

Some Broader Issues

- **Urgent need for a truly operational ‘Landsat’** – 5-8 day global cloud free coverage 20-30m – data continuity – free data – replacement
 - but OLI is not ‘operational’ - FLI needs to be
 - Will DOI be responsible for all Future Land Imaging (inc. the real ‘Moderate’ Resolution 250m-1km imaging)
 - how quickly this can be put in place is critical
- **NASA**
 - Doesn’t do ‘operational’ but it does do ‘systematic’ because data continuity is critical
 - NASA does applications but science drives the missions
 - NASA is attempting to transition research to operations
 - NOAA and NPOESS mixing applications and science
 - USGS and LDCM mixing science and applications (USGS LDCM ST)
 - Both instruments are critical to land science
 - **Need to make sure critical capabilities and functions don’t get lost**
 - Who does the LDCM Engineering and Remote Sensing R and D and the Land Science Research

Issues Continued

- LDCM Science Team (tomorrows discussion?)
 - Representing science interests for the LDCM Mission
 - The future is on integrated observations using VIIRS and LDCM data in conjunction – LDCM could/should facilitate this
 - Curtis' comment on LDCM objectives for whole mission rather than data provision
 - Need for a supporting Land Imaging R and D program
 - Need for a Science Program
 - Continued and broad science involvement will be critical

Science Program Context for LDCM

- **NASA Land Cover Land Use Change (LCLUC)**
- **US CCSP Coordination: LULCC and Observations**
 - NASA, USGS, USDA, EPA, SI etc
- **International Programs (Coordination)**
 - Observations
 - **GTOS - GOFC/GOLD (Land Cover IT)**
 - **IGOL (Land Observation requirements refinement)**
 - **GEOSS ('Applications' Focus)**
 - **CEOS inc. Cal Val - LPV (Land Cover Validation)**
 - Science
 - **ESSP (IGBP, IHDP, WCRP, DIVERSITAS)**
Global Land Project (GLP)

Interagency Science Coordination

US Climate Change Science Program (CCSP) and the USGCRP

- Focus on coordination and short-term deliverables
- **Land-Use/Land-Cover Change element (LULCC)**
 - LULCC interagency working group (LUIWG) (consisting of representatives from Federal Agencies)
 - Compton J. Tucker (NASA) & Nancy Cavallaro (USDA)
 - Science Steering Committee – Chair. Dan Brown U. Mich
 - Sample results in the annual ‘Our Changing Planet’
 - **The high-priority items**
 - continuity of ‘high-resolution’ data to the science community (MDGLS, Data Gap)
 - Land-use modeling review (National Academy of Sciences)
 - LCLUC- Carbon Element Joint workshop
 - LCLUC- Human Dimensions Joint workshop



NASA Land Cover and Land Use Change



- LCLUC is an interdisciplinary scientific theme within NASA's Earth Science Program of the Science Mission Directorate (SMD).

The ultimate vision of this program is to:

- *develop the capability to perform repeated global inventories of land-use and land-cover from space, to develop the scientific understanding and models necessary to simulate the processes taking place, and evaluate the consequences of observed and predicted changes.*
- **further our understanding of the consequences of land-use and land-cover changes on environmental goods and services, the carbon and water cycles and providing the science underpinning for improved management of natural resources**
- **improve understanding of human interaction with the environment, and thus provide a scientific foundation for sustainability, vulnerability and resilience of land systems and their use.**
- **<http://lcluc.hq.nasa.gov/>**



NASA LCLUC Program - Building Blocks

- Forcing Factors (Processes)

- Climate and Ecological Drivers
- Socioeconomic Drivers

- Responses and Consequences

- Land cover conversion, abandonment
- Land use intensification
- Land degradation
- Landscape fragmentation

- Modeling and Implications

- LCLUC modeling & projections
- Coupled modeling of LCLUC with biogeochemical and water cycles
- Modeling land-atmosphere interactions
- Climate impacts on land use

- Technique Development

- Remote Sensing R and D
- In-situ data collection - surveys / validation / process studies
- Data Management

- Satellite Observations

- Long -term measurements
 - Landsat series L7>LDCM
 - AVHRR.>MODIS>NPP (VIIRS)
- Experimental missions
 - EO-1 - hyperspectral
- Commercial Data Buy
 - Ikonos - hyperspatial
 - Geocorrected Global Landsat Database > MDGLS

