LANDFIRE
Program and LF 2010 Project

Program Update and
Project Closeout Report

Prepared for:
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LANDFIRE Program and LF 2010 Project

March 2014

EXECUTIVE SUMMARY

LANDFIRE (LF), also known as Landscape Fire and Resource Management Planning Tools, is an interagency program of vegetation, fire, and fuel characteristics mapping reflecting landscape condition changes over time. LF is directed by the United States Department of the Interior (DOI) and the United States Department of Agriculture (USDA), Forest Service (FS). The program includes data production, such as the LF 201 project, and other functions, such as data support, technical transfer and outreach.

RESULTS: LF Program and LF 2010 Project

LF 2010 Intent— The primary intent of the LF 2010 project was to update LF map layers to provide for currency of landscape conditions, by applying updated remote sensing data, and by applying available disturbance information for calendar years (CY) 2009-10.

Summary Performance— Overall, the LF 2010 project concluded in February 2014, requiring 24 months to complete, or 10 months in addition to the baseline completion date. The annual LF Program budget averaged $3.2 million in fiscal years (FY) 201 and 2013. The LF Program included the LF 2010 project with method refinements; and, non-production efforts, such as user support for LF 2001/2008 data products, technology transfer, special data and analysis requests, and program governance.

In comparison, the LF 2001/2008 project required 2 months to complete, and an additional $800 thousand funding during the LF 2010 program period. The LF program, in operation and maintenance, continues to reduce time and cost in each successive project update segment.

Project Detail— The LF 2010 project updated the LF data suites comprising 27 product groups. Updates were applied for landscape changes and disturbance information for years 2009-10 applied to the conterminous United States, Alaska and Hawaii. Partial data suites were produced for Insular Areas.

Refinements/Innovations— The LF 201 Refinements include new data sources and methods not available to LF National or LF 2001/2008, resulting in improved data quality, content, and usability. Introduction of new scientific methodologies resulted in a range of unpredicted challenges that contributed to an extension in the project duration required to complete the project deliverables.

LF Program Activity— LF program activities such as technology transfer, data distribution, and stakeholder outreach have been critical in addressing user needs for LF data. This was accomplished by providing stakeholder and user support technical training, guidance on use of LF data, and provision of tools and ancillary products to assist in use of LF data.

External Challenges— During the LF 201 project external factors complicated production and non-production activities; the most significant included travel restrictions in CY 2012-13; funding restrictions as part of the sequestration in CY 2012-13; and, the partial government shutdown in October 2013.

FUTURE: Plans and Next Steps

Updates—The LF Program will continue to provide consistent updates to LF data products, to further enhance and extend the use of LF data, while continuing an annual collection of available disturbance data. The LF 2012 project is expected to deliver updated products in early CY 2015.

Partnerships— The LF Program will continue to foster partnerships with companion programs, such as US Geological Survey (USGS) Gap Analysis (GAP) and the National Land Cover Database (NLCD).

Remap— Comprehensive remapping of the complete geographic extent of the LF product layers using the most current available satellite imagery is presently under consideration and planning analysis is being conducted. Work activity on the Remap project is expected to commence in CY 2016.

PROGRAM UPDATE AND PROJECT CLOSEOUT REPORT

Purpose and Description

The purpose of the Closeout was to assess the performance of LF activities, report to leadership on findings, and derive lessons learned and best practices to be applied to future program efforts. This closeout report summarizes the key procedures conducted in the completion of the LF 2010 project.

The primary activities related to close out of the LF 201 project[1] is referred to in conventional project management terminology as Post Implementation Review and Administrative Closure.

- **Post Implementation Review**
  This review (internally termed After-Action-Review [AAR]) was to assess how the project met defined goals, highlight what worked well, learn from challenges during the project, identify patterns and trends, document areas to improve upon processes, and, most importantly, communicate results.

- **Administrative closure**
  Administrative closure addresses the interactions, activities, and operational roles and responsibilities of the team members and relevant stakeholders. This procedure also includes collecting relevant documentation and records, assess success or failure in completing the project objectives, assimilate lessons learned, and archive project information for future use.

Outputs or results from project closeout include the closeout procedure itself; the delivery of the full complement of final products and services; and, the closeout procedure assets, including formal acceptance documentation, project management files, project closure documents, and historical data.

LF Program Overview

The LF program is an interagency vegetation, fire, and fuel characteristics mapping program, incorporating changes over time as directed by the United States DOI and the USDA FS.

- **Program Components**

✓ LF 201 Project

In FY 201 and 2013, the primary program focus was the LF 201 project, to provide updates to the LF product data set. The updates addressed changes in vegetation across the landscape, such as those resulting from wildland fire, fuel and vegetation treatments, or management. In addition, where data was available, changes from insects and disease, storm damage, invasive plants, and other natural or anthropogenic events were incorporated. The project incorporated significant methodological enhancements that are noted in detail through the remainder of the report.

[1] The LF Program applied closeout guidelines set forth in the Project Management Institute (PMI), Project Management Body of Knowledge (PMBOK), American National Standards Institute (ANSI) 99-001-200.

✓ Non-Production Components

Other program components in addition to the LF 201 project included 1) Stakeholder Outreach, 2) Technology Transfer, and 3) Other Program Operations (e.g., end-user support, special projects, and program governance). Examples of outreach and technology transfer include training and presentations o the use of LF data and modeling toolsets that apply LF data. Examples of other program operations include coordination and assistance provided to land management programs such as the Southern Wildland Fire Risk Assessment and partnerships with the USGS GAP.

