAND DIRECT READOUT

Current Direct Readout Land Applications and Related Activities

Nearly 60 participants representing eight countries attended the Land/Vegetation Direct Readout Workshop. Information provided in presentations, posters and breakout sessions highlighted several ongoing activities in the land direct readout community. These activities consist of operational land applications, regional data sharing/coordination, research and development efforts, and new technologies including:

- Operational fire detection and monitoring in Australia by Geoscience Australia (http://sentinel.ga.gov.au) and LANDGATE (http://www.landgate.wa.gov.au/corporate.nsf/web/Fire+Hotspots) using MODIS and AVHRR.

- Operational flood monitoring, agriculture/vegetation monitoring and land cover mapping/characterization in western Australia by LANDGATE using MODIS (http://www.landgate.wa.gov.au/corporate.nsf/web/Satellite+Imagery).

- Operational fire detection and monitoring in Mexico and Central America by CONABIO using MODIS and AVHRR (http://www.conabio.gob.mx/conocimiento/hotspots/doctos/puntos_calor.html).

- Operational hazard monitoring (wildfire and flood monitoring) and disaster management support for the Asia-Pacific Region by Sentinel Asia direct readout network (http://dmss.tksc.jaxa.jp/sentinel) using MODIS and AVHRR.

- Operational fire detection and monitoring in the United States and Canada by USDA Forest Service Remote Sensing Applications Center (RSAC) using MODIS and AVHRR (http://activefiremaps.fs.fed.us). RSAC leverages a MODIS direct readout network of ground stations to provide near real-time geospatial fire products for nearly all of North America.

- Operational land use/land cover change monitoring in Mexico by CONABIO using MODIS (tri-national initiative (NALCMS) between USGS, CCRS, INEGI, CONABIO, CONAFOR under development).

- Research and development of MODIS-based, regionally-adapted fire risk models for North and South America by Conservation International and CONABIO (under development).

- Monitoring change for 26 Long Term Ecological Research Network (LTER) sites throughout the United States by University of New Mexico CREATE (http://create.hpc.unm.edu/create/lter.php).

- Earth observation radar data available from the TerraSAR-X, a high-temporal, multi-resolution radar instrument with direct broadcast capabilities launched in June 2007 by DLR

(http://www.dlr.de/tsx/start_en.htm). Data will also be received at Mexico´s Chetumal receiving station beginning 2008.

- Status report on testing and implementation of the International Polar Orbiting Processing Package (IPOPP) at the USDA Forest Service RSAC (http://svinetfc6.fs.fed.us/directreadout; http://directreadout.gsfc.nasa.gov/index.cfm?section=technology&page=IPOPP&subpage=./alpha). IPOPP is the primary direct readout data processing package for NPP/NPOESS VIIRS.

Current Direct Readout Ground Stations

Thirteen direct readout ground stations had representation at the workshop. Table 1 contains a listing of these ground stations with associated contact information and current instrument data collection status (MODIS and/or AVHRR).

Table 1 - Listing of direct readout ground stations with representation at the Land/Vegetation Direct Readout Workshop.

Name/Agency	Abbreviated Name	Location	URL	Data Collection
National Commission for the Knowledge and Use of Biodiversity	CONABIO	Mexico City, Mexico	http://www.conabio.gob.mx	MODIS, AVHRR
USDA Forest Service Remote Sensing Applications Center	RSAC	Salt Lake City, UT (USA)	http://activefiremaps.fs.fed.us http://svinetfc6.fs.fed.us/directreadout	MODIS
University of Wisconsin Space Science Engineering Center	SSEC	Madison, WI (USA)	http://eosdb.ssec.wisc.edu/modisdirect	MODIS, AVHRR
Purdue University Terrestrial Observatory	PTO	West Lafayette, IN (USA)	http://www.itap.purdue.edu/pto	MODIS, AVHRR
University of New Mexico Center for Rapid Environmental Assessment and Terrain Evaluation	CREATE	Albuquerque, NM (USA)	http://create.hpc.unm.edu	MODIS, AVHRR
NASA GSFC – Direct Readout Lab	NASA-DRL	Greenbelt, MD (USA)	http://directreadout.gsfc.nasa.gov	MODIS
Geoscience Australia	Geoscience	Alice Springs, Australia	http://www.ga.gov.au/	MODIS, AVHRR
LANDGATE	LANDGATE	Midland, Western Australia	http://www.landgate.wa.gov.au	MODIS, AVHRR
ScanEx	ScanEx	Moscow, Russia	http://www.scanex.ru/en/index.html	MODIS
German Aerospace Center	DLR	Oberpfaffenhofe, Germany	http://taurus.caf.dlr.de:8080/index.html	MODIS, AVHRR
South Africa	SA	Pretoria, South Africa	http://www.meraka.org.za/rsru.htm	MODIS

German Aerospace Center/ National Commission for the Knowledge and Use of Biodiversity (and other mex. Partners)	DLR / CONABIO (+mex. Partners)	Chetumal, Mexico	http://200.34.194.58/cgi-bin/guestimage.html	MODIS (and other)
Brazil National Institute for Space Research	INPE	Brasilia, Brazil	http://www._NPE.br/ingles	MODIS, AVHRR

A current and precise global inventory of direct readout ground stations collecting direct broadcast data from both MODIS and AVHRR is currently lacking. However, the latest available NASA inventory identifies more than 125 ground stations in 30 countries acquiring direct broadcast data from MODIS (Figure 1). Eighty-five percent of these ground stations are collecting MODIS in support of near real-time applications. According to the latest NOAA inventory, there are approximately 500 ground stations in over 70 countries collecting direct readout data from AVHRR (Figure 2). An accurate report of the current operational status of both the MODIS and AVHRR ground stations is not available, and it is not known how many could potentially be part of the land direct readout community.

