Program Business Plan

December 2014

REVISION HISTORY

Document Version #	Revision Date	Description of Change	Name
1.0-2014	06-13-2014	Removal of outdated information from 2008 business plan. Highlight content questions and outline new program business plan.	Oates and Zahn
1.1-2014	06-18-2014	Additional edits before distribution to LANDFIRE Business Leadership Group (BLG) for "first pass" review.	Oates
1.2-2014	July 2014	Comments and recommendations.	Bastian
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2.1-2014	09-30-2014	Update incorporating comments with added section on business benefit, and updates in sections 3.	Oates, Zahn, Bastian, Fay
2.2-2014	10-14-2014	Update including strategic data use examples, and updates in sections 3-4 and Appendix.	Oates
2.3-2014	10-24-2014	Update primarily in sections 4-5 and Executive Summary.	Oates, Zahn, Fay
2.4-2014	11-10-2014	Refinements throughout document incorporating comments.	Oates, Zahn, Fay, Hahn
3.0-2014	12-01-2014	Final comments and refinements incorporated throughout document.	Oates, Fay Bastian, Smith

APPLICABILITY AND LIFE OF THE PLAN

This program plan uses the best available information regarding current and future mission and stakeholder needs. The primary timeframe of focus is the immediate 5-year period from the beginning of 2015 to the beginning of 2020, along with consideration of forward looking program direction for the period 2020 through 2025. During this time period, program sponsors, along with agency and departmental leadership, will provide program oversight, direction, and adjustments as needed.

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EXECUTIVE SUMMARY

Introduction
The LANDFIRE Program Business plan outlines the vision, mission, and objectives of the program; relationship of the program to agency strategic direction and stakeholder needs and uses; organization of program components; and, program future direction.

Support To Mission
The LANDFIRE Program provides a common "all-lands" data set of vegetation, land cover and wildland fire and fuels information for strategic fire and natural resource management planning and analysis. LANDFIRE contributes to the Department of the Interior (DOI) and the U.S. Department of Agriculture (USDA) missions concerning natural resource management, conservation of wildlife and habitats, landscape understanding of resources, clean air and water, and wildland fire programs.

Benefits
The LANDFIRE Program has generated significant benefits accruing from the original LANDFIRE National Project since 2004. The total program lifecycle financial benefit to date is estimated at $92 million. Additionally, LANDFIRE Program products used by wildland fire and non-fire ecological programs provide numerous qualitative benefits.

LANDFIRE Organization
The LANDFIRE Program is comprised of four organizational components in a blended-matrix structure involving Business Leadership from the DOI and the USDA Forest Service; Agency Science Center Operations; and, Operational Partners.

- Operations: Program functions that do not include direct data production. These functions include website support, hardware and software systems, science and technical support, and management and administrative activities.

- Maintenance: Direct production of data products including version updating of existing products and new editions applying comprehensive product-wide mapping.

- Improvement and Innovation: Enhancement to current data production methods and advancement of new scientific methods and information sources.

- Governance: Common oversight of program activities, management of component functions, coordination with sponsors and stakeholders, program budgeting and maintaining the program business case.

Future Direction
Advances in science and technology, and evolving mission and stakeholder needs, will strongly influence the character of the future LANDFIRE Program. Accordingly, the program is studying prospective activities in anticipation of potential user requirements. Focus areas under evaluation include continuous multispectral change monitoring, fuels data that account for seasonal changes and changes in climate patterns, enhanced integration of land cover mapping programs, vegetation classification improvements, support of increased specialization in wildland fire applications, and continued improvement in production efficiencies.

1.0 Introduction

1.1 Purpose of Plan

The central focus of the LANDFIRE Program is to provide comprehensive maps and data describing vegetation, fire regimes, wildland fire and fuels characteristics across the United States and insular areas.

The primary purpose of this document is to internally define the following LANDFIRE organizational concepts: 1) the vision, mission, and objectives of the LANDFIRE Program, 2) the relationship of the LANDFIRE Program to agency strategic direction and to stakeholder needs and uses, 3) the organization of LANDFIRE Program components, and 4) future direction of the LANDFIRE Program. Lastly, the plan provides a summary business description to sponsor, partner, and stakeholder audiences.

1.2 Program Vision, Mission, Purpose

Vision

The vision is the future intended outcome and optimal desired future state of the program and provides guidance on what the LANDFIRE organization is focused on achieving.

> *LANDFIRE is a cornerstone of a fully integrated national data information framework developing and improving vegetation and fuels data products based on the best available authoritative data and science in an all-lands landscape conservation approach based on inter-agency/inter-organizational collaboration and cooperation. LANDFIRE is acknowledged for management excellence and effective mission delivery.*

Mission

The LANDFIRE mission defines the state and purpose of the program by addressing the "who and what" that benefit from LANDFIRE Program products and services.

> *LANDFIRE's mission is to provide agency leaders and managers with a common "all-lands" data set of vegetation and wildland fire/fuels information for strategic fire and resource management planning and analysis.*

Purpose

LANDFIRE focuses effort in four aspects to realize its vision and mission objectives.

- Provide national-level comprehensive and consistent strategic geospatial data products and databases to support wildland fire and natural resource management, planning, research, analysis, and assessment;

- Produce repeatable, identifiable, mappable, and scalable data products;

- Supplement and assist modelling of fire behavior and effects; and,

- Improve collaboration between programs, data, and agencies for holistic wildland fire and natural resource management.

1.3 Program Overview

General Description

LANDFIRE (Landscape Fire and Resource Management Planning Tools) is a joint program between the U.S. Department of Agriculture (USDA) Forest Service (USFS) and the Department of the Interior (DOI), with The Nature Conservancy (TNC). LANDFIRE applies consistent methodologies and processes to develop comprehensive maps and data describing vegetation, disturbances, fire regimes, and wildland fuels across the United States and insular areas.

LANDFIRE was initiated in 2004 as a formal project to develop wildland fuel, fire regime, ecological characteristics, and vegetation data products. This type of integrated geospatial vegetation, fuel, and fire regime data suite had never existed previously across the U.S. geographic extent, either in the public or private sector. Also, no previous efforts at this scale had attempted to update wildland fuel and fire regime conditions due to vegetation changes or other disturbances caused by wildland fire, vegetation and fuel management activities, and plant growth.

From a strategic view, LANDFIRE data products are used in national, regional, and landscape-level fire, fuel, and natural resource planning, and reporting of management activities by land and fire managers, planners, scientists, and policy makers. Moreover, LANDFIRE data products are used for strategic analysis and planning to support the national prioritization of fire and fuel management and vegetation and habitat management resources. LANDFIRE data are applied in assessment of wildland fire threats and management of complex natural resource issues.