LF 2010 Project – Initial Plan and External Factors

■ Initial Planning

The LF 2010 project pre-planning was conducted in stages during calendar year 2011, with a significant focus at the LF business leadership group meeting in October 2011, and additional planning refinements conducted through the formal project kick off on March 1, 2012. A review of technical and science outcomes from the previous LF data update project (LF 2001/2008) was conducted in the summer of 201 and contributed to the methodological and data source considerations in the LF 2010 project.

■ External Factors

number of external factors contributed challenges to the production effort including responses to stakeholder requests not defined within the LF 2010 project scope, and operational challenges presented across agency operations at the DOI and USDA-FS.

In CY 2013, requests for detailed analysis and review sessions with regional stakeholders resulted in a helpful dialogue between LF data user groups and the LF production team. However, these sessions resulted in a concurrent support of user review and response activities, at the same period of production activity for some of the LF 2010 products. The review sessions increased workload for LF personnel and contributed to extending the duration to complete certain LF 2010 data products.

Agency level challenges in CY 201 and 201 resulted from organizationally mandated travel restrictions in response to budgetary limitations facing both the DOI and the USDA-FS. Alternative arrangements were implemented through internet-based conferencing to conduct group meetings in support of LF 201 management. Although work progressed, the deferral of selected onsite meetings resulted in inefficiencies that impaired productivity and overall LF program outcomes.

Across many federal government operations, 3-week partial government shutdown was experienced in October 2013. This shutdown tangibly affected the final stages of the LF 2010 project completion. It is estimated that the shutdown resulted in an added 1.5 months to conclude the LF 2010 project effort.

■ Revisions to Baseline

The original project baseline for the LF 201 project was established in March 2012, and adjusted to a revised baseline in January 2013. More adjustments to the project schedule were implemented in March 2013 through May 2013 to provide stakeholders with a current schedule. However, project delays persisted, but additional adjustments were not made due to the majority of the deliverables being produced. The most substantial science and technical challenges that resulted in extending the duration necessary to complete the LF 2010 project are summarized as follows:

- ✓ Enhanced Disturbance Mapping Approach

  Part of the baseline revision was necessitated by complexities involving the disturbance mapping activities in the continental U.S. A new disturbance-mapping algorithm was approved and adopted shortly before the start of LF 2010 production activities. This new algorithm supported use of improved change detection using the Multi-Index Integrated Change Analysis (MIICA) approach. The new change detection and disturbance mapping approaches required additional time to gain familiarity and proficiency with use in a production environment. Estimation assumptions were made as to the speed with which disturbance products could be produced and the amount of data that could be processed concurrently in drafting the original baseline. These assumptions proved optimistic and, while the average rate of processing exceeded projections, the entire disturbance mapping effort took longer than initially estimated, requiring the first baseline revision.

- ✓ Revisions to Vegetation Products

  Other complications were encountered with the vegetation mapping process. Application of master look up tables (LUTs) for disturbance information as well as using the new disturbance mapping algorithm resulted in production delays. Numerous technical process adjustments were necessary, including updates to multiple LUTs, as well as revisions to coding masks for input datasets, such as the Conservation Easement Database (CED) and the Cropland Data Layer (CDL). Challenges continued to be discovered with selected vegetation product layers when applied in the fuels product development. Certain wall-to-wall enhancements implemented after LF 2001/2008 resulted in complications when utilized in the LF Total Fuel Change Tool (LFTFCT), and, in applying fuel model assignments. Initial testing of these refinements was conducted and deemed feasible to implement in LF 2010; however, implementation at a full production scale presented unpredicted difficulties, necessitating schedule changes mentioned above. The vegetation issues are estimated to have extended the project by 6 months toward completing the overall LF 2010 product suite.

LF 2010 – Objectives

In brief, the LF 2010 project updated LF National (circa 2001) and LF 2001/2008 (circa 2001 through 2008) map layers to reflect more current landscape conditions, with a primary focus on vegetation changes, including a broad range of disturbances. Key objectives for the LF 2010 project included:

- ✓ Update the comprehensive suite of LF National data products encompassing CY 2009-2010 conditions.
- ✓ Focus o relevant and significant landscape changes or disturbances to vegetation, such as those resulting from wildland fire, fuel and vegetation / silvicultural treatments, insects and disease, storm damage, etc.
- ✓ Leverage Landsat imagery and point and spatial polygon data for years 2009-2010, and utilize newly available or newly refined institutional data sources, to update data products.
- ✓ Retain original information for areas that did not experience a vegetation change or disturbance.
- ✓ Incorporate user focused improvements and enhancements, primarily through user feedback from the LF helpdesk, focus group reviews, and internal lessons learned.

LF 2010 Project and LF Program Results

■ Performance Summary

Performance of LF 2010 resulted in completion of data production and administration activities in 24 months, schedule variance of 48%, or 10 months beyond the baseline plan. Data products were delivered in incremental packages rather than a combined national delivery. However, the overall delivery of the LF 2010 project was completed in less time than required in the LF 2001/2008 project.

LF Program Funding	
Fiscal Year	Amount
2012	$ 3.4
2013	$ 3.1

Table 1. The LF program budget for fiscal years 2012 and 2013

Cost performance of the LF program budget averaged $3.2 million in fiscal years 2012 and 2013. This represents an approximate 14% reduction in annual program funding compared to FY 201 and 2011.

Some “carry over” elements from the LF 2001/2008 project were completed during the LF 2010 project effort: primarily completion of the comprehensive results summaries for the LF 2001/2008 updated products, referred to as Geographic Area (GeoArea) Reports, which document both the methodology and evaluation of updated product results in distinct report documents for each GeoArea.