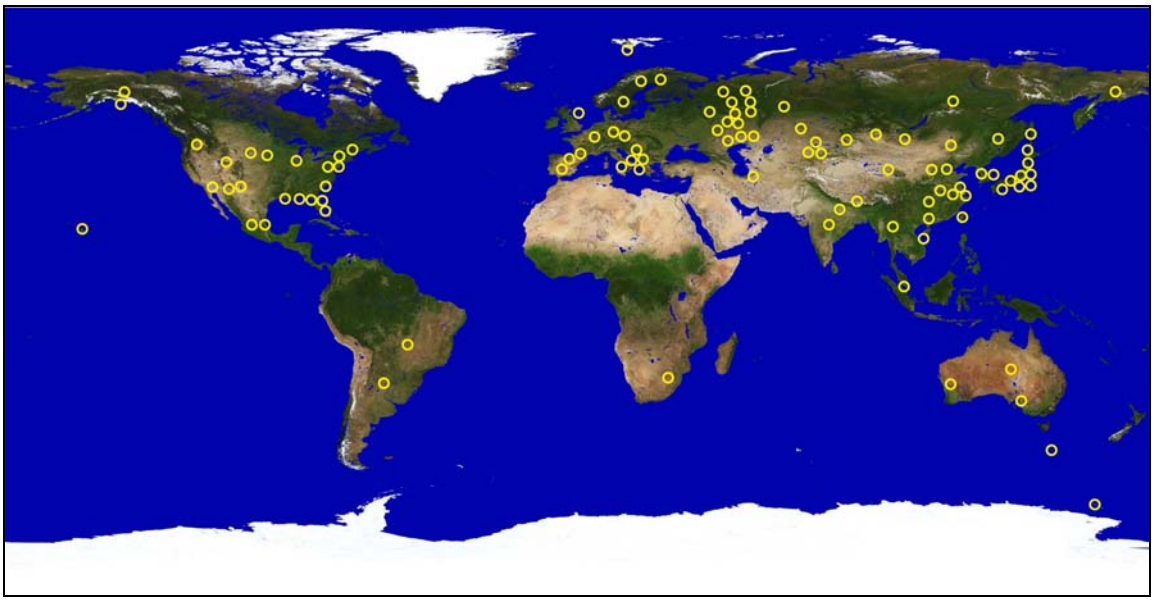


Figure 1 - EOS MODIS X-band ground station sites (provided by NASA Direct Readout Laboratory).

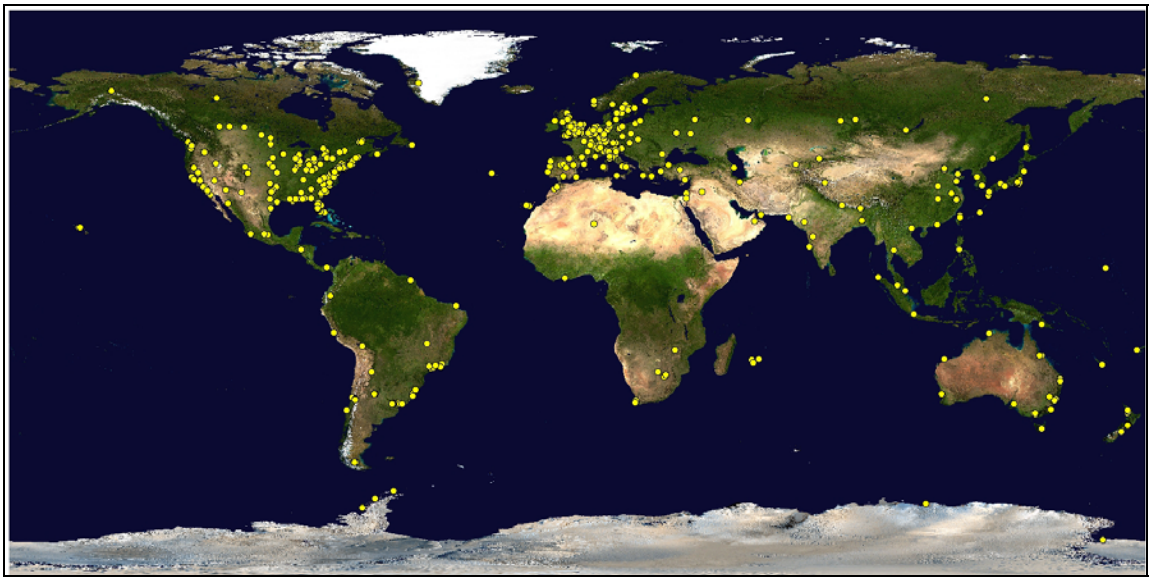


Figure 2 AVHRR HRPT L-band ground station sites (provided by NOAA)

Current Land Product Algorithms for Direct Readout

Based on information provided by workshop participants, a listing of current MODIS and AVHRR land products, and atmosphere products with land application dependencies, are provided in Tables 2 and 3. Implementation status of each land product is identified for each direct readout ground stations represented at the workshop.

