

## **Summary of MDGLS Phase III Workshop February 27-28, Historic Inns of Annapolis, Annapolis MD**

A workshop was held Feb 27-28 in Annapolis MD to formulate a strategy for generating derived products, global assessments of land cover, land cover change, and vegetation dynamics from the upcoming Mid-Decadal Global Land Survey (MDGLS). The MDGLS will consist of ~9500 orthorectified, mostly cloud-free Landsat images, providing global coverage for the 2004-2007 epoch. The MDGLS extends the range of the successful GeoCover datasets which provided similar global coverage centered on 1975, 1990, and 2000 epochs. The discussion emphasized the critical role of the Landsat archive for characterizing land cover dynamics, and established community consensus on an initial suite of global, Landsat-resolution land cover products.

### **Background**

The MDGLS was originally initiated through the US Climate Change Science Program, as an effort to acquire global Landsat coverage before the expected demise of Landsat-5 TM. By providing coverage for the ~2005 epoch the data set would also support 5-year interval mapping of global land cover change, a priority for both international programs (e.g. GEOSS, GCOS - UNFCCC, GOFD/GOLD) and national science objectives (e.g. CCSP Strategic Plan, NASA Earth Science Strategy). The project is implemented as a collaboration between USGS and NASA, and has been divided into three phases:

- Phase I: acquisition of all relevant data sets, including Landsat-5 data from International Cooperators and temporary ground receiving stations, and auxiliary data from EO-1 and ASTER;
- Phase II: processing of data, including calibration to at-sensor radiance, orthorectification, and (in the case of Landsat-7 ETM+) gap filling, as well as data distribution;
- Phase III: generation of land cover, land-cover change, and vegetation dynamics products from the processed data set.

In addition to providing a critically important data set to the science community, the MDGLS is considered as an important pathfinding activity for the Landsat Data Continuity Mission (LDCM) in terms of data acquisition, data pre processing and product generation needs.

The primary goal for the Annapolis workshop was specify priorities and implementation options for Phase III activities, although issues from Phase I and II were brought into the discussion as required.

Twenty-three participants attended the workshop, including representatives from academia, government, and the conservation community. After an initial set of presentations, the participants discussed four general topics:

- What products should come from the MDGLS data sets?
- How should they be produced?

- Is the Phase II processing scheme appropriate for these products?
- How does the MDGLS fit with longer-term objectives of the LDCM era.

## **Workshop Findings and Recommendations**

**1. The MDGLS Project is of critical importance for both land use science and** assessments and implementation should be shared and expedited by NASA and USGS.

- despite 35 years of Landsat observations, there has not been a unified global analysis of land cover trends using the archive. Previous Geocover processing projects did not include resources for land cover analyses.

- the MDGLS represents a critical opportunity to begin assessing land cover change and vegetation dynamics at high resolution

- the MDGLS data set is critically important for the FAO FRA 2010 initiative to map the world's forest cover and its changes via geographic sampling.

**2. Global estimates of land cover change are the highest priority for Phase III**

- there has never been a global assessment of land cover change at Landsat resolution – now is the time to start.

- forest cover change (including conversion, disturbance, recover) has high impact via carbon cycle science and biodiversity – this product should be the initial focus.

- secondary objectives include:

- agricultural extensification (including irrigated agriculture)

- global standing water extent and variability

- arctic hydrology, including permafrost dynamics, bogs, thermokarst

- urbanization

- focus on products that meet the needs of society in responding to climate change, food security, and bio-energy availability. Think about breaking out of the disciplinary “IGBP” box.

- preprocessing steps are essential, and constitute a separate product class. Surface reflectance via atmospheric correction is desirable, and should be provided via Phase III activities through web-enabled tools or as a separate product.

- basic mapping of land cover type can also be pursued at the same time as change is mapped – continuous fields approaches should be harmonized with classification.

- products should take advantage of synergies with MODIS (e.g. cross-calibration through MODIS VCF and land cover products; improved characterization of phenology via integration of MODIS reflectance).