Overall, the LF Program delivered a significant continuum of stakeholder and end-user service activities, internal program operations, and a comprehensive suite of LF data products reflecting landscape changes through CY 2010, updating the previous suite of data products from the LF 2001/2008 project.

LF 2010 Project Results

The LF 2010 project schedule was approached as a "waterfall" product delivery by geographic area, with the first products released in June 2013, and final deliverables concluded in February 2014. summary of the schedule results is displayed in Figure 1. Data products were delivered in two product groups. Group A consisted of critical products used by wildland fire programs such as Fire Program Analysis and Wildland Fire Decision Support System. Group B includes products important to LF stakeholders, but of less urgency for use in modeling activities. Product delivery was accomplished primarily through the LF Data Distribution System hosted by the USGS Earth Resources Observation and Science (EROS) Center.

Group A:
Forest Canopy Cover, Forest Canopy Height, Canopy Bulk Density, Canopy Base Height, Fire Behavior Fuel Model 13, Fire Behavior Fuel Model 40, Fuel Characteristic Classification System, Existing Vegetation Cover, Existing Vegetation Height, Existing Vegetation Type, LF Reference Database, LF Events Database, LF Vegetation Transition Database

Group B:
Biophysical Settings, Fire Regime Condition Class (FRCC), FRCC Departure Index, Fire Regime Groups, Mean Fire Return Interval, Percent Low-severity Fire, Percent Mixed-severity Fire, Percent Replacement-severity Fire, Fuel Loading Models

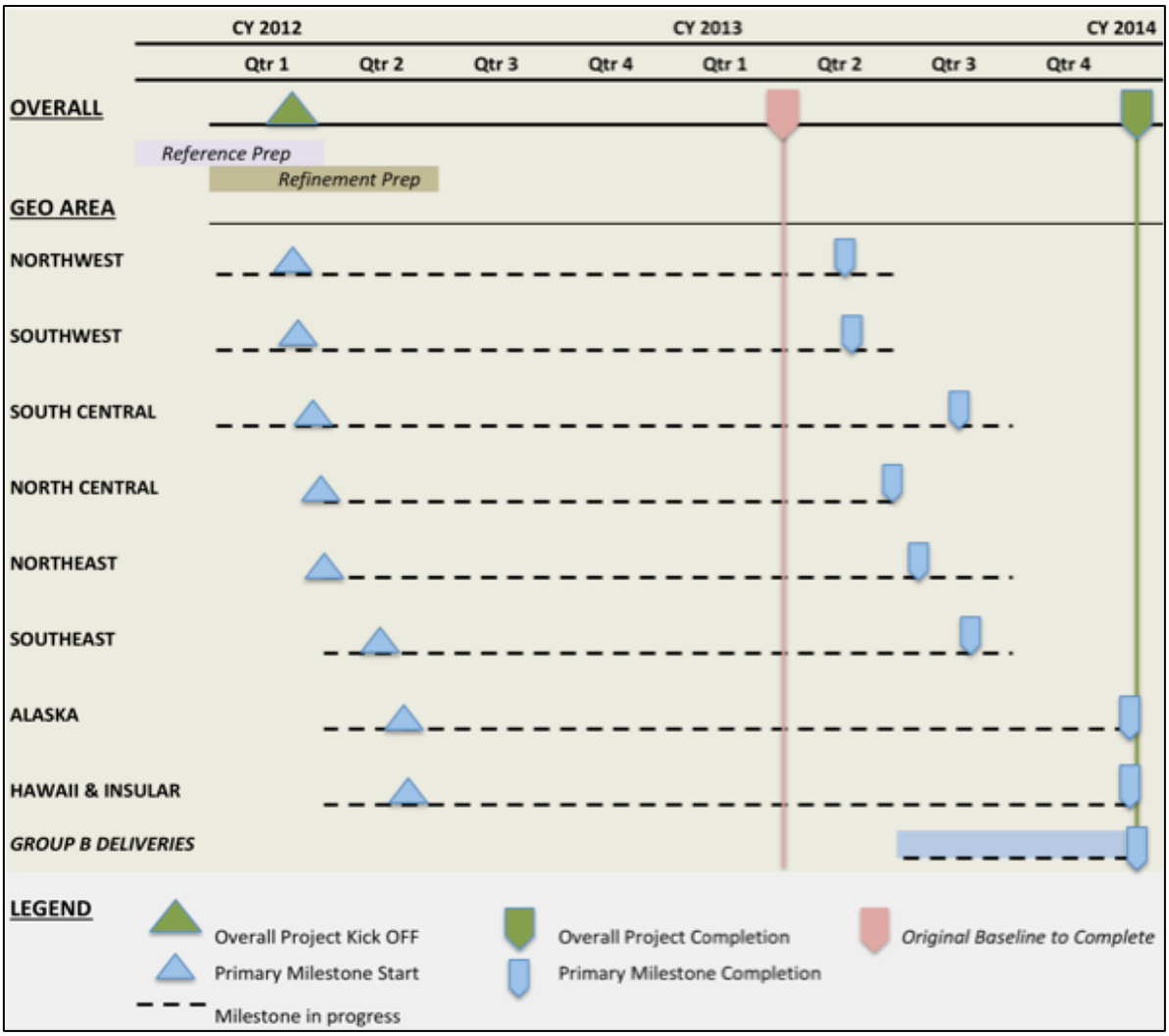

Figure 1. Timeline: baseline and completion of LF 2010 products by geographic area.