Source code for standard and custom MODIS and AVHRR land product algorithms are currently available from a variety of sources on the web (i.e. agencies, direct readout stations, etc.) or directly from product scientists. Science sanctioned MODIS land algorithms for direct readout are currently

compiled, maintained and documented at the NASA Direct Readout Laboratory (NASA DRL). A single web portal to acquire current and documented AVHRR land algorithms for direct readout is currently not available.

Table 2– Current land direct readout algorithms at selected ground stations. "X" denotes algorithm is currently in operational production by the ground station. "B" identifies algorithms currently running in beta mode. "P" represents pending algorithms soon to be released to the community by DRL.

	LAND PRODUCT	NASA-DRL	SSEC	RSAC	PTO	CREATE	CONABIO	INPE	ScanEx	DLR	Geoscience	LANDGATE	SA	CONABIO/ DLR
MODIS	Level 0-1 w/MODISL1DB	X	X	X	X	X	X	X	X	X	X	X	X	X
	Surf Reflectance (DRL/CREFL)	X	X	X	X	X	X	X	X	X	X	X	X	X
	Surface Reflectance (MOD09 beta/6S)		B								B		B	
	Surface Reflectance (SMAC)											X		
	BRDF (MOD43)			X							X		X	
	BRDF (AUS)											X		
	Burned Area (MCD45)										X		X	
	Burned Area (AUS)											X		
	Burned Area (MEX)						X							X
	Fire (DRL/MOD14)	X	X	X	X		X	X	X	X	X	X	X	X
	Fire (Regional Customization)						X	X	X		X	X		X
	Veg Index (DRL/MOD13)	X	X	X	X		X			X				X
	Veg Index (MEX)						X							X
	Snow/Ice	P		P		P	P					P		P
	LST (DRL/MOD11)	X		X			X						X	X
AVHRR	Surface Reflectance		X		X						X	X		
	Fire						X				X	X		X
	LST													

Table 3 – Current atmosphere direct readout algorithms with land dependencies at selected ground stations. "X" denotes algorithm is currently in operational production by the ground station.

ATMOSPHERE PRODUCT	NASA-DRL	SSEC	RSAC	PTO	CREATE	CONABIO	INPE	ScanEx	DLR	Geoscience	LANDGATE	SA	CONABIO/ DLR
TPW (DRL/MOD05)	X	X	X		X	X					X		X
AOD (DRL/MOD04)	X	X	X		X	X				X	X		X
Atmos. Profiles (DRL/MOD07)	X	X	X		X	X					X		X
Cloud Mask (DRL/MOD35)	X	X	X		X	X		X	X	X	X	X	X

Land Direct Readout Transition to VIIRS

In addition to bolstering the availability of direct readout-based land product algorithms/code for MODIS and AVHRR, further efforts are currently underway to prepare the direct readout community for the transition to the Visible Infrared Imager Radiometer Suite (VIIRS) instrument. The VIIRS instrument is the logical operational follow-on mission to AVHRR and EOS MODIS. The VIIRS instrument will be launched on the NPOESS Preparatory Project (NPP) in early 2010 and on subsequent NPOESS missions throughout the following decade.

To support the transition from EOS MODIS to VIIRS, the NASA Direct Readout Laboratory (NASA DRL) is developing the International Polar-Orbiting processing Package (IPOPP). IPOPP is designed to be the next generation processing and visualization environment for direct readout data. The design of IPOPP provides a standardized direct readout data processing framework that is modular and can be scaled to meet user needs. In addition, the IPOPP environment will facilitate integration of both new and updated science algorithms and custom product algorithms developed specifically for regional applications.

Several ground stations are currently testing the Alpha version of IPOPP using live MODIS direct readout data. The current Alpha version of IPOPP has 12 science sanctioned land, atmosphere and ocean algorithms that are used to generate swath based, level 2 products in GeoTiff format. Alpha testers are currently providing feedback and recommendations to NASA DRL for future IPOPP technology enhancements. Additional MODIS algorithms continue to be added to the IPOPP environment as well as available VIIRS EDR algorithms. When IPOPP is released to the public one year prior to the NPP launch it will be capable of processing EOS MODIS direct readout data and eventually NPP/NPOESS VIIRS as the first instrument comes online.

WORKSHOP PROGRAM

The workshop agenda with presentation topics and presenters is provided in Appendix A. PDF documents of the presentations are available from the Land/Vegetation Direct Readout Workshop website hosted by CONABIO at http://www.conabio.gob.mx/conocimiento/premota/doctos/papers.html.