In a tactical perspective, LANDFIRE data supports land managers in their decisions to help locate fire hazards and risks to communities and important values. These data are used to prioritize where and evaluate how to restore fire-dependent landscapes while managing for natural resources, such as wildlife habitats and watersheds. LANDFIRE data have become critical in use on small to large wildfires for predictions of fire behavior and effects used to support decisions and inform firefighters of safety issues.

With regard to natural resource management, LANDFIRE data products provide an informational foundation to support applications in land management planning, environmental analyses, biological evaluations, and resource assessments. LANDFIRE data has also been used to identify areas of value such as threatened and endangered species, energy development, and other values at risk across the landscape. Use of LANDFIRE data can also be found in research projects that focus on influences related to landscape change, climate change, and carbon sequestration.

Program Timeline

Initial investigations and research regarding a national scale dataset utilizing consistent methodologies and peer-reviewed science were initiated at a coarse-scale resolution in the late 1990s. Findings from these analyses indicated national issues of increasing fire and fuel hazards, high departures in fire regimes, indications of poor land health, and lack of ecosystem resilience and sustainability. These indications supported decisions at the national level to explore moderate scale 30-meter data and research that began in earnest in 2002. Catastrophic wildfires starting in the late 1980s through the 1990s in the west and then experienced across the U.S. in 2000 and subsequent years, added additional urgency for advancement in tools and information to assist in wildland fire and fuel management policy and implementation. With the support of the President and Congress, the National Fire Plan and the 10-Year Comprehensive Strategy were produced, resulting in strategic direction and funding that supported the initiation of the LANDFIRE project. In addition, the Healthy Forests Restoration Act of 2003 raised many of the same issues that required the same type and quality of LANDFIRE data.

The 2004 charter for the LANDFIRE National Project did not specifically address the sustainment and improvement of the suite of LANDFIRE data products other than the formulation of an operations and maintenance (O&M) handoff plan after its conclusion in 2009. The handoff plan outlined a strategy for consistent and sustained operations under a program structure. LANDFIRE transitioned to a program of operations in 2010.

The first LANDFIRE product suite was completed in 2009 in parallel paths with the Prototype, Rapid Assessment, and Rapid Refresh projects. National circa(c) 2001 data is still used in some analyses to inform future program efforts. Two comprehensive updates to the first product suite have been completed to date, with a third update in progress. A chronology of LANDFIRE Program activities is depicted in Figure 1.
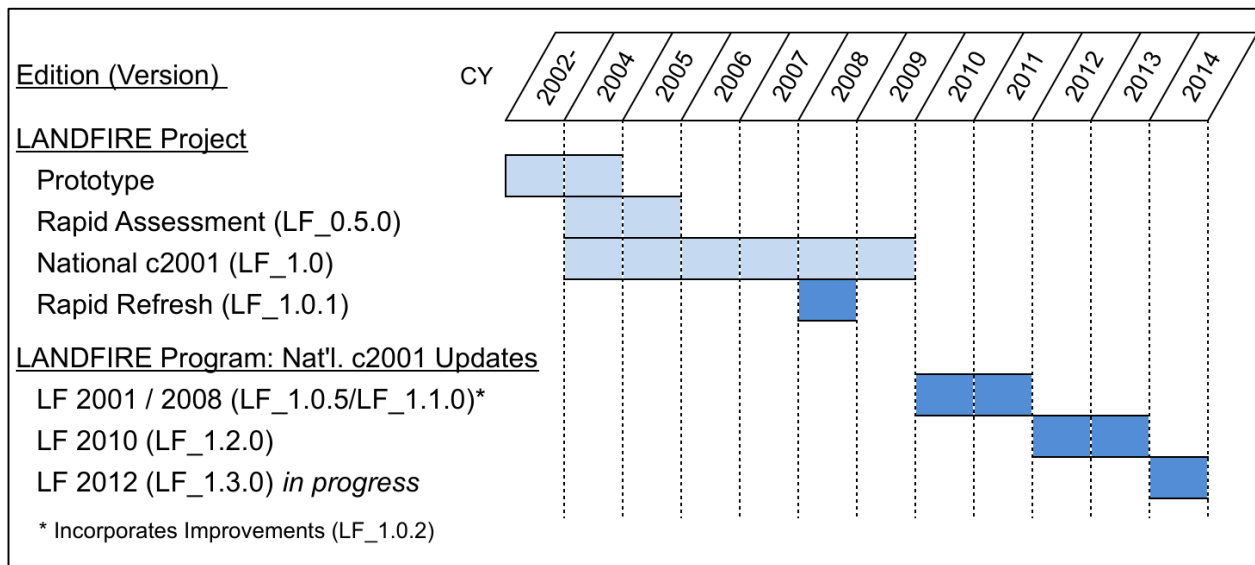

Figure 1. LANDFIRE Program Chronology

Programs that use LANDFIRE Data

An expanding and diverse range of organizations use LANDFIRE data, while the LANDFIRE Program improves and broadens its product suite and supporting functions. TNC tracks many of the initiatives that use LANDFIRE data on the TNC Conservation Gateway website. (www.conservationgateway.org) Other examples of data use are provided on the official LANDFIRE Program website. (www.landfire.gov)

Notably, many strategic-level programs use LANDFIRE data as an information base to inform policy and operational decisions that are implemented through sub-programs and enabling technology systems. The most visible strategic-level programs that use LANDFIRE data are summarized in Table 1. Brackets denote programs that have or will convert to an improved or new effort [Legacy], or programs that are in a developmental stage transitioning to be operational [In Process]. Use case descriptions of how multiple initiatives apply LANDFIRE data are provided in the Appendices.

- **Wildland Fire Management**

  The National Cohesive Strategy
- **Wildland Fire Budgeting**
  - [Legacy] Fire Program Analysis (FPA)
  - [In Process] Wildland Fire Investment Planning System (WFIPS)
- **Fire and Fuels Program**
  - [In Process] Risk-Based Wildland Fire Management
  - Interagency Fuels Treatment Decision Support System (IFTDSS)
- **Preparedness and Suppression Programs**
  - [Legacy] Wildland Fire Situation Analysis (WFSA), Wildland Fire Implementation Plan (WFIP) and Long Term Implementation Plan (LTIP)
  - Wildland Fire Decision Support System (WFDSS)
- **Natural Resource Management**
  - Ecoregional Assessments
  - Land Use and Land Cover Change

Table 1. Strategic Program Areas that use LANDFIRE Program products

2.0 Support to Mission

The LANDFIRE Program provides tangible contributions to support mission objectives of the DOI and the USDA. LANDFIRE is linked to agency activities within each department, and to crosscutting goals or multi-agency initiatives that contribute toward coordinated mission objectives. This section highlights the mission areas across departments, agencies, and other organizations supported by LANDFIRE products and services, as well as legislation that guide the direction of the LANDFIRE Program.