■ LF 2010 Refinements

Refinements include enhanced scientific or technical methods or new or additional data sources that have been incorporated in the LF 2010 project in response to stakeholder requests for product improvement or expansion, or as internally proposed enhancements to improve content, quality, or efficiency. The refinements included in LF 2010 were both ambitious and significant, in that numerous benefits and innovations were applied in a level budget and project duration. Selected refinements that were incorporated in LF 2010 are as follows:

✓ Improve Events Implementation

Improvements were made to the LF 2010 Model Ready Events in order to refine the data for disturbance mapping. Small polygons, less than 0.02 acres, were identified and deleted from the Model Ready Events in order to reduce false changes to the landscape.

✓ Multi-index Integrated Change Analysis (MIICA)

Evaluations of the LF 2008 project, which used the Vegetation Change Tracker (VCT) algorithm for disturbance mapping, indicated that changes in non-forest ecosystems were not being mapped effectively. The VCT approach was primarily developed for identifying forest change. An advanced change detection approach developed by NLCD, MIICA, was adapted for use in the LF 2010 project. MIICA was evaluated and determined to be more effective in mapping change in non-forest ecosystems and comparable to VCT in mapping forest change. MIICA was a primary refinement for mapping disturbance in LF 2010.

✓ Revised Buffer

Buffers were evaluated between the LF 2008 approach and how to conduct this in LF 2010. The buffering approach is important to help reduce the misclassification and mapping of areas where two Events are in close proximity. The Event buffer was reduced from 1,000 meters to 500 meters to improve the precision of classifying disturbance event types in the remote sensed imagery.

✓ CONUS, Alaska, Hawaii boundaries:

All map zone boundaries were reexamined prior to LF 2010 mapping. Open water had been previously mapped an inconsistent distance from the coast in earlier LF versions for the CONUS extent. After evaluating consistency with territorial laws, LF 201 mapped nautical mile extent past the United States coastline.

✓ Improve ways to incorporate new data – Forest Service Activity Tracking System (FACTS)

In the LF 2008 refresh project, LF used variety of existing data to describe yearly agency management activities. For the USDA FS, individual files for each national forest were obtained by locating local server links to each data source; and next, downloading the geospatial data and tabular data. LF 2010 used F activities data migrated to an enterprise database. Generic queries now run at the forest administrative unit to derive geo-databases describing the location and attributes for activities on agency land on yearly basis. Data for 2008 through 2010 were extracted for use in the LF 2010 project.

✓ Refine Vegetation Mapping: Urban, Riparian, and Agriculture

LF 2001/2008 existing vegetation products remapped a subset of “urban” types into burnable vegetation, defined coarsely at a life form level. LF 201 continued with this approach as well as the following adjustments: LF 2010 retracted NLCD class 22 from the burnable urban class and mapped it as non-burnable urban class and LF 2010 augmented the extent of NLCD urban types with areas from the NLCD 0 newly mapped urban map.

LF 2001/2008 existing vegetation products reflected remapping of the herbaceous wetlands using data from the NLCD 01 product. In the LF 2010 project, these data were replaced using available National Wetlands Inventory data for wetlands: Herbaceous; Woody (shrub and tree); and Water.

LF 2001/2008 existing vegetation products reflected remapping of subset of agricultural types into burnable vegetation. These were defined using National Agricultural Statistics Service crop types. In the LF 2010 project, LF used a newer version of that data, the CDL, as well as augmented the mapping of these agricultural data with other geospatial data including the Common Land Unit (CLU) data, to constrain mapping of true croplands, the Conservation Reserve Program (CRP) data (derived

from the CLU) to remove agricultural false positives and to constrain the mapping to natural vegetation types, and the Conservation Easement Data (CED), which was used to inform fuel assignments for these updated agricultural classes.

✓ Refine Vegetation Mapping: Existing Vegetation Height in Alaska

In LF 2010 forest canopy height was remapped for all of Alaska using "*lidar*" (remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light) data available from the Geoscience Laser Altimeter System (GLAS). The GLAS observations of canopy height, combined with Landsat imagery and other ancillary geospatial layers were used as training data to develop a new canopy height map. The large number of available GLAS observations enabled a better categorical resolution of the forest canopy height map, increasing the number of forest height classes from two to nine.

✓ Existing Vegetation Type (EVT) Legend Revisions

LF 201 EVT legend revisions addressed number of issues to increase the thematic resolution of data and to clarify concepts and definitions associated with each mapping unit by providing a more comprehensive and consistent suite of vegetation attributes. Primary revisions include: Expanding and redefining map unit themes including agricultural (groupings by CDL), urban, modified and managed vegetation map units; Stratified EVT legend into nested levels of resolution; Revised or expanded attributes enabling crosswalks to newly revised National Vegetation Classification System (NVCS), NLCD land cover types, Society of American Foresters/Society of Range Management cover types, and LF dominance types.

✓ Mitigating Seam Lines

LF 2001/2008 produced improvements o seam lines within the data. In the LF 2010 project, the science and production teams further assessed feedback regarding seam lines.

✓ Transition Database as deliverable

LF 200 existing vegetation products were created by a "transition" of the LF 200 data. This resulted in numerous internal databases and mapped products. The LF 2010 project focused this database toward a deliverable that was provided to users as a tabular and geospatial database.

✓ Utilization of the Forest Vegetation Simulator/Fire & Fuels Extension (FVS/FFE)

LF 2010 refined the LF 2008 updating process that used the FVS/FFE program by incorporating the following efforts: verification of fire severity modeling in FF for the following: the level of mortality and resulting tree canopy cover; improved tree regeneration processes and simulations; refined grouping strategies for summarizing individual plot modeling results; reviewed/analyzed post disturbance tree cover estimates compared to tree cover using stem mapping techniques; and used additional plot data from the Forest Inventory Analysis (FIA) program.