BREAKOUT SESSION SUMMARIES

Two breakout discussions were held to address regional/thematic issues and programmatic issues currently affecting land direct readout. Regional/thematic issue topics included product enhancements, product validation and user feedback, data sharing networks and collaboration on specialized land applications. Programmatic issue topics focused on data continuity, new sensors/missions, transition to future sensors, funding and coordination of the land direct readout community with the direct readout community at large.

Discussion Topics and Notes from the Regional/Thematic Breakout Group

Which additional priority land products/applications are currently needed?

- Live fuel moisture
- Burned area
- Evapotranspiration
- Soil Moisture
- Land Cover Classification
- Vegetation Cover Change - VCC
- Biomass
- Vegetation Continuous Fields - VC F
- Vegetation Phenology
- Fire Characterization – FRP/FRE
- Leaf Area Index / FPAR
- Net & Gross Primary Production - NPP & GPP

Accessibility of direct readout land product code and related technologies?

- NASA Direct Readout Lab (NASA DRL) can be viewed as the source for science sanctioned (EOS and NPP) land product code and customized land product code.
    - Algorithm/Code should have:
        - QA/QC info
            - Scientific validity
            - Functionality
            - Test data sets
            - Documentation
        - Source [metadata]
        - Protocol and standardization issues

        - Code modularity and portability
    - Identified ancillary data dependencies (identify and outline data dependencies)
  - A good mechanism is needed for the users to provide feedback to NASA DRL on particular products.
  - Feedback on algorithms/code should also be provided to science team members and other custom product developers.
  - NASA DRL should provide a product development "outlook" so users will know what is on the development horizon and who is responsible.
  - NASA DRL should note cooperation and outright algorithm code development of land products by DRL cooperators (i.e. University of Wisconsin-Space Science Engineering Center, MODIS Rapid Response, etc.).
- NASA DRL is ideally placed to be the broker for science sanctioned land (atmosphere and ocean as well) direct readout code; standard & custom.

Calibration Issues

- Calibration lookup tables (LUTs) should be available to the user community. Need a feedback mechanism (published links by DRL):
  - Mission/product specific calibration scientists
  - User community (regional) calibration scientists

Validation

- User community has much to offer but validation process needs to be standardized with specific (agreed upon) protocols.
- Global validation - Global product providers are doing validation with limited resources, they should leverage regional validation efforts (and vice versa), which includes data, following a global protocol. Data use for validation should be documented as thoroughly as possible (both regional and global). Sharing of the validation input data is essential.
- Regional validation – Recognize the need for DB providers to continue to do validation of their products, using appropriate independent regional data sets providing information to the broader community on their findings.

What enhancements are needed to existing products?

- Improved cloud mask, specific to certain biomes or conditions, e.g., leveraging improved cirrus cloud detection and refined cloud edge detection.
- Improve the flexibility of the syntax of the program algorithms for regional customization (without having to get into the depths of the code).
- How do we state the ways that the users can bring in useful enhancements in an efficient (easier and cheaper) way.

- Recommendation: Make sure the DB user community is notified (where and when) of MODIS & NPP science meetings. Develop a mechanism so that feedback from the user community can be brought to the science meetings so that they can be addressed.

Are the DR 'customized' products being validated?

- Answer is probably "no".
- Some products are easy to validate, other products are very difficult to validate.

Data sharing networks – What is the status? What is needed?

- Need to share validation data sets as well as protocol.
- Need to share test data sets for algorithm refinement and proof of concept.
- Try to emulate Sentinel Asia data sharing concepts in other regions of the world.
- Need certain tools which make it easy to retrieve data from other stations.
- Create a geoportal for central information sharing.
    - Build geoportal based on the data providers that currently exist.
    - DRL is interested in providing this function.
    - Suggested a wikispace.

Discussion Topics and Notes from Programmatic Breakout Group

Future Systems – GCOM presentation

- Recommend attention to data availability (Global 250m).
- Open access (continuous broadcast).
- Continued direct readout planning – scheduling.
- 3.9 channel for future systems.

Establish a formal linkage between the Direct Readout Mission and the IPO Algorithm Division

- Direct readout feedback on algorithms.
- Direct readout input on instrument performance.

Recognize the need for a parallel path for Direct Readout algorithm development, validation and distribution

- Science Processing Algorithm (SPA) Environmental Data Records (EDRs) and Community SPA Land direct readout code.

Establish a Land direct readout coordinating committee whose role is to:

- Evaluate scientific adequacy of specific direct readout algorithms.
- Provide recommendations to the priority of an algorithm to enter into IPOPP.
- Committee lead to coordinate with other discipline advisory groups for cross coordination of algorithm priorities.
- In addition to current NPP/EOS Focus – provide a forum for discussion of other international DR land community issues – new instruments, other DR capabilities.

Periodic International DB meetings coordinated by the NASA DRL provides a forum for the advisory committee to communicate with the broader community and report on formal findings

- Next Meeting March 2008 Bangkok – follow up.
- Discipline workshops as needed (piggyback on other meetings).