Current LCLUC '07 Priorities

- '07 Science Team Meetings Planned – ROSES 07
 - Spring UMD April 3-5 – Climate, Carbon, Biodiversity
 - Fall Urumqi, China Sept 16 -18 – Drylands
- MDGLS Phase 3 Design and Implementation
 - Prototyping products for LDCM
 - Utilization of MDGLS for LCLUC Science
- Develop a Land Cover Measurement Team
- Land Use and Climate Interactions
- Land Use Modeling (NRC Study)
- Increasing integration of social science
- Regional Initiatives (LBA wrapping Up, NEESPI Science underway, NACP starting up, MAIRS coming !)
- Improving P.I. Data Availability
- The Landsat Data Gap

Data Issues

- *NASA promotes the free and open sharing of data*
- **LCLUC expects its PI's to make their data and products available to the broader community**
 - **Mixed results to date (overhead?)**
- Data systems and services are currently one of the biggest challenges to earth observation systems
- LCLUC related data services being developed through REASON projects
- Data sharing is encouraged
- Data page on the LCLUC web site: Under Construction



SAXTA

Overview of SAXTA: A Distributed Data Dissemination Tool

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Bruno Margerin, Co.I. SSAI

Tim Gubbels, SSAI

**a subcontract to the
MSU Landsat - NASA Reason Project**

(Dave Skole P.I.)





Vision – self sustaining capability for data sharing

- NASA's Landsat-7 global acquisition strategy generates unprecedented volumes of data, putting a high cost on data archive and distribution.
- NASA spends millions of dollars purchasing global Landsat class data sets and providing data to scientists. **Once purchased these data can be shared, however, the problem is knowing who has which data and finding a way to advertise, search for and share them.**
- Networks are supporting the transfer of large volumes of data. New information technologies available for peer-to-peer file sharing offer an opportunity for increasing the ease with which data can be obtained and shared, moving part of the responsibility for data management to the user community.
- NASA's data policy, high bandwidth connectivity between researchers and low-cost disk storage, open up possibilities for realizing the oft-stated goal of open sharing of data.





Peer to Peer Data Sharing

- SAXTA is a tool for the dissemination of high resolution (~30 m) earth observation dataset.funded by NASA (REASoN CAN).
- Software tool is open source and free.
- Data being shared within SAXTA is free.
- Dramatically improves access to, and distribution of high resolution (~30m) datasets for P.I.s and educators within the SAXTA community.
- P.I.s retain full control of its data which are shared directly from his/her facility. No need for lengthy data registration, reconciliation.
- Data are readily available for search and download. No need for data orders .





Current Features

- **General:**
 - Software comes pre-configured. Very easy to install, configure, start and get going.
 - Java based, cross platform. Based on Popular open source JXTA (www.jxta.org) engine.
 - Works behind firewalls, no need for network reconfiguration (similar mechanism to Instant Messaging).
 - Web based GUI. Use and manage your SAXTA browser via a Web Browser.
 - **Beta version. Download it at <http://saxta.geog.umd.edu/download.html>.**
 - **Looking for Beta Testers – groups with small L7 Holdings**
- **Data searching:**
 - Unified Aster / Landsat Graphical (Google maps based) and Textual Data search queries.
 - Query results takes seconds, and are immediately available for download.





Current Features

- **Sharing data:**
 - Share a single file or a whole data holding directory in one click.
 - Automatic Metadata discovery and ingest for the following format:
 - Landsat 7 EarthSat Orthorectified .
 - Landsat 7 FAST-L7A Format.
 - Landsat 7 NLAPS Format.
 - Landsat 7 "MTL" format, (*Landsat 7 scene metadata are located in a 64k "_MTL*" file*).
 - Aster HDF Level 1a and Level 1b
 - Aster HDF Level 2 (AST_07)
 - Additional metadata / data support is driven by the user community.

Currently Aster data sharing is only supported on Windows (2000/XP/Vista) due to Java HDF limitations.

HDF Support for Linux and MacOS X is planned and will become available as the HDF Group releases up to date JAVA HDF libraries for both operating systems.