✓ Fuels Refinement: Agriculture, Urban, Tools

Reviews of LF 200 products recommended refinements to EVT to benefit fuel model mapping, including: Increased resolution in agricultural classes, including adding "Grains" as a separate class; More explicit mapping of protected areas as well as modified and managed areas within the

agricultural and semi-natural EVTs; and, Inclusion of shrub and herbaceous height and cover to better describe vegetation conditions.

Return of NLCD class 22 (Developed w/20-50% impermeable) to non-burnable urban with inclusion of shrub and herbaceous height and cover to better describe vegetation conditions.

Review of LF 2008 products recommended refinements to Canopy Base Height (CBH) lookup tables for LF 2010 within the Total Fuel Change Tool including deriving estimates of CBH o plot data from FVS/FFE estimates instead of FUELCALC estimates and regrouping of plot data to optimize accuracy of CBH assignments.

✓ Expanded Extent: Islands and Insular Areas

The LF 201 product extent was expanded to provide a spatial layer suite for the Pacific and Caribbean islands affiliated with the United States, including vegetation and fuels data layers for American Samoa, Guam, Northern Marianna Islands, Palau, Marshall Islands, Puerto Rico, and the US Virgin Islands.

■ **Distribution of Program Effort**

In general, the primary focus of the LF program was the continued sequence of data updates to the original LF National product suite. However, as the LF Program now reaches its fourth full year in operation, growing need has been experienced in data support and end user assistance across the versions of LF data products. declining budget scenario and greater volume and diversity in usage of LF data products are critical considerations in LF program direction in upcoming periods. The allocation of program effort during the LF 2010 project effort (depicted in Figure 2) is not expected to differ in the near term through the next update cycle. Careful evaluation continues to be conducted to achieve the most favorable balance of program focus areas to best serve the overall needs of the stakeholder and user communities.

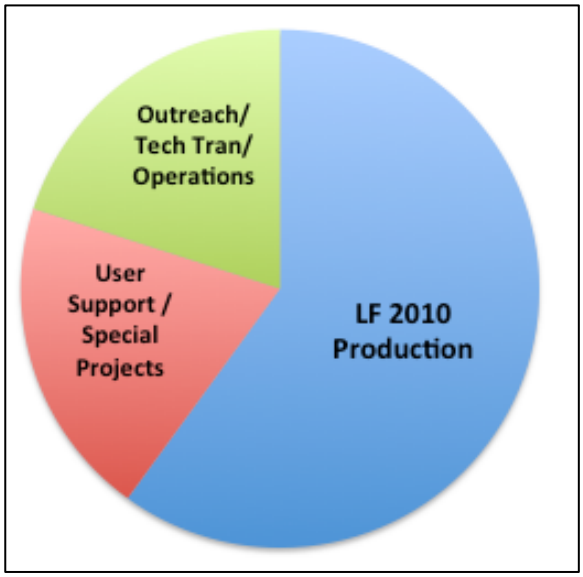

Figure 2: LF Program: Operating Segments

■ **LF Program Special Response**

range of response efforts to LF stakeholders or data users was conducted in parallel to the LF 2010 project effort. Often, key science and technical staff involved in the data update and production effort were also requested to support special response efforts. The most notable outcomes are as follows:

✓ Data Support: Indian Forest Management Assessment Team (IFMAT) III

The third Indian Forest Management Assessment was the most recent report in a series conducted over a 20-year period, mandated by the National Indian Forest Resources Management Act in 1991, to evaluate the federal investment in Indian forest management. The IFMAT III report concluded in calendar year 2013, and used LF data, among other data sources, in analysis of forest management

o tribal lands. The LF program supported multiple requests for tabular and geospatial LF data sets specific to areas located in the IFMAT study.

✓ Product Review: North Central and Northeast

In 2012, stakeholders from the North Central (NC) and Northeast (NE) GeoAreas coordinated with the LF Program regarding LF 2001/2008 products applied in fire behavior modeling, with particular focus on the following vegetation types: wetland, herbaceous wet and dry, and agricultural.

✓ Training and User Support: LFTFCT (toolset)

Most training and end user support related to LF products was conducted under Stakeholder Outreach and Technology Transfer aspects of the LF program. However, specific needs among a broad spectrum of LF data users was identified for an automated toolset developed by the LF Program for use in conjunction with ESRI ArcGIS software for managing geographic data, maps, and analytical models. Numerous online training and guided sessions were conducted by special request to assist users to utilize the LFTFCT.

✓ LF Map Library: National and Regional

Various stakeholders expressed a need for download ready LF maps to use in publications and presentations. In response, the program established LF map library containing maps that portray landscape scale vegetation disturbances, existing vegetation types, and fire behavior fuel models.

✓ LF Website: Comprehensive Redesign

website for the LF Program was maintained to serve as an information sharing tool, and draws increasing interest from the stakeholder and user community. In 2013, a comprehensive website redesign was placed in production status, utilizing contemporary content management and social media features not available in the original website launched in 2009.

