

2014-2015 Partnership Accomplishments Report on Joint Activities

National Gap Analysis Program (GAP)

And

LANDFIRE



Background and Purpose

The intended target audience for this document initially is management and project technical specialist and scientists involved in the Gap Analysis Program (GAP) and the Landscape Fire and Resource Management Planning Tools - (LANDFIRE) program to help communicate coordination activities to all involved parties. This document is also intended to give background information in other parts of the USGS and beyond, although some details given are relatively oriented to management of the respective programs.

Because the Gap Analysis Program (GAP) and the Landscape Fire and Resource Management Planning Tools - LANDFIRE programs both rely on characterizations of land cover using similar scales and resolutions, the programs have been coordinating their work to improve scientific consistency and efficiency of production. Initial discussions and informal sharing of ideas and work began in 2008. Although this collaboration was fruitful, there was no formal process for reporting results, plans, or outstanding issues, nor was there any formally-defined coordinated management team that spanned the two programs. In 2012, leadership from the two programs agreed to strengthen the coordination of their respective work efforts. In 2013 the GAP and LANDFIRE programs developed an umbrella plan of objectives and components related to three mutual focus areas for the GAP and LANDFIRE collaboration for the years 2013 and 2014 (GAP/LANDFIRE 2013). The evolution of this partnership resulted in the drafting of an inter-program [Memorandum of Understanding](#) (MOU) in 2014. This MOU identified three coordination topics relevant to the two programs participating at this point in the MOU history:

1. Vegetation mapping
2. Disturbance classes
3. Formal quality assessment

2014-2015: Accomplishments

Establishment of MOU

The MOU resulted as managers and leaders realized the need for a fully coordinated and integrated nationally consistent data set. The MOU provided for data integration and geospatial products that could be accessed by multiple parties operating at multiple scales to support a wide variety of business needs. The two programs had mapped vegetation data of the US at the same scales and resolution independently.

With this MOU in place, the participating programs (GAP and LANDFIRE) were and continue to be able to pool fiscal resources to work together producing data sets to support decision making. The MOU formally defines the need of the programs to develop and share a nationally consistent suite of data products to support their work. The MOU identifies topics of scientific integration, mostly in the form of shared assessment and classification/taxonomic schemes, and geospatial products to derive from the former. The MOU also defined that work flows and cyberinfrastructure should be developed and used to make these products accessible to parties including and beyond the two programs, and be capable of supporting scientific inquiries at multiple scales for a variety of business needs (e.g. fire and fuels planning, species habitat conservation assessments).

Expanded Coordination

As a result of the MOU, coordination between the two groups increased substantially. Several different coordination calls regularly scheduled with management, project technical specialists and scientists, and working groups focused on technical and production tasks specific to shared activities.

Leadership in the National Land Cover Database program (NLCD - another national land cover mapping program) was aware of discussions about coordination around vegetation mapping with the formalized relationship between GAP and LANDFIREs MOU, but because of conflicting priorities could not allocate resources to participate in an expanded effort, however, did collaborate on a crosswalk between the GAP/LANDFIRE legend (Ecological Systems) and the NLCD (Anderson Level 2 legend). NLCD uses a more general land cover classification than the one shared by the GAP and LANDFIRE programs. More on this effort will be reported in a separate report. The three programs also worked on a collaboration strategy document.

Key points of the expanded collaboration of the three programs was established around three topic areas:

1. Interim strategy to compare existing products using a vegetation classification crosswalk
2. Long-term strategy for consistent data production across all three programs
3. Prototyping pilot analysis to test long-term strategy

Coordination Topics

Topic 1. Vegetation mapping

Major accomplishments in this area included the finalization of a draft legend for the Conterminous U.S. in support of the 2016 joint remap effort. Vegetation classes used in previous program efforts and relationships between them were compiled (Appendix). From this, a unified classification structure and target map legend was defined. This work defined a vegetation classification structure for the conterminous United States (CONUS) that was relevant for the GAP and LANDFIRE mapping scale. This new structure was built on information developed by the NatureServe organization (<http://www.natureserve.org/>) and the U.S. National Vegetation Classification Partnership (NVC; <http://usnvc.org/>) to improve the existing structure's identification and characterization of ecological systems, along with ruderal and cultural types of vegetation. A consensus-driven process was used to simplify the classification.

Additional work related to this coordination topic involved GAP's work to update their 2001 product to 2011 conditions. This ongoing work integrates the NLCD 2011 and LANDFIRE's disturbance products to update the 2001 National GAP Vegetation Dataset to identify areas where the cover type in 2011 was different from 2001. The resulting map will be used to update [GAP's national species distribution models](#).