2.1 Department Mission Areas

Department of the Interior

The DOI Strategic Plan for Fiscal Year (FY) 2014-2018 presents strategic priorities in six mission areas that capture responsibilities administered by 10 bureaus and multiple offices. DOI mission areas, goals and strategies (Table 2.) are supported by LANDFIRE products in bureaus and offices involved in natural resource protection, conservation of wildlife and habitats, landscape-level understanding of resources, and management of wildland fire programs.

DOI Mission Area	Goal	Strategies
[1] Celebrating and Enhancing America's Great Outdoors	1. Protect America's Landscapes	• Improve land and water health by managing wetlands, uplands, and riparian areas • Sustain fish, wildlife, and plant species • Manage wildland fire for landscape resiliency, strengthen the ability of communities to protect against fire, and provide for public and firefighter safety in wildfire response
[3] Powering Our Future and Responsible Use of the Nation's Resources	2. Sustainably Manage Timber, Forage, and Non-Energy Minerals	• Manage timber and forest product resources • Provide for sustainable forage and grazing • Manage non-energy mineral development
[6] Building a Landscape-Level Understanding of our Resources	1. Provide Shared Landscape-level Management and Planning Tools 2. Provide Science to Understand, Model, and Predict Ecosystem, Climate, and Land Use Changes at Targeted and Landscape Levels 3. Provide Scientific Data to Protect, Instruct, and Inform Communities 4. Provide Water and Land Data to Customers	• Ensure the use of landscape-level capabilities and mitigation actions • Identify and predict ecosystem changes at targeted and landscape-levels (biota, land cover, and Earth and ocean systems) • Assess and forecast climate change and its effects • Monitor and assess natural hazard risk and resilience • Provide environmental health to guide decision-making

Table 2. DOI Mission, Goal, and Strategies supported by LANDFIRE Program

U.S. Department of Agriculture

The USDA Strategic Plan for Fiscal Year (FY) 2014-2018 presents five strategic goal areas that capture responsibilities administered by 17 agencies and multiple offices. LANDFIRE products are utilized to support USDA goal areas, objectives and strategies (Table 3.), including promoting clean air, water, and wildlife habitat in national forests and private working lands, and enhancing workplace efficiency for USDA employees.

USDA Goal Area	Objective	Strategies
[2] Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources	2.1. Improve the health of the Nation's forests, grasslands and working lands by managing our natural resources	• Improve land and water health by managing wetlands, uplands, and riparian areas • Sustain fish, wildlife, and plant species • Manage wildland fire for landscape resiliency, strengthen the ability of communities to protect against fire, and provide for public and firefighter safety in wildfire response
	2.2. Lead Efforts to mitigate and adapt to climate change, drought, and extreme weather in agriculture and forestry	• Introduction of seven "Regional Climate Hubs" to deliver science-based knowledge and practical information to farmers, ranchers and forest landowners to support decision-making related to climate change
	2.4. Reduce risk of catastrophic wildfire	• Coordination with the DOI, other Federal agencies, Tribal and State governments and local law enforcement and emergency preparedness staff on prevention, preparedness, and response • Partnership with communities to assess risks and develop, implement, and update Community Wildfire Protection Plans and improve local wildfire suppression capability and coordination
[5] Create a USDA for the 21st century that is high performing, efficient, and adaptable	5.2. Build a safe, secure, and efficient workplace by leveraging technology and shared solutions across organizational boundaries	• Improve the effectiveness of its employees through the increased implementation of technology solutions and workplace enhancements

Table 3. USDA Mission, Objective, and Strategies supported by LANDFIRE Program

2.2 National Cohesive Strategy

A significant initiative supported by the LANDFIRE program, is the National Cohesive Wildland Fire Management Strategy ("Cohesive Strategy"), a crosscutting effort to achieve effective wildland fire and fuel management among the USDA, DOI, tribal governments, regional and community partners, and other interested parties.

The Cohesive Strategy implements a three-phased, intergovernmental planning and analysis process involving stakeholders and the public. This results in a dynamic National Strategy with a companion National Action Plan. The Cohesive Strategy fundamentally addresses the broad wildland fire management challenges including: managing vegetation and fuels; communities, and other values at risk; managing human-caused ignitions; and effectively and efficiently responding to suppress unwanted wildland fire (wildfire). Three primary national goals are the cornerstone of the Cohesive Strategy.

- *Restore and maintain landscapes: Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives;*
- *Fire-adapted communities: Human populations and infrastructure can withstand a wildfire without loss of life and property; and,*
- *Wildfire response: All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.*

The Cohesive Strategy, initiated in 2010 and completed in 2014, reflects a multi-agency initiative by supporting the mission area strategies of the DOI and the USFS. Numerous spatial data layers and tabular data products produced by the LANDFIRE Program have been used to support the Cohesive Strategy analysis process. In particular, in the role of vegetation and fuels in "restoring and maintaining landscapes," LANDFIRE data was used to develop the eleven landscape classes to inform management options across the conterminous United States.

2.3 Climate Change Adaptation and Carbon Management

The DOI and the USDA maintain plans that identify climate change and carbon management as major challenges that affect missions in each department. The DOI and the USDA are collaborating with partners to enhance scientific understanding, including integrating various datasets and information sources to better inform decision makers for both climate and carbon efforts.

An area of notable progress that has benefitted from the use of LANDFIRE data is the ongoing partnerships by Climate Science Centers and Landscape Conservation Cooperatives (LCCs) with the DOI, USDA, and other agencies. The results from these partnerships include practical, landscape-level strategies for managing climate-change impacts and carbon management across the United States. LANDFIRE data support research and monitoring initiatives in developing strategies for managing, restoring, and monitoring of carbon cycles and climate change effects on ecosystems. These strategy

frameworks assist land managers in improved forest sustainability, reduced carbon footprints, and climate change vulnerability assessments.

2.4 Legislation and Authoritative Recommendations

FLAME Act

The principal federal legislation influencing the LANDFIRE Program is the Federal Land Assistance, Management, and Enhancement Act of 2009 (FLAME Act). On October 29, 2009, the House and the Senate passed the Interior, Environment, and Related Agencies Appropriations Act, 2010, which included Title V – The FLAME Act of 2009. A key provision of The FLAME Act mandated the development of a national cohesive wildland fire management strategy to comprehensively address wildland fire management across all lands in the United States. Seven elements outlined in the FLAME Act are encompassed in the cohesive wildfire management strategy.

1. *The identification of the most cost effective means for allocating fire management budget resources;*

2. *The reinvestment in non-fire programs by the Secretary of the Interior and the Secretary of Agriculture;*

3. *Employing the appropriate management response to wildfires;*

4. *Assessing the level of risk to communities;*

5. *The allocation of hazardous fuels reduction funds based on the priority of hazardous fuels reduction projects;*

6. *Assessing the impacts of climate change on the frequency and severity of wildfire; and,*

7. *Studying the effects of invasive species on wildfire risk.*

Authoritative Recommendations

The Government Accountability Office (GAO) conducts program reviews across the federal government, focusing on management performance and opportunities for improvement within and across departments and agencies. Congress typically requests these reviews and the results may substantially affect policies, management, and funding. GAO reports that focused on Wildland fire Management, have relevance to producing data like LANDFIRE to support Wildland Fire Management efforts. Some of the reports with significant reference to the LANDFIRE Program are listed below.