✓ Conference Presentations

LF team members often participate in professional and scientific conferences where factors such as value to LF mission, stakeholder request or invitation, availability of staff, and event location provide for an opportunity to present the significant results being achieved by the LF program. A few examples of conference participation in FY 201 and 2013 are as follows:

- International Fire Congress in Portland, OR, December 2012,
- Tallgrass Prairie and Oak Fire Consortia, Dubuque, IA, January 2013
- 4th International Fire and Fuels Symposium, Raleigh NC, February 2013

■ **LF Program: Stakeholder Outreach and Technology Transfer**

Stakeholder Outreach

Outreach activities were accomplished primarily through two efforts conducted by program partners, including The Nature Conservancy (TNC) LF Project, and the National Interagency Fuels, Fire, and Vegetation Technology Transfer (NIFTT). Each program partner also provides direct technology transfer services and products to LF end users and stakeholders. Highlights of the outreach accomplishments during the period of the LF 2010 project effort are as follows:

National Interagency Fuels, Fire, and Vegetation Technology Transfer

The NIFTT organization released or significantly updated six modeling applications essential to support the work in wildland fire analysis, planning, management, and research.

- ✓ LFTFC, new release for ArcMap 10.1/10.2
- ✓ Wildland Fire Assessment Tool (WFAT) 2.40, new release for ArcMap 10.1/10.2
- ✓ Fire Regime Condition Class modeling tool (FRCCmt) 3.2.0, new release for ArcMap 10.1/10.2
- ✓ Multi-raster Classification Tool (MRCT)
- ✓ User downloads of various tools in CY 2012 and 2013 approximated 1,200 per year

NIFTT also delivered curricula for assessing Fire Behavior, Fire Effects, and Fire Regimes, through workshops, online courses, and other training mechanisms. New online courses and materials were developed for FRCC, FRCCmt, WFAT, LFTFCT, Predicting Vegetation Change, and working with LF Vegetation Dynamics Models.

Lastly, the NIFTT program managed the LF helpdesk function, gathering end user and general interest inquiries, conducting end user surveys, and coordinating with LF production teams to respond to helpdesk inquiries.

LF Technology Transfer Administered by The Nature Conservancy

The LF Program devotes significant focus to open communication with the stakeholder and user community. On behalf of LF, TNC leads this effort, and successfully accomplished this assignment in a variety of approaches, and co-leads and coordinates technology transfer with the NIFTT organization.

- ✓ Digital Outreach and Information Products LF Bulletin, LF Postcard, YouTube LF Channel, LF Twitter, Web Hosted Applications Map, and How-To-User Guides
- ✓ Collaboration in University and Conference Programs Initiatives including institutions such as Villanova, Michigan Tech, and Northern Arizona. And presentations of LF product and tool resources at significant landscape management and wild land fire events, such as Human Dimensions of Wildfire, Association for Fire Ecology, Society for Conservation GIS, and the 4th Fire/Fuels International Symposium
- ✓ How To Use LF Guides: Posted on the TNC Conservation Gateway, the guides present hands-on, step-by-step approach to help you learn how to review and modify vegetation models and spatial data for local conditions.
- ✓ Model Tracker Database: Developed the LF 200 Vegetation Departure layer for Hawaii, and created a national Model Tracker Database in Access format for user download from the LF website.
- ✓ Vegetation Tool Development and Support: Coordinated a stakeholder group to complete the enhancement of the vegetation-modeling platform (Path) to include both improved state-and-transition modeling and enhanced spatial functionality.

■ LF Program Governance

LF Program and LF 201 Project was initiated under the continuation of the original LF National project charter, and subsequently continued operation under revised program charter. Guidance of the

program was conducted primarily through business lead oversight, program management activities, and scientific and technical supervision. The Executive Oversight Committee that operated under the LF National charter was disbanded at the end of that project in 2009. Continuing forward, executive-level oversight is provided through the Director of the USDA FS – Fire and Aviation Management, the Director of the US DOI – Office of Wildland Fire. LF Business Leads guide program direction, and variety of program and project management roles. As an interagency project crossing administrative lines and organization structures, program members were organized in a matrix structure. A business leadership group was a central point of communication for the contributing organizations that fulfill LF Program operations.

Lessons Learned, Feedback, Next Steps

- **Success Factors and Outcomes**

Continued advancement in scientific methods and expanded access to input datasets has resulted since updates in the Rapid Refresh and LF 2001/2008 projects. The LF Program continues to support an increasing user base for legacy data, while also expanding special response, outreach, and technical transfer activities in the context of a diminishing budget environment. Nonetheless, the project duration and level of budget resources required to conduct a production update has been successfully reduced from previous efforts. Expectations and needs expressed by stakeholders for LF products continue to evolve. As such, continued rigor in program prioritization will be applied for both external and internal requests for products and services. In the 3 to 5 year planning horizon, a comprehensive remapping of the LF product suite is under consideration, also necessitating careful review or program priorities.

- **Opportunities and Challenges**

✓ Operations and Maintenance Growth (O&M)

Supporting current and legacy data products has become growing area being served by the LF Program. This operational aspect is being addressed through careful consideration of program prioritization, as well as investigating partnerships where external teams with interest and capability may contribute in developing selected LF data products

✓ Change Management

Including the aspect of O&M growth, other aspects of the LF Program are experiencing greater demands o the LF science and production team. The overall team of performance contractors and a small federal employee staff were allocated at full capacity with little availability for contingency or surge capacity. As such, when technical or external challenges were presented, immediate production activities were often affected directly, resulting in project timing of goals not being fulfilled. Acknowledging aspects of declining resource levels and growing external and internal requests has focused on reviewing change management across the LF program, with an objective of optimizing the alignment of program resources to highest-ranking program objectives.

✓ Internal Product Testing and Quality

With each LF data update cycle, there are numerous opportunities to apply improved data sources, process enhancements, and scientific methodologies. The application of these improvements can often affect resource and schedule factors. Enhancement of internal product testing and existing

quality assurance and quality control procedures was expected to reduce instances of product rework due to compatibility or syntactical problems uncovered in the production sequence.