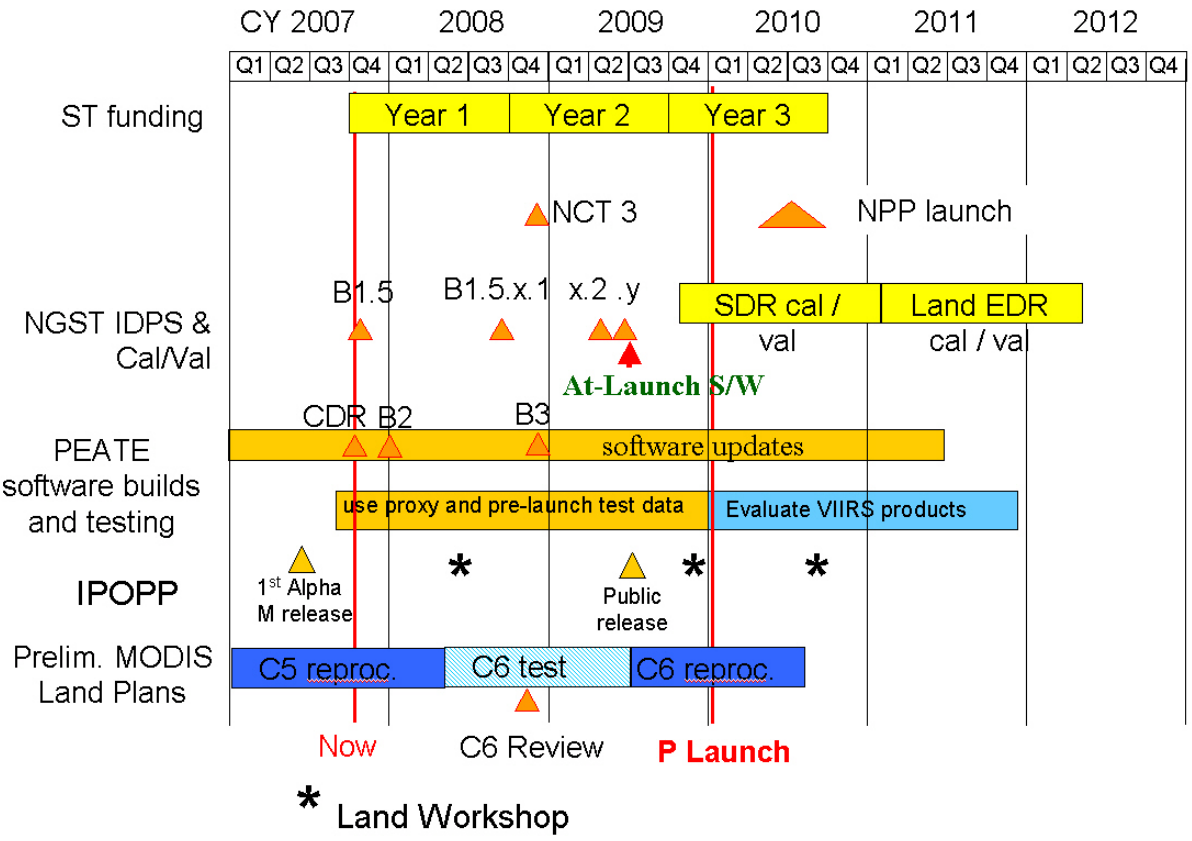
Schedule Issues

- 3rd quarter 2009 will be first release of IPOPP to public with select algorithms.
- Advisory committee workshop 6 months after 1st light of NPP.