- Wildland Fires: FS and BLM Need Better Information and a Systematic Approach for Assessing the Risks of Environmental Effects, June 2004, GAO-04-705.

- Wildland Fire Management: Progress Has Been Made, but Challenges Remain to Completing a Cohesive Strategy, January 2005, GAO-05-147.

- Wildland Fire Management: Federal Agencies Have Taken Important Steps Forward, but Additional, Strategic Action Is Needed to Capitalize on Those Steps, September, 2009, GAO-09-877.

2.5 Partners

Support to mission and accomplishment of objectives is distinctly connected to departmental and agency strategic initiatives. The LANDFIRE Program was designed and implemented to support these initiatives as well as the mission objectives of partners and stakeholders. Frequently the mission concerns of partners and stakeholders are complementary. The partnership between the wildland fire management programs at the USFS and the DOI (Fire and Aviation Management (FAM) and Office of Wildland Fire (OWF), respectively) has been one of the greatest strengths facilitating cross department coordination along with executive awareness and sponsor guidance. This section touches upon specific partner initiatives that support the LANDFIRE Program.

Mapping Partnerships

LANDFIRE benefits from partnerships with constituent programs that share similar ecologically based mapping themes and data elements that focus on vegetation and land cover data. Partnerships that promote coordinated development of mapped data products provide increased benefits and return on investment. The primary mapping partnership involves the United States Geological Survey (USGS) Gap Analysis Program (GAP). The second partnership involves the USGS National Land Cover Database (NLCD) via the Multi-Resolution Land Characteristics Consortium (MRLC).

Production Partnerships

The USGS Earth Resources Observation and Science (EROS) Center is the core operational facility supporting LANDFIRE activities. The EROS Center conducts data production, operations and other support functions in coordination with the USFS Rocky Mountain Research Station (RMRS). The RMRS also organizes activities with the USFS Fire Modeling Institute (FMI) and the USFS Forest Inventory Analysis (FIA) program. The Wildland Fire Management Research, Development and Application (WFM RD&A) Team, and TNC LANDFIRE team, have been the primary organizations conducting LANDFIRE Technical Transfer and Outreach functions.

Data Partnerships

An important element in LANDFIRE product development is the contribution of data from partners, stakeholders, and users. Partnership data sources are essential where information in certain regions is limited and there are challenges in obtaining field data. A highly beneficial partnership is in place with the USFS Forest Inventory and Analysis (FIA) program, providing data on status and trends in forest conditions. The Landsat Program is the partner that provides earth satellite imagery to the LANDFIRE Program. A partnership in development involves the USDA Natural Resources Conservation Service (NRCS) to explore the integration of the National Resources Inventory (NRI) data to benefit LANDFIRE data products.

3.0 Benefits

This section reviews the costs and benefits of the LANDFIRE Program with an assessment of operations following the conclusion of the original National project. In short, the program continues to deliver upon the central goal of the LANDFIRE National project.

> *The national implementation of LANDFIRE will develop maps and digital geospatial data of vegetation characteristics and condition, fire behavior and effects, fuel models, historical fire regimes and fire regime condition class at the landscape scale.*

The basis of the LANDFIRE Project need statement continues to be relevant in the current program context "*as the only consistent one-source dataset available on a regional and national scale for use by land management agencies in planning and management activities.*" Alternative datasets are available with current fire and fuel data. However, these datasets are developed locally, most with limited extents and varying methods and requirements. It remains challenging to apply localized alternative data to consistently and reliability support regional and national scale applications.

3.1 Cost Profile

The LANDFIRE National project required $43.3 million to complete the 6-year effort, supporting data production and operation components. Since the original project, two update projects have been completed to enhance products and reflect contemporary landscape conditions. Figure 2., displays the annual fiscal year (FY) costs of the LANDFIRE Program through 2013.
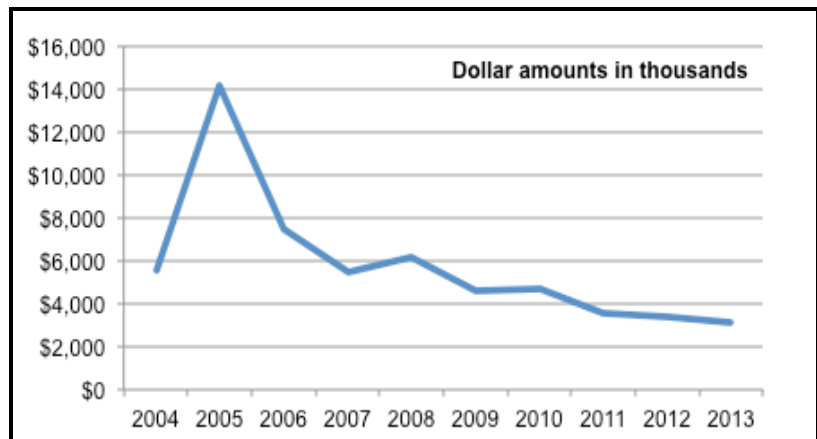

Figure 2. LANDFIRE Program Investment

The lifecycle investment in the LANDFIRE Program through the conclusion of the LANDFIRE 2010 project is approximately $58 million. The majority of the lifecycle cost was devoted to the original LANDFIRE National project. Considering program costs in a landscape context, the extent of LANDFIRE data coverage is depicted in cost per acre for the National project and the two completed update projects. (Table 4.) The program cost equates to 1.8 cents/acre for the National project. Moving forward, program costs have been considerably reduced for the updating projects (2001/2008 and 2010) equating to approximately 0.3 cents/acre.

3.2 Benefit Profile

A comprehensive benefit-cost analysis was developed and validated at the initiation of the LANDFIRE National project. The original business case analysis projected a minimum annual quantified financial net benefit of $18.5 million, based on statistical historical fire activity and fire suppression costs recorded by the National Interagency Fire Center (NIFC). Applying the original analysis to the program lifecycle through FY 2013 results in an estimated financial benefit of $92.5 million. This estimate does not reflect the financial benefits that have

LANDFIRE Project Segment	Cost Millions	Cost/ Acre
National	$43.30	$0.0184
2001/2008	$7.80	$0.0033
2010	$6.90	$0.0029
The LANDFIRE geographic coverage extent totals approximately 952 million hectares across the conterminous U.S., Alaska, Hawai'i and territories.		