- **Future Plans/Next Steps**

✓ LF 2012: Faster and Simpler

Changes will continue to affect vegetation across the landscape and as such the need to update LF data products resulting from disturbances such as wildland fire, fuel, and vegetation treatments, and management activities. Leadership and science members of the LF program are carefully reviewing the timing and content of LF product updates, as these data are applied increasingly in multiple application settings. Work will continue in the program to provide for operations and maintenance activities that support improvements, enhancements, updates, and innovations.

✓ Systematic Collection and Production

LF endeavors to provide an opportunity for data contributions and implemented an annual approach to collect input data sources such as Burned Area Reflectance Classification, Rapid Assessment of Vegetation Condition after Wildfire, Monitoring Trends in Burn Severity, etc., and expects to produce updated products o a recurrent basis (roughly every 13 to 2 months depending o the scope of the data product suite). The next update of the LF product suite, including CY 2012 landscape disturbance, is scheduled for completion in early calendar year 2015.

✓ Comprehensive LF Remap Under Evaluation

Comprehensive remapping of the complete geographic extent of the LF product layers using the most current available satellite imagery is presently under consideration and planning analysis is being conducted. Specific goals and objectives for one, three, and five-year planning cycles and accompanying performance measures are intended to support both the guidance and the refinement of the LF program mission. Albeit, these planning cycles will be subject to numerous external factors such as budgetary resources, stakeholder requirements and concerns, and the future progression of technology and data innovations.

USDA FS, Fire and Aviation Management and Fire Modeling Institute
LANDFIRE 2010 Summary Report

FTEs 2.0 Government staff; Variable Contracting Resources

Accomplishments Summary

1: Coordinated processing and delivery of refined and updated LF 201 vegetation products including:

- Existing vegetation products
- Vegetation transition products
- Potential vegetation products

2: Coordinated and implemented LF 2010 innovations oriented toward future versions data

- Fuel loadings classification and mapping
- Landscape change classification and mapping
- Increased collaboration with GAP, NVCS, and Rocky Mountain Research Station (RMRS) specialists
- Contributed to National Resources Conservation Service (NRCS) National Resources Inventory pilot project and final report

3. Continued development of LF methods and process documentation

- Website group modifications of the LF Website
- Continued summary and documentation of LF processes and products
- Continued user support pertaining to LF processes and products
- Validation analysis of forest canopy cover and stand height layers (landfire.gov)
- Helpdesk support and version upgrades for LF Data Access Tool

4. Acquired and processed field data supporting vegetation change analysis and fuel load mapping:

- New plot data through 2009 for the Pacific Northwest FIA region
- FIA Phase data for down woody material in the eastern US
- FIA plot data for the Pacific Islands, Puerto Rico, and US Virgin Islands
- Forest Service FACTS polygons and attribute data for 2011

5. Participated in development of production and delivery plan for the LF2012 effort, such items as:

- Vegetation-Transition Team AAR
- Revised product suite and attribution
- Production scheduling and staffing

6: Conferences / Presentations Posters

- December, 2012: Portland, Oregon: Association of Fire Ecology
- December, 2012: Baltimore, Maryland: Forest Inventory and Analysis Symposium, “Development and applications of the LF forest structure layers”
- February, 2013: Raleigh, North Carolina: International Association of Wildand Fire
- September, 2013: Sioux Falls, South Dakota: LF 201 Planning

U.S. Geological Survey Earth Resources Observation Systems
LANDFIRE 2010 Summary Report

FTEs 2.75 Government staff and variable contracting resources
Contractors Stinger Ghaffarian Technologies; ASRC InuTeq

Accomplishments Summary

1: Planning / Developmental Tasks Teams

Developmental Tasks Teams established in May 2011 to develop LF 2010 Update production processes. Teams established for the major production components: LANDFIRE (LF) Reference Database (LFRDB)/Events; Land Change/ Disturbance Mapping; Vegetation Mapping Improvements; Vegetation Transition; Wildland Fuels; Data Product Distribution; and Miscellaneous Activities, i.e. database management and User Guided Tools.

2: Refinement/Development Tasks

Refinements were identified and processes developed for each of the major production components.

3: LF 201 Update Production Activity

(A) Support LF process development and production of LF 2010 data products. Deliver updates to changed areas to bring mapped data products to currency as of 2010. (B) Develop and maintain the LFRDB and Events DB. (C) Conduct RSLC process time series data stacks using the MIICA algorithm, create final disturbance data products for 2008-09-10. (D) Incorporate refinements and develop Vegetation Transitions for production of vegetation products. (E) Incorporate refinements and develop Fuel Model assignments leading for the production of fuel products. (F) Product distribution through web services and direct distribution. (G) Support "user services" facilitating use of LF 2010 products.

4: Mapping of insular areas

US affiliated insular areas in the Pacific/Caribbean were mapped for the first time in LF 2010. Relevant areas were cross-walked to create common EVT legends for the Pacific, and separately for the Caribbean islands. Existing Vegetation Height (EVH) and Existing Vegetation Cover were mapped using airborne and spaceborne lidar data, Landsat imagery, and ALOS PALSAR radar data. Topographic layers created by combining National Elevation Dataset with additional data to fill gaps. Fuel layers were mapped using rule sets created with USDA-FS and other local vegetation and fuel experts.

5: Alaska EVH re-map

EVH in Alaska was re-mapped using airborne and spaceborne lidar data. Airborne lidar were used to develop slope correction parameters applied to the spaceborne lidar waveforms used as training sites to re-model forested EVH for Alaska delivered as a replacement for LF National/2001/2008/ forested EVH.