Data Search Query Overview

- SAXTA Search Query:
 - Spatial or Temporal query criteria
 - Lat / Lon Based or WRS-2 Based.
 - Spatial boundary specified textually or graphically

My Search:
Search Criteria:

Path: Row: Date: (MM-DD-YYYY)

Western Most Lon: Northern Most Lat:
Eastern Most Lon: Southern Most Lat:
Date: (MM-DD-YYYY)

WRS-2 Path / Row and Lat / Lon Helper:

The map displays a satellite view of the Americas with a grid of WRS-2 contours. A white callout box points to a specific location on the grid, labeled "WRS-2 Locator: Path: 18, Row: 50". The map includes navigation controls (up, down, left, right arrows) and map style options (Map, Satellite, Hybrid). The bottom right corner of the map area contains the text "Imagery ©2007 NASA - Terms of Use".





Data Search Result Overview

- **SAXTA Search Results:**

- Returns both Landsat and Aster Data.
- Available in seconds, sorted by relevance.
- Data are directly and immediately downloadable.

My Search:

Path: Row: Date: (MM-DD-YYYY)

South Western Lon: South Western Lat:
 North Eastern Lon: North Eastern Lat:
 Date: (MM-DD-YYYY)

My Results:

My Download Directory:

 Automatically share the downloaded Data

34 Files Matching your Query:

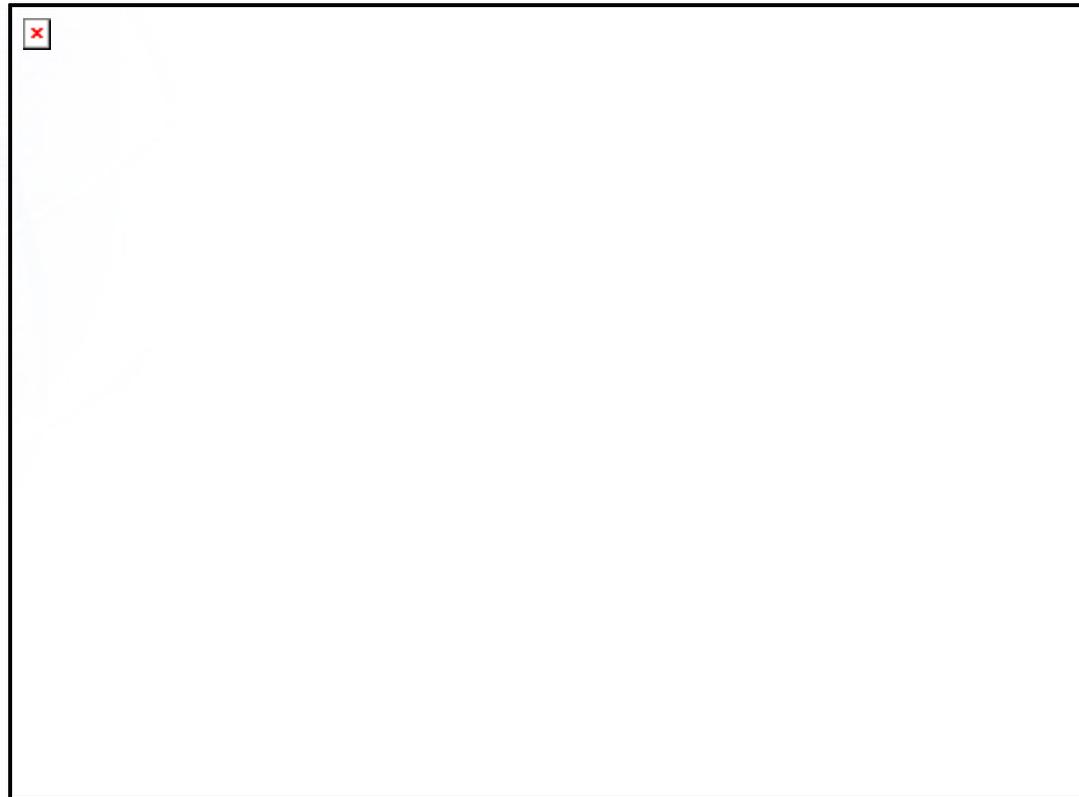
| Select for Download | Path | Row | Acq. Date | Band | %Cloud Cover | %Missing Data | Sensor | File Name | File Size | File Type | Publishing Node |
|--------------------------|------|-----|------------|----------|--------------|---------------|--------|---|-----------|-----------|-----------------|
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 61 | N/A | 66.0 | ETM+ | p018r050_7k20000329_z16_nn61.tif.gz | 6117113 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 62 | N/A | 66.0 | ETM+ | p018r050_7k20000329_z16_nn62.tif.gz | 7443047 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 8 | N/A | 66.0 | ETM+ | p018r050_7p20000329_z16_nn80.tif.gz | 116354886 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7i20000329.742.browse.jpg | 455790 | Browse | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7i20000329.742.preview.jpg | 12438 | Browse | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7i20000329.browse.jpg | 403395 | Browse | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7i20000329.preview.jpg | 11725 | Browse | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 1 | N/A | 66.0 | ETM+ | p018r050_7i20000329_z16_nn10.tif.gz | 27199812 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 2 | N/A | 66.0 | ETM+ | p018r050_7i20000329_z16_nn20.tif.gz | 27492363 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 3 | N/A | 66.0 | ETM+ | p018r050_7i20000329_z16_nn30.tif.gz | 32010893 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 4 | N/A | 66.0 | ETM+ | p018r050_7i20000329_z16_nn40.tif.gz | 30293783 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 5 | N/A | 66.0 | ETM+ | p018r050_7i20000329_z16_nn50.tif.gz | 36764939 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 7 | N/A | 66.0 | ETM+ | p018r050_7i20000329_z16_nn70.tif.gz | 34583932 | Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7x20000329.met | 5522 | Metadata | UmdServer2 |
| <input type="checkbox"/> | 18 | 51 | 10/16/2003 | Multiple | 0.52 | 0.52 | ASTER | AST_L1B_00310162003162927_05262004164023.hdf | 124512005 | HDF Data | UmdServer2 |
| <input type="checkbox"/> | 18 | 51 | 01/14/2002 | Multiple | 0.01 | 0.01 | ASTER | AST_L1B_003_01142002163155_12162003014911.hdf | 124502582 | HDF Data | UmdServer2 |