Table 4. Cost Per Acre Estimates

accrued to non-fire applications that use LANDFIRE data. The following case examples demonstrate both financial and non-quantitative benefits to wildland fire programs through the use of LANDFIRE data.

- The 2005 Dammeron and Valley Road fires in Utah and Idaho

  LANDFIRE fire behavior fuels data were used to predict fire progression and estimate fire spread probability. The incident managers of these fires estimate that approximately $8 million savings resulted from modified tactical decisions due to informed fire progression and spread predictions using LANDFIRE data.

- The 2007 Tin Cup Fire in Western Montana

  Fire managers developed a Wildland Fire Situation Analysis (WFSA) to help coordinate fire strategies for the entire area. The situation indicated a more comprehensive strategy was needed, which triggered decision-making involving the Chief of the Forest Service. A situation analysis of this scale had not been produced before in the continental U.S. and would have been impossible to create without the consistent coverage provided by LANDFIRE data.

- Wildland Fire Potential Map

  The 2012 map of wildland fire potential (WFP) produced by the USDA FS FMI depicts the relative potential for wildfires that would be difficult to suppress. The WFP map was based on past fire occurrence, 2008 fuels data from LANDFIRE, and other data, which supports national analyses and planning efforts resulting in many non-quantifiable benefits.

Selected case summaries of cross-organization and regional area qualitative benefits derived from the use of LANDFIRE data are provided in Table 5.

Benefits Across Interagency and Stakeholder Partners

- Improved working relationships between scientists, managers and the public. [Enables: Community Wildfire Protection Plans, Fire Management Plans, etc.]

- Increased scientific capacity for modeling public and private land and fire management planning alternatives. [Enables: Cohesive Strategy, State and Regional Risk Assessments, etc.]

- Integration of LANDFIRE data and models to support planning, lessons learned, and decision support. [Enables: Wildland Fire Decision Support System, Interagency Fuel Treatment Decision Support System, etc.]

- Increased public support of fire management decisions through engagement of partners in development of models and data. [Enables: Landscape Cooperatives]

- Consistent, relevant, and efficient vegetation condition data [Enables: Ecological and Eco-Regional Assessments]

Regional Benefit Examples

- *California: Bodie Hills Landscape Conservation Forecasting (LCF)*

  In 2007, the BLM Bishop Field Office in cooperative agreement with TNC developed a conservation action plan using LCF™ methods. Approximately 200,000 acres are in the study area. LANDFIRE data and models were used to compare current vegetation departure with reference conditions.

- *Hawai'i: Assessment & Strategy*

  The Hawai'i Department of Forestry and Wildlife developed a Statewide Assessment of Forest Conditions and Resource Strategy in 2010 using LANDFIRE data sets. Trends, existing conditions, threats and benefits for forests and treed landscapes were characterized.

- *Idaho: Payette National Forest Bighorn Sheep Viability Analysis*

  In 2005, the Payette National Forest (PNF) completed an assessment and plan to maintain habitat for bighorn sheep. LANDFIRE existing vegetation type and canopy cover data provided the spatial extent and scale to complete the analysis of the Hell's Canyon and the PNF areas.

- *Western North America: Sage-Grouse Habitat Analysis*

  In 2009, LANDFIRE data products were used to support a broader analysis and study evaluating the ecology and conservation interactions. The analysis of spatial patterns in sage-grouse populations can be incorporated into range-wide and regional conservation strategies.

Table 5. LANDFIRE Qualitative Benefit Case Summaries

4.0 LANDFIRE Organization

This section describes the organization of core LANDFIRE components: Operations; Maintenance; Improvement and Innovation; and Governance. LANDFIRE is a blended-matrix program involving the following organizations (Figure 3):

- Program Sponsors: Business Leads from the DOI and the USFS
- Science Centers: Teams at the USGS EROS Center and the USFS RMRS
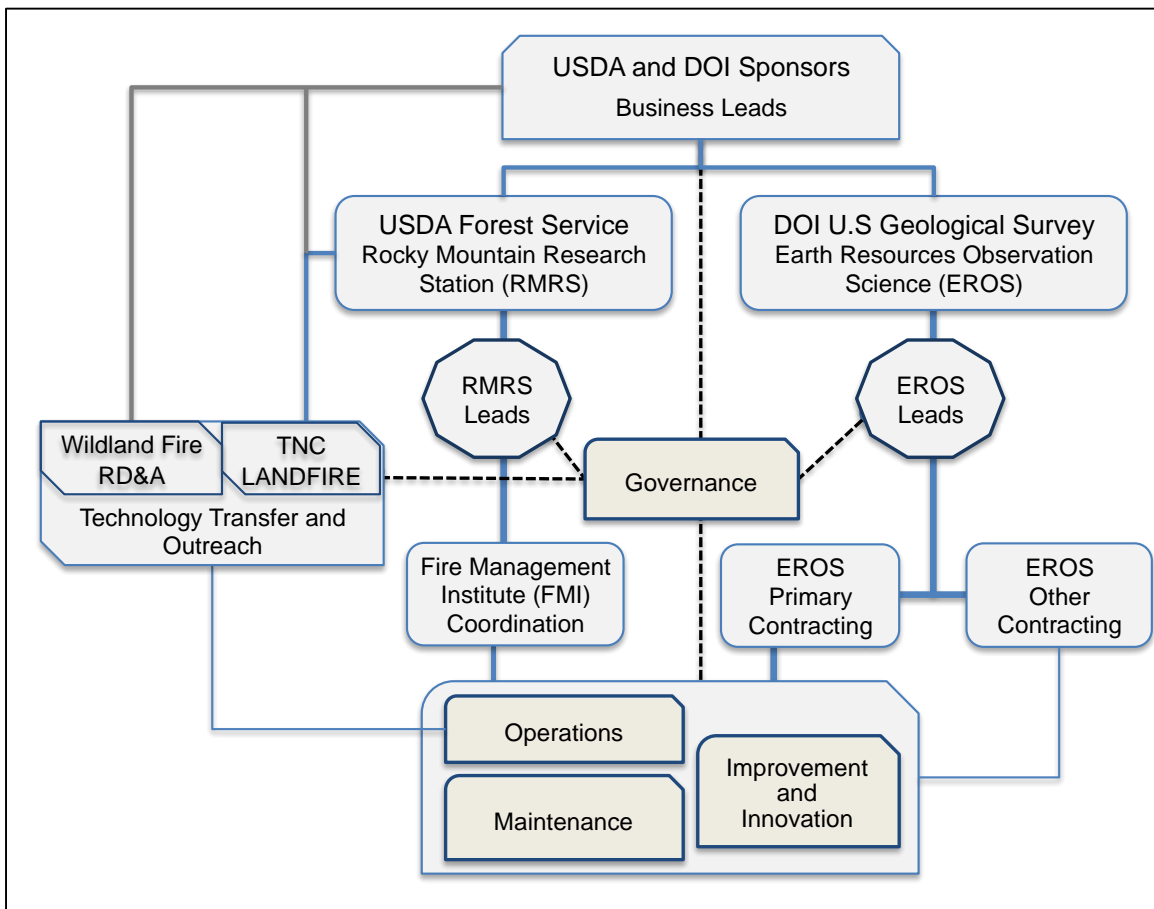- Operational Partners: Teams at TNC LANDFIRE and WFM RD&A

Figure 3. LANDFIRE Organization Components

4.1 Operations

Operations are a critical LANDFIRE Program component including all functional activities supporting the delivery of LANDFIRE Program products, and activities that are not involved in product development (Maintenance)[1]. Operations includes two main functions: 1) Science Center Operations, and 2) Technology Transfer and Outreach.