6: Workshops and Publications

Nelson, K.J., Connot, J., Peterson, B.E., and Picotte, J.J., 2013, LANDFIRE 2010—updated data to support wildfire and ecological management: Earthzine, http://www.earthzine.org/2013/09/15/landfire-2010-updated-data-to-support-wildfire-and-ecological-management/.

Presentations at the Association for Fire Ecology's (AFE) 5th International Fire Ecology and Management Congress, LANDFIRE Data Products and Methods special session in December 2010: LANDFIRE Reference Data, LANDFIRE 2010 Disturbance Mapping, and LANDFIRE Fuel Attributes Layer Development.

National Interagency Fuels, Fire, and Vegetation Technology Transfer
LANDFIRE 2010 Summary Report

FTEs 1.0 Government Staff and variable contracting resources
Contractors University of Idaho (Cost Reimbursable Agreement); SEM, LLC

Accomplishments Summary

1: Program Management

- Continued Cost Reimbursable Agreement between RMRS and University of Idaho;
- Added tasks to existing ID/IQ contract with SEM, LLC;
- Completed Deliverables for competitive-bid contract with SEM, LLC; and
- Continued transition into the Wildland Fire Management RD&A.

2: Develop Applications for Assessing Fire Behavior, Fire Effects, and Fire Regimes

- Released MRCT,
- Released new versions of WFAT 2.40, and FRCCmt 3.2.0 and Area Change Tool 3.2.0 to be compatible with ArcMap versions 10.1 and 10.2
- Tool Downloads for 2012/2013 approximately 1,200 per year

3: Develop Curricula for Assessing Fire Behavior, Fire Effects, and Fire Regimes

- Conducted four 3-day workshops o FRCC and the use of the Mapping Tool
- Managed student registration for eleven online courses
- Released new online courses and tutorials:
    - (FRCC
    - FRCCmt
    - WFAT
    - LFTFCT
    - Predicting Vegetation Change
    - Working with LANDFIRE (LF) Vegetation Dynamics Models
- Hosted materials for three National Wildfire Coordinating Group courses (S244, S491, S495)
- Taught multiple classroom workshops pertaining to WFAT and FRCC
- Distributed a questionnaire on field use and feedback of FRCC – received over 400 responses
- Completed learning pathway for vegetation dynamics
- NIFTT online courses received approximately 600 registrations in 2012/2013
- Began use of a Learning Management System – Moodle to host all NIFTT courses in the future

4: Provide User Support

- Managed Help Desk to respond to user's questions pertaining to LF data, NIFTT tools, and NIFTT courses
- The Help Desk responded to approximately 1,100 inquiries in 2012/2013
- Developing Fuels and Fire Planning Resource Portal to assist fuels managers in finding information
- Developed User Forum on www.niftt.gov website to assist with frequently asked questions and other discussion topics

The Nature Conservancy
LANDFIRE 2010 Summary Report

FTEs 4 FTEs
Contractors EcoSmartt, LLC; Axiom IT Solutions; Apex RMS, Ltd.

Accomplishments Summary

1: Co-Lead the LANDFIRE Technology Transfer and Outreach Program

The LANDFIRE (LF) Program is committed to open communication with the user community. TNC leads this effort, and successfully accomplished this assignment in a variety of ways. Examples include the LF Bulletin, LF Postcard, YouTube LF Channel, LF Twitter, Web Hosted Applications Map, and How-To-User Guides. We networked with academic institutions (Villanova, Michigan Tech, Northern Arizona, etc.), and presented at many professional meetings such as Human Dimensions of Wildfire, AFE, Society for Conservation GIS, and the 4th Fire/Fuels International Symposium. The TNC Team assisted in the development of both the Vegetation Modeling Learning Pathway and the online LF course, and collaborated with 9 Joint Fire Sciences Program Fire Consortia.

2: Applications Development and Applications Support

The TNC-LANDFIRE Team worked with a diverse set of current and potential users of LF Program products from the federal, state, and non-governmental realms. Some notable examples are: Cohesive Strategy, Forests Restoration Initiative, Grand Canyon Resource Assessment, Forest Stewardship Council, NRCS, TNC, USGS, Wayne National Forest, Hiawatha National Forest, Michigamme Highlands, Baraboo Hills, Eastern Washington Assessment, Uinkaret Landscape (Parashant), Upper Monument Creek,Collaborative Forest Landscape Restoration Program (CFLRP) Monitoring, Landscape Conservation Collaboratives, and many others.

3: Vegetation Tool Development and Support

The TNC-LANDFIRE Team coordinated a stakeholder group that successfully completed the enhancement of the vegetation-modeling platform (Path) to include both improved state-and-transition modeling and enhanced spatial functionality (ST-Sim).

4: Support LF Production Processes

TNC played an important role supporting product development and improvement. TNC coordinated LF Improvements Project #1, investigated Biophysical Settings grouping issues and recommended changes, and provided national fire regime attribute information to the Vegetation Team. TNC developed the LF2008 Vegetation Departure layer for Hawai'I, and created a national Model Tracker Database in Access format for user download. TNC collaborated o the LF 2010 Succession class process, and worked with the Fire Effects Information System (FEIS) to integrate LF model information into their online information framework. TNC is leading the Auto-Key Improvement project, and the Online Support Development Team.

5: Participate in LF Program Planning Activities

TNC accomplishments within this task were diverse, including participating in various business and technical calls and AARs. TNC leads the Product Quality Working Team, and coordinates the project management subcontract for LF. TNC reviewed numerous LF and related plans and reports (e.g. GeoArea Reports), and participated on the Website Working Group.