Data Download Status Overview

- SAXTA Download:
 - Multi-threaded and downloads multiple file simultaneously.
 - Download Status shows completion of the data download.





Contributing Data Overview (1/2)

- Contribute a single scene or a whole directory in one click.
- Automatic metadata discovery, parsing and advertisement; No manual metadata entry.
- Increasing number of supported metadata formats:
 - Landsat 7 EarthSat Orthorectified .
 - Landsat 7 FAST-L7A Format.
 - Landsat 7 NLAPS Format.
 - Landsat 7 "MTL" format, (*Landsat 7 metadata are in a 64k "._MTL*" file*).
 - Aster HDF Level 1a and Level 1b.
 - Aster HDF Level 2 (AST_07).
- P.I retain full control over its data, can end contribution of any data, at any time.
- No need for metadata push, reconciliation, refresh or other metadata manipulation.





Contributing Data Overview (2/2)

Enter the directory or file to be added to your shared list:

C:\Documents and Settings\bruno\Desktop\Sample D:

My Shared Data: 28 Files

| Select for Removal | Path | Row | Acq. Date | Band | %Cloud Cover | %Missing Data | Sensor | File Name | File Size | File Type | Publishing Node |
|--------------------------|------|-----|------------|------|--------------|---------------|--------|-------------------------------------|-----------|-----------|-----------------|
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 61 | N/A | 66.0 | ETM+ | p018r050_7k20000329_z16_nn61.tif.gz | 6117113 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 62 | N/A | 66.0 | ETM+ | p018r050_7k20000329_z16_nn62.tif.gz | 7443047 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 8 | N/A | 66.0 | ETM+ | p018r050_7p20000329_z16_nn80.tif.gz | 116354886 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7t20000329.742.browse.jpg | 455790 | Browse | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7t20000329.742.preview.jpg | 12438 | Browse | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7t20000329.browse.jpg | 403395 | Browse | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7t20000329.preview.jpg | 11725 | Browse | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 1 | N/A | 66.0 | ETM+ | p018r050_7t20000329_z16_nn10.tif.gz | 27199812 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 2 | N/A | 66.0 | ETM+ | p018r050_7t20000329_z16_nn20.tif.gz | 27492363 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 3 | N/A | 66.0 | ETM+ | p018r050_7t20000329_z16_nn30.tif.gz | 32010893 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 4 | N/A | 66.0 | ETM+ | p018r050_7t20000329_z16_nn40.tif.gz | 30293783 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 5 | N/A | 66.0 | ETM+ | p018r050_7t20000329_z16_nn50.tif.gz | 36764939 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | 7 | N/A | 66.0 | ETM+ | p018r050_7t20000329_z16_nn70.tif.gz | 34583932 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 18 | 50 | 01/29/2000 | N/A | N/A | 66.0 | ETM+ | p018r050_7x20000329.met | 5522 | Metadata | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | N/A | N/A | N/A | ETM+ | LE7034032000110750.H1 | 2721 | Metadata | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 1 | N/A | N/A | ETM+ | LE7034032000110750.I1 | 60460120 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 2 | N/A | N/A | ETM+ | LE7034032000110750.I2 | 60460120 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 3 | N/A | N/A | ETM+ | LE7034032000110750.I3 | 60460120 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 4 | N/A | N/A | ETM+ | LE7034032000110750.I4 | 60460120 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 5 | N/A | N/A | ETM+ | LE7034032000110750.I5 | 60460120 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 7 | N/A | N/A | ETM+ | LE7034032000110750.I7 | 60460120 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | N/A | N/A | N/A | ETM+ | LE7034032000110750.H2 | 2154 | Metadata | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 61 | N/A | N/A | ETM+ | LE7034032000110750.I6 | 15115030 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 62 | N/A | N/A | ETM+ | LE7034032000110750.I9 | 15115030 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | N/A | N/A | N/A | ETM+ | LE7034032000110750.H3 | 2014 | Metadata | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | 8 | N/A | N/A | ETM+ | LE7034032000110750.I8 | 241840480 | Data | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | N/A | N/A | N/A | ETM+ | LE7034032000110750.MTL | 7216 | Metadata | BrunoDevLaptop |
| <input type="checkbox"/> | 34 | 32 | 01/17/2001 | N/A | N/A | N/A | ETM+ | README.TXT | 15125 | Metadata | BrunoDevLaptop |





Future Development

- Enhance data sharing scalability.
- Enhance existing Digital Certificate (X509) authentication to provide full data traceability.
- Enhance User Interface with a web 2.0 look and feel.
- Add support for simultaneous access to a given file across more than one SAXTA nodes.
- Add additional Data and Metadata Support.
- Other Developments suggested by the SAXTA community.





More Information

- SAXTA Web Site:
 - <http://saxta.geog.umd.edu>
- SAXTA Download:
 - <http://saxta.geog.umd.edu/download.html>
- SAXTA Contact Information:
 - eMail: SaxtaHelp@ssaihq.com





Data dissemination in the LDCM timeframe

- **The right LDCM Data Policy will be critical**
 - LDCM will be just one source of Landsat class data
 - Early negotiation of reciprocal arrangements at the international level needed – (unlike MODIS/SPOT VGT)
- **We need to give some serious thought as to what dissemination systems will look like and be needed in 2010**
 - Recognize the user community as a potential resource – involve the community >self help
 - Reduce the burden on and cost of any one system > distributed services (keep costs down and competitive)
 - Develop a suite of dissemination systems and services
 - Both centralized and distributed



Data Policy Issue

- **NASA Open Data Policy** (<http://globalchange.gov/policies/agency/nasa.html>):

“NASA is committed to the full and open sharing of the Earth Science data obtained from U.S. Government-funded and -owned systems with all users as soon as such data become available. All Earth System Enterprise missions, projects, and grant proposals shall include data management plans to facilitate implementation of this principle.”

- **Aster Data Redistribution Policy**
(http://edcdaac.usgs.gov/aster/aster_redistribution_policy_clarification.asp)

“ASTER data purchased through the LP DAAC have no restrictions on subsequent use, sale, or redistribution regardless of the date of purchase.

*Two groups-NASA-funded researchers and **affiliated users***-are provided access to ASTER data at no cost and should submit a request for this privilege by using the form at:
<http://LPDAAC.usgs.gov/aster/afd/index.php>*

Redistribution of ASTER data obtained at no cost through this NASA agreement is limited by certain restrictions. Researchers and educators may only redistribute these data to other researchers and educators. These data may not be redistributed to the general public or others who do not fit the criteria stated above. Any users not complying with this policy will be billed for all data received at no cost and will be subject to loss of their privilege to obtain any additional ASTER data at no cost.

*NASA-funded researchers receive funds directly from NASA through a grant, contract, or cooperative agreement. Affiliated users fall into one of three categories:

- Researchers who receive NASA research funds through a third party
- Researchers from interagency and international partners affiliated with NASA through joint projects
- International users including both NASA-sponsored and non-NASA-sponsored.”