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[1] The Operations component and the Maintenance component include distinct activities. These components are not synonymous with "operations and maintenance" in hardware and software systems.

4.1.1 Science Center Operations

The EROS center is the primary operational facility supporting the LANDFIRE Program, staffed by federal agency and contracting teams. The primary function of LANDFIRE Program Operations is to ensure the consistent and reliable delivery of LANDFIRE data products. The EROS team conducts technical, administrative, science, and user support activities, enabling a stable production environment.

The RMRS also supports LANDFIRE Program Operations, primarily focusing on science methodology and user support functions. The EROS and RMRS teams closely coordinate the collective operations activities. The following activities are categories of functional operations conducted by the EROS and RMRS facilities.

Website Development and Maintenance

- Design, new functionality and content updates to the LANDFIRE Program website.

- Maintenance activities ensure reliable and secure operation of the program website and compliance with federal, departmental and agency standards.

Data Archival Services

- The LANDFIRE Program provides access to product suites through a data distribution site (DDS) for data selection and file downloads; a data access tool to facilitate data use in geographic information system (GIS) software; and, web services to support machine-readable access to LANDFIRE data products.

- Data support services provide four active versions of LANDFIRE data, and respond to special requests for archival versions of LANDFIRE Program products.

Data Standards and Documentation

- LANDFIRE data are maintained to comply with pertinent standards of the Federal Geographic Data Committee (FGDC) and the National Wildfire Coordinating Group (NWCG), and GIS specifications issued by the Environmental Systems Research Institute (ESRI).

- Comprehensive documentation for the content of LANDFIRE data is provided in the Data Products section of the LANDFIRE Program website. Information is also provided regarding Data Alerts and Data Notifications.

Technical and System Infrastructure

- Comprehensive information security, disaster recovery, business resumption, and business continuity services.

- Planning and implementation for data archival services, software and hardware maintenance and replacement.

Management and Administration

A core team of science and technical professionals supporting the LANDFIRE Program is based at the EROS center. A second team of professionals is based at the RMRS facility. Management and administration functions support the federal and contracted teams based at both locations. These functions include procurement, performance management, staff development, and compliance with facility requirements.

User Support

- Support to LANDFIRE data users provides technical and scientific assistance in the application, troubleshooting, and interpretation of LANDFIRE data.

- TNC-LANDFIRE team provides a wide range of support services including response to user inquiries to outreach, training and communication activity. (See section 4.1.2)

- EROS and RMRS teams often assist the technology transfer teams in supporting LANDFIRE users, as well as serving as the primary technical support for customer inquiries submitted through the LANDFIRE Help Desk.

- The LANDFIRE science and technical teams are the primary authorities for internal analysis and interpretation of the LANDFIRE products.

- External requests for customized reporting, analysis or modeling of select LANDFIRE data products requires support from technical and science teams. The requests often involve strategic-level planning and decision-making.

4.1.2 Technology Transfer and Outreach

The LANDFIRE Program conducts technology transfer and outreach to support end users in achieving the most benefit from LANDFIRE data products. This includes providing instruction regarding the use of LANDFIRE data, maintaining toolsets to apply LANDFIRE data, offering general helpdesk support, and conducting outreach to expand awareness regarding the overall efforts of the LANDFIRE Program. The TNC-LANDFIRE team supported by previous contributions by WFM RD&A team have administered the Technology Transfer and Outreach program component.

Technology Transfer

Overall, the LANDFIRE Program technology transfer effort is a collection of activities to support users in applying LANDFIRE data to best support the users' specific business needs. This includes providing educational materials, providing assistance in the application of LANDFIRE products, developing and maintaining toolsets to apply LANDFIRE data, and providing technical support through the help desk service.

- *Education*

  Educational offerings consist of both reference and self-help materials as well as course-based instruction. An expansive library of education materials for LANDFIRE Program products is provided via Internet-based frequently asked questions, tutorials, and how-to user guides. Additionally, there is a catalogue of on-site and

virtual courses that focus on the toolsets, platforms, and customizing data sets in applying the full range of the LANDFIRE product suite.

- *Applications*

  The LANDFIRE Program works with a diverse set of current and potential users of LANDFIRE products from the federal, state, and non-governmental realms to assist in applying LANDFIRE data. This involves assistance to user groups in the planning, design or implementations using LANDFIRE products.

- *Toolsets*

  Development and maintenance of toolsets is an important technology transfer element to assist users in applying LANDFIRE data. The focus on toolsets includes support of existing tools and the enhancement of evolving tools and platforms. Support is provided for vegetation modelling platforms and tools, database extensions that complement core LANDFIRE data products, and toolsets for Assessing Fire Behavior, Fire Effects, and Fire Regimes.

- *User Support*

  LANDFIRE products can involve complexity that requires direct user assistance. The LANDFIRE Program responds to this need through a help desk service, where questions are collected via a web-based form and referred to LANDFIRE technical staff. Other support resources include a web-based user forum and a resource portal. Ongoing development of an online support system will integrate the help desk services and enhance information about LANDFIRE Program products.

Outreach

The LANDFIRE Program implements outreach activities to foster resilient connections with the user community. Outreach activities improve general awareness regarding the content and uses of LANDFIRE products. Communications channels include periodic user teleconferences, bulletins and email notices describing LANDFIRE activities. More recently, outreach efforts have expanded through Internet-based social media channels, including YouTube and Twitter.

Other elements in outreach include participation in networks with academic institutions and science consortia, and conducting presentations at selected professional meetings and conferences. Additionally, web-based print media and interactive maps promote increased awareness of how LANDFIRE data is used to address landscape, wildlife, or other natural resources management challenges.

4.2 Maintenance

The Maintenance component of the LANDFIRE Program produces both spatial and non-spatial data products. The maintenance component is focused toward two production areas: 1) Updating existing editions of LANDFIRE Program products, and 2) Mapping new editions of LANDFIRE Program products. The production cycle under

consideration for Updating and Mapping projects through the calendar year (CY) 2020 is portrayed in Figure 4.