Through the coordination efforts, five pilot projects were identified to test various aspects of the combined vegetation mapping. These include:

- Test alternate wetland mapping approaches in CONUS, with the hope of aligning with coastal work happening through NLCD partners, specifically NOAA Coastal Change Analysis program
- Increasing accuracy in the process of labeling vegetation plot data to a target map class. This labeling process is done with computer scripts (autokeys) that sort the plot data according to species composition, dominance, and canopy characteristics in order to label that plot with a target map class. This can then be used as training or assessment data in the mapping process.
- Refinement and finalization of anthropogenic classes
- Testing the integration of continuous variable mapping products being developed as a part of the NLCD (e.g. % shrub, % grass) BLM rangeland mapping effort.
- Identifying common requirements for the pre-processing of LANDSAT 8 images for use in land cover mapping and modeling.

Topic 2. Disturbance classes

LANDFIRE has continued to expand and improve upon methods for collecting information about vegetation disturbance and incorporating this information into a spatial database. LANDFIRE's disturbance mapping process provides details on time-since, severity and type of disturbance based on time series analysis of LANDSAT satellite imagery. The process involves Landsat change detection, use of Landsat derived indices (e.g. Normalized Difference Vegetation Index, differenced normalized burn ratio), as well as fire, fuel, or other vegetation disturbance perimeters and extent mapping (e.g. Monitoring Trends in Burn Severity, Burned Areas Reflectance Classification, Rapid Assessment of Condition after Wildfire). Multi-Index Integrated Change Algorithm (MIICA) methods (Jin et al. 2013) was used to detect land cover changes. GAP applied the LANDFIRE 2010 disturbance layer in an effort to update the GAP 2001 land cover and species models to 2011 conditions.

Topic 3. Formal quality assessment

The LANDFIRE Reference Database (LFRDB) includes vegetation and fuel data from geo-referenced plot samples nationwide. The data were largely amassed from existing information resources such as: USFS Forest Inventory and Analysis data, GAP field plot data, and the National Park Service Vegetation Characterization program's Vegetation Inventory program. LANDFIRE had developed Autokeys [a series of tables that automatically assign reference plots from the LFRDB to ecological systems (Reid et al. 2015)] with NatureServe as part of the national mapping effort in 2001 but this information needed to be updated in preparation for the remap.

GAP, LANDFIRE, the Bureau of Land Management (BLM), The Nature Conservancy and NatureServe worked together to improve the Autokeys. That work was guided by the results of an earlier [Improvements Project](#) in which expert labeled plots were used to assess the autokeys and identify ecological systems or specific geographies where there were higher rates of confusion in the remote sensed data and quality of ground plot data. Historically these assignments were primarily based on the vegetative characteristics of land cover plots. In developing the second generation auto-keys, information on bioclimates and landforms was available in addition to plant species composition for making plot assignments. The Autokey working group defined 17 Autokey regions and worked to develop rules that result in a more accurate assignment to both ecological systems and NVC Groups in each region. The

newly defined Autokey regions are based on a combination of the U.S. Forest Service ECOMAP and the EPA Level IV ecological regions (Reid et al. 2015) with the understanding that the ecological context of the geographic data will improve the process by creating Autokeys for areas with a narrower range of target vegetation types. The process is also identifying ecological systems and USNVC Groups that will be mapped using alternative techniques. Work is being conducted on each of the 17 Autokey regions independently. That work was completed for the Conterminous U.S. in December of 2015 (Reid et al. 2015).

In addition to the refinement in the variables added to help label the vegetation plots and the change in geographic units (aggregations of ecoregions) in which Autokeys are applied, a process of expert labeling of plots based on the raw field data was done in for a small subset of the total LFRDB database. Those plots are being used as an additional check on the results of the Autokey process.

Work was also done to improve the completeness of the LFRDB by collecting additional reference plots to the database. One large contribution to this increase in coverage will be the addition of BLM plots collected as part of their Assessment, Inventory, and Monitoring (AIM) Strategy as well as the new agreement between LANDFIRE and Natural Resources Conservation Service (NRCS) for the National Resources Inventory (NRI) dataset.

RESOURCES AND FUNDING

The GAP program provided approximately \$150,000 in funding transferred to the U.S. Geological Survey Earth Resources Observation Systems (EROS) Data Center in 2013 and \$60,000 in 2014 & 2015 to the LANDFIRE program. This funding directly supported task activities of mutual interest.

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APPENDIX



LANDFIREGAP_LEGEND_AppendixA.xlsx