**3. Implementation via distributed teams is appropriate, but harmonization essential**

- Data volumes (~7 TB) are not too large for PI-driven processing

- Funded analysis projects need to commit to consistent mapping criteria (e.g. modified LCCS) and validation protocols

- Individual products do not have to be strictly global, but can be thematic e.g. boreal wetlands

- Possibility for joint USGS/NASA solicitation to support MDGLS Phase III analysis in FY08.

#### **4. An open archive for MDGLS will greatly advance the science utility of the project**

- cloudy regions will require more than 1-2 images per epoch for adequate characterization of change; multi-season imagery would be preferred for many temperate regions.
- data costs currently limit the amount of Landsat data that can be applied to the MDGLS effort.
- it was proposed that USGS provide open access to the archive for the MDGLS Project, thus allowing a temporally richer data set to be analyzed. Given the general willingness of foreign ground stations in MDGLS, opening the archives for this contained project would be a good way to pilot a broader archive access initiative in the future.

#### **5. The FAO Land Cover Classification Scheme (LCCS) is appropriate for MDGLS but will require revision**

- In general LCCS provides a flexible means of describing land cover type in terms of physical attributes
- Some modifications to LCCS are necessary before it could be applied to MDGLS – avoid land use descriptors
- Need comparable effort for standardizing legends for land cover change products – what do we mean by change?

#### **6. Validation should be integrated into MDGLS Phase III activities from the start**

- validation of land cover change needs to be considered carefully, including use of dense image time series, high-resolution imagery, and local knowledge.
- the GOFCC land cover validation team and the CEOS CVWG On land product validation (LPV) should be engaged for validation.
- implementation options include independent validation teams and/or PI-led validation. Separate validation teams have not been a successful model in the past, however.
- Phase II production should include an estimate for the number of validation scenes required.

#### **7. The Phase III activities represent a pathfinder for a 2010 assessment and annual assessments in the LDCM era**

- we need to move toward routine, global monitoring of land cover changes, not just through “one time” collections of data
- planning for a 2010 characterization should begin now, with a focus on the use of international sources of data to complement the Landsat capabilities. This would be an excellent focus for the Landsat Data Gap Initiative.
- an open LDCM archive is essential for meeting the scientific and societal requirements of the mission

#### **Additional Points from the Workshop**

- “Keep it simple” – even a simple analysis of global forest to non-forest conversion performed globally will be revolutionary compared to what has been done before. We need to avoid “scope creep” that increases the complexity of the analysis.

- The role of a MDGLS is not to generate analyses of land cover tailored for a single region or application – local products will generally be better for specific users. Instead the MDGLS should be geographically consistent and provide the basis for global assessments.
- The MDGLS is critical for the FAO FRA 2010 project, but timeliness is a concern. Radiance products need to be available by 2008 to be useful for FAO. Phase III analyses need to be prepared shortly thereafter to be relevant to society.
- The current data processing requirements seem appropriate to the analysis products outlined here. Tropics should include denser temporal coverage to reduce cloud effects.
- GeoCover 1990 and 2000 will need to be re-orthorectified to bring in compliance with SRTM-based MDGLS. Also MDGLS should replace scenes from Geocover data sets with more seasonally appropriate choices, if resources allow.
- Opportunities exist to enhance the MDGLS data set through collaborations with FAO FRA and JRC, under the auspices of GEO.
- Consistent terminology needs to be established WRT resolution – is Landsat high- or moderate-resolution?

### **Proposed MDGLS Organizational Structure**

At the conclusion of the workshop, an organizational structure for the MDGLS was proposed. This structure would include agency management (NASA and USGS HQ), Project Scientists (USGS and NASA), and an MDGLS Science Working Group. The latter would be composed of funded MDGLS PI's, the current Science Steering Group, selected partners (e.g. GOFD, GEO, FRA, TREES), and independent advisory members (including representatives from the USGS Landsat Science Team).