

GCPOLCC Steering Committee Meeting

GCPO LCC Land Cover Database (LCDB)

May 2013 Progress Report

Background

The GCPO LCDB project was envisioned as a two-year effort which began in the summer of 2011. The initial proposal developed by Chuck O'Hara was intended to address land cover change, dynamics, and change monitoring capabilities in a manner that enabled effective modeling and simulation of landscape dynamics to inform conservation planning across the GCPOLCC geography.

The goal of GCPO LCDB project was to provide an updated, complete, coordinated, and consistent land cover classification and mapping using common ecological systems or similar nationally consistent classification system, ideally with 5 year updates.

The need for development of a current, seamless and consistent LCDB was based on an analysis of alternative data sources and consensus among the geomatics working group that extant land cover data were either out of date, insufficient in terms of thematic resolution, or incomplete with respect to geographic coverage. Requirements discussed by the geomatics working group emphasized a consistent data and information framework for landscape-scale conservation for the entire region of the GCPO LCC. Such a data and information framework would include baseline data sets for characterizing land cover, modeling and designing management strategies, and addressing the challenges of matching appropriate data with advanced applications, decision making, and knowledge science.

The proposal outlined a phased approach to collecting existing and historical land cover data that partnered and harmonized efforts with national teams to deliver capabilities to identify land cover changes, conduct updates to land cover databases, and include these changes and dynamics into a seamless consistent land cover and conservation monitoring framework that informs conservation planning. The workflow plan called for collection of source data, development of change detection methods, and preliminary classification protocols to be completed by the summer of 2012. Preliminary classification products were planned for delivery by the fall of 2012 and final products were to be delivered and available in the summer of 2013.

Specific Tasks Included:

- Task 1: Participate in LCC geospatial data teams and initiate a working group to identify historical data sets, preliminary data needs, and key aspects of the effort. (Y1 / Q1)

- Task 2: Travel to USGS EDC to meet and coordinate with national teams and gain access to early versions of the 2006 MRLC source data as well as the 2006 NLCD and ancillary data that may be used to enhance products including the 'change products' utilized as part of the update process.
- Task 3: Coordinate with USGS and National NLCD / MRLC / USDA and other partners to compile 2010 MRLC source data collections as well as other ancillary data sets needed to create 2010 update products.
- Task 4: Provision historical land cover, ancillary data, and updated 2006 MRLC and NLCD data into the GCPO LCC Conservation Atlas.
- Task 5: Coordinate with national leadership teams on methods for hybrid change detection for streamlining and enhancing computation and methods for land cover updates and creation of land cover change and dynamics modeling products.
- Task 6: Test methods and protocols for extracting change and testing LCDB change analysis methods leading to an updated 2010 LCDB.
- Task 7: Test Integration of Ancillary 'High Confidence' Data and Evaluate Methods for Update of Change Data with New /Updated Classification Labels.
- Task 8: Coordinate with working group and national teams to get user feedback, evaluate accuracy and quality of products, and verify results
- Task 9: Deliver GCPO LCC LCDB Update Products and Provision into the GCPO LCC CA.
- Task 10: GCPO LCC LCDB Plans for Land Cover Updates and Change Monitoring.

Tasks 1-5 were largely completed and Task 6 was underway, but the project fell behind schedule because of loss of key personnel and competing time demands to other commitments on the Principal Investigator (PI). In January 2013, Dr. O'Hara accepted a position in industry and severed employment with MSU effective Feb 28, 2013. With the project behind schedule, approximately 1/3rd of the work completed, but ¾ of the way through the performance period, and loss of the PI, MSU/GRI administration crafted an alternative plan to bring the project to completion. A new team, led by Dr. H. Alexis Londo, was assembled and included Dr. Qingmin Meng (Geosciences), Lee Hathcock (GRI), and geosciences graduate student Ravi Sadasivuni.

In mapping the path to project completion, the team critically reviewed all assumptions and proposed methodologies. After extensive discussions with a myriad of sources within the geomatics and conservation community it was determined that a more direct and consistent pathway to classification of regions lacking coverage and crosswalking this new classification to extant coverages might be pursued. Although the original objectives of producing a current,

seamless, consistent, high confidence and dynamic landcover have not changed, a revised methodology to arrive at this objective is being proposed. This approach is summarized as follows:

Project Objectives:

- 1.) To classify to NatureServe Ecological System areas not previously classified to that resolution. This area includes Missouri, Arkansas, and Louisiana. The first classifications will be equivalent to GAP level 2 classifications. The final classification will be NatureServe Ecological Classifications (NEC) as was done in the SE GAP and by Missouri Resource Assessment Partnership (MoRAP) in Texas and currently in Oklahoma.
- 2.) Crosswalk the western portion of the GCPO LCC (Texas and Oklahoma) classified to NEC by MoRAP, to GAP level 2 classifications. Eastern portion of GCPO LCC is currently classified to NEC and GAP level 2 thus this will result in two equivalent levels of classifications across the entire geography of the GCPO LCC.
- 3.) Develop a schematic for updates to these classifications based on the MRLC change detection products. This change detection analysis will be used to update the SE GAP classification present on the eastern portion of the GCPO LCC. Using this same approach, areas where land use/ land cover has changed as detected by the MRLC change products, the entire GCPO LCC geography can be updated on a 5-year cycle.