User selectable granule sizing at the sensor data record (SDR) level

- Initial release default to be defined by entire pass length

Land high level milestones



• Figure 3 - Programmatic milestones for the NPP VIIRS

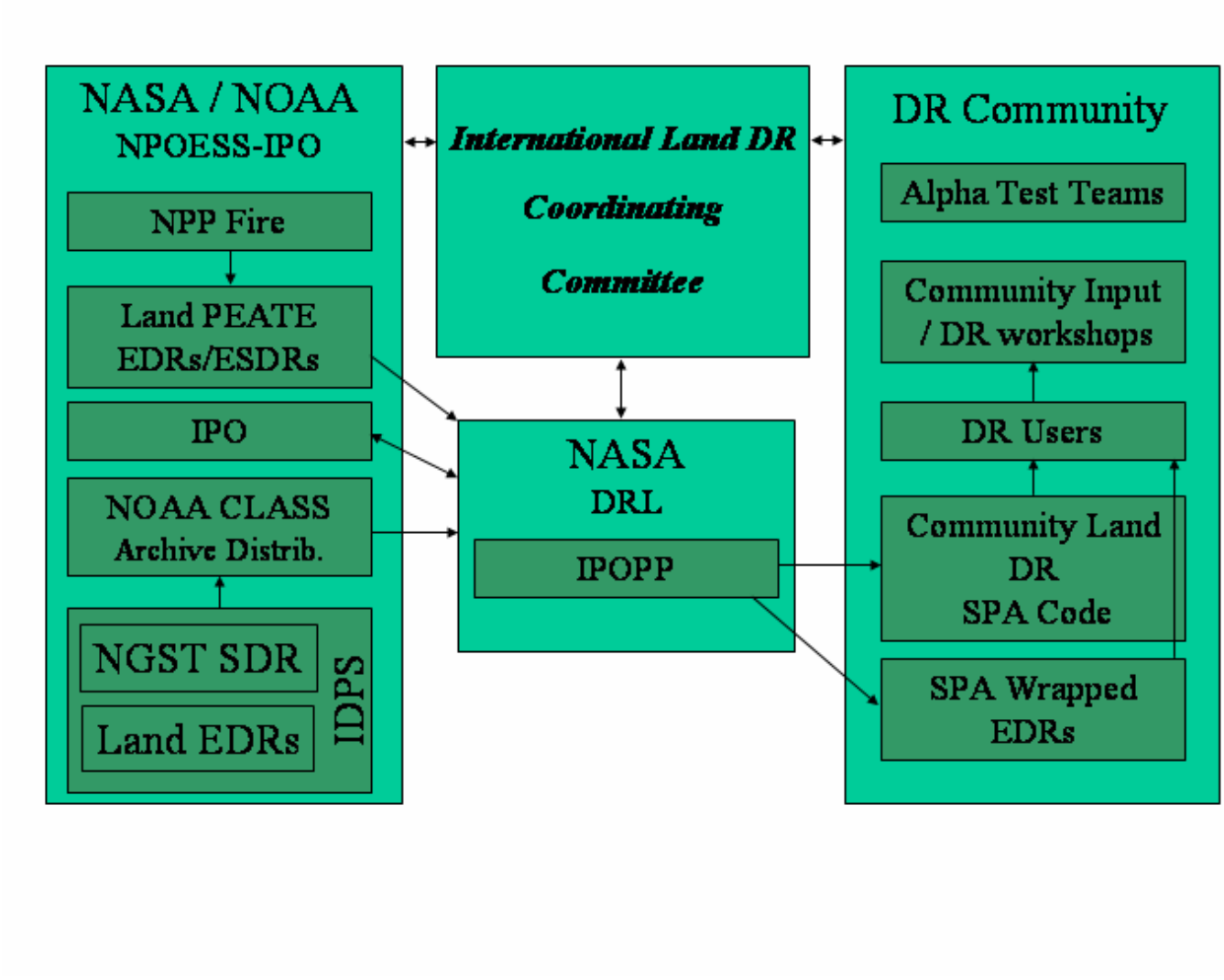
WORKSHOP RECOMMENDATIONS AND ACTION ITEMS

Workshop participants developed a series of DR community-focused and programmatic recommendations designed to address the issues and needs discussed throughout the workshop and specifically identified in the breakout sessions. Immediate action items necessary to ensure future momentum of the ideas and actions discussed were also identified. Recommendations specific to the DR community of practice focus on establishing and formalizing an international Land DR coordination body whose objectives would include a sustained effort to promote international DR dialogue, develop regional DR networks, and address and help resolve science and operational issues affecting the international DR community. The steering group will be established under the auspices of GOFC-GOLD and serve as an organized link between the DR user community and the international space agencies. Although initial focus is being given to NASA EOS/NPP, NOAA Integrated Program Office (IPO), NASA DRL, and the associated Land science teams, future efforts will be made to engage other moderate resolution sensing systems. Participation in the Land steering group will be encouraged from the international DR land community and efforts to expand participation by organizations who were not able to attend the workshop in Mexico City will be ongoing.

Recommendations specific to the DR user community

- Formally establish the International Land DR Coordinating Committee (ILDRCC) with broad representation from the international DR community. The ILDRCC would provide recommendations and feedback directly to the GOFC-GOLD executive committee, NASA programs (EOS/NPP, IPO, DRL), and other international EO programs that interface with the DR community. The ILDRCC is to be co-chaired by existing agencies with operational DR assets, initially proposed to be US Forest Service RSAC, Geoscience Australia, and CONABIO. Committee objectives would include:
    - Provide recommendations on priority land products and applications. Current focus is on canopy water content/live fuel moisture, burned area, and snow/ice.
    - Provide recommendations on future system and sensor capabilities for land applications.
    - Provide feedback to NASA DRL on availability and access to land algorithms/code.
    - Provide feedback on calibration issues and ways to coordinate regional and mission calibration efforts.
    - Work with the science community on establishing standard validation protocols and help to coordinate global and regional validation efforts.
    - Coordinate with other disciplines concerning DR algorithms/products.
    - Serve as an interface between DR community requirements and existing and future land monitoring programs of NASA/NOAA and other participating space agencies.

- Expand regional networking of DR stations – the Sentinel Asia Model provides a working example.
- Engage and solicit participation by more agencies and programs with operational DR interests in future land DR meetings.