Edition / Version	CY	2015	2016	2017	2018	2019	2020
LF 1.0 Updating			Ver 1.4				
LF 2.0 Mapping		Ver 2.0					
LF 2.0 Updating						Ver 2.1	Ver 2.2

Figure 4. Anticipated LANDFIRE Production Roadmap

4.2.1 Updating

The LANDFIRE Program focuses on updates to a base edition product suite, presently LANDFIRE National c2001 (LF 1.0.0). Updates focus on landscape changes to vegetation and fuels resulting from disturbance and treatment activities such as wildland fire, fuel and vegetation treatments, mortality from insects and disease, storm damage, invasive plants, and other natural or anthropogenic events. Other aspects of updating include vegetation successional change in forested types, revisions to address discrepancies between map products and known field conditions, and specific systematic improvements to the original data.

Approach

The LANDFIRE Program applies a consistent approach to product updating utilizing change detection methods with airborne or satellite imagery to detect and characterize landscape disturbances. Updating projects employ assorted processes and multiple sources of disturbance and change information to build a convergence of evidence from a composite of data sources. This information is used to supplement imagery-based change detection techniques. The periodicity of update projects generally requires an 18 to 24-month cycle. However, recent advances in scientific methodology, data sources, and scoping refinement is expected to enable more frequent product updates. Updates are applied to a current product suite of data layers, relational databases, models and other datasets grouped in six thematic areas, as summarized in Table 6.

Updating Versus Mapping

Updating projects (version updates) are conducted within the design boundaries of the current base product, LANDFIRE National c2001 (LF 1.0.0). New information is applied to the base product where areas of change or opportunities for improvement are identified. However, the basic design, original imagery, and core production techniques serve as the technical boundary to conduct updating efforts. The primary benefit of updating projects is the frequency of revision to reflect recent landscape changes and newly available data.

Mapping projects (new edition or remapped products), result in a new base data suite. In general, this includes mapping the complete geographic extent ("wall-to-wall") using current satellite imagery. The primary benefit of mapping projects versus updating projects is the opportunity to use the most current data sources, methods, protocols, and technology without the constraints involved with updating a legacy data suite. Mapping projects do involve greater complexity, duration and resource needs as compared to updating projects.

Reference	
• Reference Database (plot data)	• Events Database (polygon data)
• Forest Vegetation Simulator Ready Database	
Disturbance	
• Vegetation Disturbance	• Fuel Disturbance
• Vegetation Transition Databases	• Vegetation Transition Magnitude
• Forest Vegetation Simulator Disturbance Database	
Vegetation	
• Existing Vegetation Type	• Existing Vegetation Cover
• Existing Vegetation Height	• Biophysical Settings
• Vegetation Dynamics Models	• Environmental Site Potential
Fuel	
• Fire Behavior Fuel Model 13	• Fire Behavior Fuel Model 40
• Fuel Loading Models	• Forest Canopy Cover
• Forest Canopy Height	• Canopy Bulk Density
• Canopy Base Height	• Landscape Files
• Fuel Characteristic Classification System	• Canadian Forest Fire Danger Rating
Fire Regime	
• Fire Regime Groups	• Mean Fire Return Interval
• Percent Low-severity Fire	• Percent Mixed-severity Fire
• Percent Replacement-severity Fire	• Vegetation Condition Class
• Vegetation Departure	• Succession Classes
Topographic	
• Aspect • Slope • Elevation	

Table 6. LANDFIRE Product Suite, LF 2010 (LF_1.2.0)

4.2.2 Mapping

Mapping is a comprehensive project in the LANDFIRE Program that requires a multi-year approach to produce a completely new edition of the LANDFIRE product suite. Currently available satellite imagery, contemporary data sources, software and hardware technologies, and broadening program partnerships support development to

create a new edition product that significantly improves upon updated versions of legacy edition data.

Approach

The NLCD program and the GAP program are the primary partners in LANDFIRE mapping efforts. These partnerships benefit mapping projects by combining efforts, reducing potential duplication, and improving consistency in methodologies. Mapping partnerships also improve compatibility and comparability of data across each of the programs' product suites.

LANDFIRE mapping projects are expected to coincide with future product strategies being explored by NLCD and GAP. Common strategies include more frequent product releases and shifting emphasis from mapping outcomes toward "real time" monitoring capabilities. Other common focus points include revised classification of vegetation and integration of expanded data sources.

At the writing of this document, the goals, requirements, and production strategies for the next mapping effort are in development with mapping partners, and with input from stakeholders and users. The following priority areas are identified for the next edition of the LANDFIRE product suite:

- Imagery from Landsat 8 providing improved signal-to-noise (SNR) radiometric performance to advance characterization of land cover state and condition.

- Additional field plot and point data. Expanded range of new data sources, and updates to original data sources[2].

- New, or updated, physical and biological gradients.

- Improved hardware and software resources. Technological advances over the last decade will allow for improved algorithms and faster image processing.

4.2.3 Source Data

The LANDFIRE Program relies upon partners and contributors to provide source data that is the basis for all LANDFIRE data products. The success of the program relies on mission-critical relationships across program areas. Data sources used by the LANDFIRE Program are detailed below, organized by informational theme.

Topographic Data

- National Elevation Dataset (NED) comprises merged 7.5-minute quadrangle topographic data resulting in a high quality, elevation data set that spans the nation.

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[2] One example of an expanded data source is GLAS (Geoscience Laser Altimeter System) topography data via airborne Light Detection And Ranging (LiDAR), provided by The National Aeronautics and Space Administration (NASA).

- Elevation Derivatives for National Applications (EDNA) is a multi-layered database that provides topographically derived hydrologic derivatives.

Disturbance Information

- Events Data include contributed activities data from stakeholder and user organizations that provide current point and polygon information, as well as "corporate" datasets that organize disturbance-theme information under formal database maintenance programs.

- Multi-Index Integrated Change Analysis (MIICA) Input Datasets[3]:

  - Landsat (Landsat Data Continuity Mission - Landsat 5 & 7) provides satellite imagery at a regional to national scale appropriate for use in vegetation and wildland fuel mapping. The most current Landsat 8 mission is expected to provide the majority of satellite imagery utilized by the LANDFIRE Program beginning in 2015.

  - Protected Areas Database of the United States (PAD-US) is produced by the USGS GAP program as an official inventory of protected open space in the United States. The database represents over 715 million acres, thousands of land holdings, and includes spatial data representing certain public lands held in trust by national, State, local governments, and nonprofit organizations.

  - The Monitoring Trends in Burn Severity (MTBS) project provides a dataset of nationally consistent burn severity assessments of large fires that have occurred in the United States since 1984. MTBS data includes "large fires" greater than 500 acres in the eastern U.S., and "large fires" greater than 1,000 acres in the western U.S.