Project Procedures

Objective 1 - Part A: - Final Product GAP Level 2 Classification for Unclassified Areas

Expected Completion: August 15, 2013

First, training data is being developed from which we will train the classification process. This dataset is being developed with the intention of incorporating existing field derived data such as FIA data, and randomly allocated photo interpreted points. The training set is only the first dataset to be used in the GAP level 2 classification processes. Input data layers will include:

1. **LandsatTM imagery** from three dates during or around 2011.
2. **Soil Adjusted Vegetation Index (SAVI)** derived from LandsatTM.
3. **Modified Soil adjusted Vegetation Index (MSAVI)** derived from LandsatTM.
4. **Slope** derived from National Elevation Data (30m).
5. **Aspect** derived from National Elevation Data (30m).
6. **Insolation** derived from National Elevation Data (30m) using the automated program supplied to us from MoRAP.
7. **Landscape Position** is currently being explored by a student supported on this project. However, programming has been supplied by MoRAP to ascertain landscape position and will be used if necessary.
8. **National Agriculture Statistics Service Cropland Data Layer** will be used to determine rowcrop, aquaculture, and fallow lands.

9. **Wetland Information constructed from National Wetlands Inventory, NHDPlus, and NLCD** will be used to identify emergent wetlands, forested wetlands, and scrub shrub.
10. **Physiography** features extracted from elevation data may be used to further enrich classification of landcover/landuse.

These layers will be stacked with the training data and classified using CART or Neural Network approach to GAP level 2. A cursory accuracy assessment using NAIP imagery will be conducted. Modifications to this process and the information used in this step may be made based on the results and accuracy assessment.

Objective 1 - Part B: Final Product NEC for Unclassified Areas
Expected Completion: May 15, 2014

In a separate step, 4 band (Blue, Red, Green, Near Infrared) NAIP imagery will be resampled to a 10m pixel size. Principal Component Analysis (PCA) will be performed on this multispectral data and the first component will be used in object oriented classification to create polygons (mapping units) to be further classified to the level of NEC. Each object will be attributed with several identifying characteristics including but not limited to:

1. **Soils** - texture, depth to A horizon, and depth to impervious layer. Floodplain soils and soil types will be noted and removed from the next step.
2. **Riparian areas** - determined from the National Hydrological Data (NHDPlus). The streams will be buffered 30 meters and if a majority of the polygon falls in this riparian buffer it will be noted. This will help determine upland riparian ecological classifications.
3. **GAP level 2 classification** – results from Part A.
4. **Slope** – from Part A.
5. **Landscape Position** – from Part A.

Once all the polygons are attributed, NEC names will be assigned based on these characteristics. Further investigation may be needed to separate two close classes or to combine some classes where necessary. Additional soil data or other datasets may be needed to differentiate some classes. Rule sets will be developed and will be applied universally where possible. Further investigation may be needed and will then be conducted at the sub geography level.

Objective 2. Final Product Entire GCPOLCC GAP Level 2 Classification
Expected Completion: August 15, 2013

The eastern portion of the GCPOLCC is already classified to NEC and GAP level 2 with the SE GAP product. The results from above, objective 1 part A, use the GAP level 2 classification. Texas and Oklahoma are the only portions of the GCPOLCC missing this level of classification. To meet this objective, the final output from MoRAP for these states (currently classified to NEC level)

will be cross walked to GAP level 2 classes. This will result in the entire GCPOLCC having a GAP level 2 designation.

Objective 3. Update Procedures

Expected Completion: May 15, 2014

These steps produce a complete NEC level classification throughout the entire GCPO LCC geography; however, there will be a temporal difference between the newly classified western portion of the GCPO LCC and the 2001 SE GAP classification in the eastern half of the GCPO LCC. Land use/land cover change between 2001 and 2011 can be identified using the MRLC change detection product. By combining this change information with the above described procedures, SE GAP can be updated producing a seamless, consistent, and current land cover at NEC level of specificity. Using MRLC change detection products, this approach can be repeated for the entire GCPO LCC geography on a five year interval thus producing seamless, consistent, and current land cover at a finer temporal scale than previously available.

Recommendations:

The above procedures are consistent with those used by MoRAP. However, MoRAP incorporates field derived training data obtained by vegetation ecologists during the classification and validation process. The methodology outlined above will produce a classification system that will require field validation in the future. The original project had no allocation for the gathering of field data. It is the recommendation future consideration is given to the gathering of field derived data to validate and refine this classification.