• Figure 4 - Potential Information Flows for the VIIRS Land DR community

DR Programmatic Recommendations

- Establish NASA DRL as a central portal for land algorithms/code and data products.
    - EDR SPA and Community SPA and Code (links to regional customized versions).
    - Data sharing via a data GEOportal – info and data (links) clearing house.
    - Updated Land VIIRS DR information.
- Establish a formal linkage between the Direct Readout Mission and the IPO Algorithm Division, followed by a formal relationship with the ILDRCC.
- Ensure continuity of MODIS DR Land algorithms to VIIRS and ultimately to the IPOPP framework.
- Develop new MODIS and VIIRS DR Land algorithms as desired by the DR community. The ILDRCC will prioritize algorithms and data needs of the participating members and present this information to the appropriate program and science committees.
- Expand the focus beyond EOS/NPP focus to include other international DR land community issues including new instruments and DR capability.

A series of action items to be conducted immediately following the workshop were identified. These actions are intended to ensure momentum for the ideas and recommendations discussed and expand interest and participation in future Land DR workshops.

- Generate a Land DR workshop report summarizing the discussions and recommendations identified through the course of the workshop.
- Post the final workshop report and PDF's on the Conabio and GOFC Web sites.
- Establish a formal Land DR coordinating group and identify co-chairs.
- Develop presentation on the 1st Land DR workshop and report for the International EOS/NPP workshop in Bangkok-March 2008.
- Present report at the next MODIS/NPP ST Meeting.
- Identify upcoming, scheduled opportunities to present on the Land DR workshop and future efforts and goals. Potential opportunities include:
    - ACRS Kuala Lumpur
    - Redlatif 08
    - SELPER Cuba 08
    - Dec 2008 NOAA DR conference Miami
    - 14th ARSPC Darwin Sept 08
    - ISPRS Beijing Aug 08
    - IGARSS 09 - DR focus (possible pre-launch meeting)
    - ISRSE Ispra Italy June 09

APPENDIX A: Land/Vegetation Direct Readout Workshop Agenda

Land and Vegetation Direct Readout Workshop Agenda

Tuesday, October 9, 2007

5:00pm – 7:00pm **Poster Session**
Poster session exhibiting direct readout land applications and relevant workshop topics. The poster session will be a bridging activity between Seaspace Conference and the Land/Vegetation Direct Readout Workshop. Presenters will be available for questions and discussion for the duration of the poster session.

Posters will continue to be available for viewing during the workshop until 12:00pm Thursday.

Wednesday, October 10, 2007

MORNING SESSION: PROGRAMATIC OVERVIEW OF DIRECT READOUT FOR LAND APPLICATIONS

8:30am – 8:45am **Welcome** (Rainer Ressl CONABIO)
- Workshop overview
- Logistics
- Highlight of direct readout applications on display in poster session

8:45am – 9:15am **Introduction of Workshop Attendees**

9:15am – 9:45am **Objectives for Workshop**
(Chris Justice, GOFC-GOLD/University of Maryland)

9:45am – 10:05am **Sentinel Asia Direct Readout Network**
(Craig Smith, Geoscience Australia)

10:05am – 10:35am **Break**

10:35am – 10:55am **NASA Direct Broadcast/Direct Readout**
(Patrick Coronado, NASA)

10:55am – 11:15am **EOS/NPP Transition, NPP/NPOESS Direct Broadcast/Direct Readout Framework**
(John Overton, NOAA IPO)

11:15am – 11:35pm **IPOPP Framework Implementation at the USDA Forest Service**
(Brad Quayle, USDA Forest Service)

11:35am – 12:00pm **TeraSAR-X - New High Resolution SAR Data from Space**
(Achim Roth, DLR)

12:00pm – 1:30pm **Lunch**

AFTERNOON SESSION: DIRECT READOUT LAND PRODUCTS/ALGORITHMS

1:30pm – 2:00pm **Surface Reflectance**
(Eric Vermote, University of Maryland/NASA-GSFC)

2:00pm – 2:30pm **Albedo**
(Crystal Schaaf, Boston University)

2:30pm – 3:00pm **Fire Detection**
(Louis Giglio, NASA-GSFC)

3:00pm – 3:30pm **Burned Area**
(David Roy, South Dakota State University)

3:30pm – 4:00pm **Break**

4:00pm – 4:30pm **Snow/Ice**
(Peter Romanov, NOAA)

4:30pm – 5:00pm **Vegetation/Biophysical Parameters**
(Alfredo Huete, University of Arizona)

5:00pm – 5:30pm **Land Cover Change/Fractional Vegetation Cover**
(Gerardo Lopez, CONABIO)

5:30pm – 10:00pm **Evening Social Outing**
(Boat trip in Xochimilco and traditional Mexican dinner)

Thursday, October 11, 2007

MORNING SESSION: BREAKOUT GROUPS

Breakout Session Objectives

- Identify current needs/near term plans
- Areas and opportunities for cooperation and data exchange
- Areas needing additional research and development
- Future systems and plans
- Recommendations from the workshop

8:30am – 10:00am **Breakout Session I – Programmatic and Regional Issues**

- Programmatic Breakout Group (Moderator: John Overton/Pat Coronado)
    - Data continuity issues
    - New sensors/missions
    - Transition to future sensors
    - Funding sources
    - Coordination of Land DB community with general DB community

- Regional/Thematic Breakout Group (Moderator: Brad Quayle/Brian Schwind)
    - Product validation/user feedback
    - Product enhancements
    - Data sharing networks
    - Coordination/sharing specialized land applications

10:00am – 10:30am **Break**

10:30am – 12:00pm **Breakout Session II – DR Products and Algorithms**

- Vegetation/Biophysical Parameters, BRDF/Surface Reflectance Breakout Group (Moderator: Crystal Schaaf/Alfredo Huete)
  - Current direct readout product directions
  - Direct readout product needs

- Fire/Burned Area, LST, Snow/Ice Breakout Group (Moderator: David Roy/Peter Romanov)
  - Current direct readout product directions
  - Direct readout product needs

12:00pm – 1:30pm **Lunch**

AFTERNOON SESSION: BREAKOUT GROUP SUMMARIES/DISCUSSION

1:30pm – 3:30pm **Breakout Group Summary/Discussion**
(Rainer Ressl, CONABIO)
30 minutes for each group (20 minute summary and action items/10 minute discussion)

3:30pm – 4:00pm **Break**

4:00pm – 4:30pm **Formulation of Workshop Recommendations**
(Pat Coronado, NASA/Brad Quayle, USDA Forest Service)

- Framework for workshop report to be produced
- Report will be generated within one month of the workshop
- Workshop report/recommendations will be presented at next international direct broadcast/direct readout conference in 2008

4:30pm – 4:45pm **Workshop Summary/Wrap Up**
(Chris Justice, GOFC-GOLD/University of Maryland)

- Workshop report and presentations to be posted on GOFC/GOLD website

APPENDIX B: Land/Vegetation Direct Readout Workshop Attendees

Land/Vegetation Workshop Attendees and Affiliated Organizations:

Achim Roth, DLR - German Aerospace Center

Alfredo Huete, Dept. Soil, Water & Environmental Science, University of Arizona

Aristides Saavedra Guerrero, Centro de Investigación en Geografía y Geomática "CENTROGEO"

Brad Quayle, USDA Forest Service Remote Sensing Applications Center

Brendon McAtee, Landgate

Brian Schwind, USDA Forest Service, Remote Sensing Applications Center

Carmen Lourdes Meneses Tovar, CONAFOR

Chris Justice, Department of Geography, University of Maryland

Craig Smith, ACRES, Geoscience Australia

Crystal Schaaf, Department of Geography, Boston University

Couturier Stephane , Doctorado en Geografía, Instituto de geografía UNAM

David Roy, South Dakota State University

Deanesh Ramsewak, INSTITUTE OF MARINE AFFAIRS

Elizabeth Mirna Romero Vertti, CIIEMAD-IPN

Enrique Muñoz, CONABIO

Everett Hinkley, USDA Forest Service, Remote Sensing Applications Center

Eric Baptiste , SeaSpace Corporation

Gabriela Gómez-Rodríguez, Instituto de Geografía, UNAM

Gerardo Lopez, CONABIO

Gordon H. Fesenger, Integrated Program Office

Haruhisa Shimoda, Tokai University Space Information Center

Héctor Francisco del Valle, CENPAT (CONICET)

Hind Taud, Instituto Politécnico Nacional

Izumi Nagatani, AFFRIC/MAFFIN,Japan

Javier Colin, Conabio

Jazmín Haydeé González Rivera, CONABIO

Jesús Abad Aegumedo Espinoza, INEGI

Jean F. Mas, Centro de Investigaciones en Geografía Ambiental - UNAM

John Overton, NPOESS Integrated Program Office/Aerospace

John van de Wouw, Northrop Grumman

John VandeCastle, CREATE, University of New Mexico

Karyn Tabor, Conservation International

Kelvin Brentzel, NASA/GSFC

Larry Biehl, Purdue University

Liam Gumley, CIMSS/SSEC, University of Wisconsin-Madison

Louis Giglio, SSAI

Luis Sanchez, CONABIO

María Isabel Cruz López, CONABIO

Michael Schmidt, DLR - German Aerospace Center

Norma Angelica Sanchez Licona, Ciamad- IPN

Olga Gernshanzon, ScanEx

Patrick Coronado, NASA/GSFC

Pedro Díaz, CONABIO

Pete Kindilien, UNM/Create

Peter Romanov , NOAA

Rainer Ressl, CONABIO

Ramiro Luis Cartagena, UNAM - INSTITUTO DE GEOGRAFÍA

Raúl Jiménez Rosenberg, CONABIO

Rebella César, Instituto de Clima y Agua - INTA Castelar

Renè Arturo Mandujano Hurtado, Instituto de Geografia de la UNAM

Samayoa Luis, Lab. Sig y Percepción Remota Instituto de Geografía, UNAM.

Sergio Cerdeira, CONABIO

Thilo Wehrmann, DLR - German Aerospace Center, DFD-US

Tom Bobbe, USDA Forest Service, Remote Sensing Applications Center

Tzitziki Janik García Mora, Doctorado en Geografía, Instituto de geografía UNAM

William M Thomas, The MITRE Corporation

Yunuen Sevilla Salcedo, Universidad Autonóma Metropolitana-Unidad Xochimilco