  - SmartFire is a fire information system and framework for aggregating, associating, and reconciling wildland fire information from disparate sources, developed and maintained at the USFS Pacific Northwest Research Station.

  - Burned Area Reflectance Classification (BARC) is a satellite-derived data layer of post-fire vegetation condition. BARC has four classes: high, moderate, low, and unburned, used as an input to the soil burn severity map produced by the Burned Area Emergency Response (BAER) teams.

  - Rapid Assessment of Vegetation Condition after Wildfire (RAVG) provides a suite of products following containment of a wildfire that burns 1,000 acres or more of forested National Forest System (NFS) land. RAVG products provide information that assists in post-fire vegetation management.

Existing Vegetation

- Vegetation Plot Data includes vegetation from geo-referenced sampling units nationwide input to "ground truth" spatial and non-spatial vegetation models. LANDFIRE benefits from data sourced from "corporate" datasets as well as

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[3] The LANDFIRE Program has tailored an implementation of MIICA as originally developed at USGS EROS, which extracts change information from two Landsat image pairs.

information provided by individual contributions. A listing of individual data contributions is available on the LANDFIRE Program website. (www.landfire.gov)

- o The Forest Inventory Analysis (FIA) program provides an important corporate source of plot data. FIA provides a United States-wide continuous forest census of information on status and trends in forest area and location; in the species, size, and health of trees; in total tree growth, mortality, and removals by harvest; in wood production and utilization rates by various products; and, in forest land ownership.

- o Contributed plot data is also a vital input to the Existing Vegetation product, accounting for 40% of the sampling events in the data acquisition process. Primary contributions are accredited to the USFS, multi-agency data sources, and the USGS.

- Landsat (Landsat Data Continuity Mission—Landsat 5 and 7) provides satellite imagery for LANDFIRE Program products developed through 2014. Landsat 8 is expected to provide the majority of satellite imagery used by the LANDFIRE Program beginning in 2015.

- The NLCD program provides 21-classes of land cover classifications applied consistently over the United States. This program is on a general schedule to produce a national map every 5 years. Future LANDFIRE products will utilize NLCD 2011 and later datasets.

- The USDA National Agricultural Statistics Service (NASS) produces the Cropland Data Layer (CDL) dataset using satellite imagery to produce digital, crop-specific, categorized geo-referenced data. CDL data is a supplemental component for LANDFIRE vegetation products and is used to inform agricultural cover types.

- The National Elevation Dataset (NED) is a raster product assembled by the USGS providing national elevation data in a seamless form with consistent format, elevation unit, and coordinate reference system. LANDFIRE uses NED topographic data elements including Elevation, Slope and Aspect.

Potential Vegetation

- Vegetation Plot Data includes vegetation from geo-referenced sampling units nationwide input to spatial and non-spatial vegetation models. LANDFIRE benefits from data sourced from "corporate" datasets as well as individual contributions from users and stakeholders

- Biophysical Data includes Biophysical Gradient Variables such as spatially extrapolated weather data, soils data and indirect gradient layers, such as elevation, slope, and indices of topographic position.

4.3 Improvement and Innovation

Improvement and Innovation activities promote LANDFIRE data products that extend beyond the customary range of maintenance and update projects, including expanded

product extent (e.g., adding US insular areas to mapping coverage area) or additional features to data products (e.g., improved depiction of riparian areas). Improvements generally enhance methods for production, while Innovations involve application of science or research that is not currently used in production activities.

4.3.1 Improvement

Improvement refers to developments (e.g., technological and scientific advancements) that benefit existing production methods resulting in enhanced product quality and timeliness, and confirms that defensible science is applied to LANDFIRE data products. Improvements include recommendations gathered internally or through external feedback mechanisms. In planning for Update and Mapping projects, evaluations of recommended improvement actions are considered in the context of methodological feasibility, data availability, and constraints of delivery objectives and resource availability. Past Updating projects, including LANDFIRE 2001/2008 and LANDFIRE 2010, implemented a significant range of improvements resulting in an expanded product suite, as well as enhancements and corrections to prior production methods.

4.3.2 Innovation

Innovation refers to the advancement of unique scientific methods, data sources or technological advances for application beyond the current circumstances for LANDFIRE Program activities. Innovation opportunities are often presented that broaden the uses of LANDFIRE Program products. Research and development is supported by land management agencies such as the Joint Fire Science Program (JFSP) or by external agencies, such as NASA and The National Oceanic and Atmospheric Administration (NOAA). Innovation involves longer-range investigation that is exploratory in focus, which can result in significant advances or entirely new discoveries with potential application to either Updating or Mapping projects.

Improvement and Innovation activities include LANDFIRE team member participation in conference and consortia events. Examples of team member contributions include:

- Teams based at the EROS and RMRS facilities develop presentations for conferences as part of the ongoing development of LANDFIRE Program products based on peer-reviewed science from multiple fields, coordinated with Technology Transfer and Outreach, and Maintenance components of the LANDFIRE Program.

- Participation in consortia that produce land cover information in environmental, land management, and modeling applications, including the FGDC, the MRLC, and the JFSP, among others. Members of the LANDFIRE team contribute scientific expertise to consortia efforts that benefit the member organizations as well as the LANDFIRE Program.

4.4 Governance

Governance refers to oversight, roles and responsibilities, and a standard business process to conduct a sustainable and consistent program of operations. The governance component of the LANDFIRE Program is a contributed effort among the managerial representatives from the agency sponsors, and key program partners. Governance activities are aligned in four functional areas: Business Leadership, Program Management, Production Management, and Advisory Group.

Business Leadership

The business leadership function includes the LANDFIRE managerial oversight conducted on behalf of the land management and wildland fire programs at the DOI and the USDA. This function maintains direct coordination with executive oversight at department and agency levels to guide LANDFIRE Program priorities, implement interagency funding support, liaise with mapping and data partners, and promote stakeholder and user engagement. The business leadership function defines metrics and monitors program performance, and maintains and communicates the LANDFIRE Program business case. Business leadership is a spokesperson to stakeholders, oversight authorities, and the general public, as well as coordinator of the LANDFIRE Advisory Group.

Program Management

The program management function provides the direct management oversight of primary LANDFIRE Program activities in the Operations, Maintenance, and Improvement and Innovation components. Program management orchestrates the administration of program components in coordination with technical management of data production and operations activities. This involves project management of component schedules and budgets, maintaining project plans, and monitoring program deliverables, expenditures and performance metrics. The program management function interacts closely with the business leadership function to ensure adequate visibility toward program challenges and opportunities, and effective resolution of decision points that require consideration at an executive or sponsor level.

Production Management

The production management function is focused on the technical direction of production activity, namely Update and Mapping projects conducted in the Maintenance component, and supporting tasks conducted in the Operations component. This involves project management in organizing, staffing, and leading teams, as well as monitoring production scope, schedule, deliverables, and budgets. Production management also involves guiding scientific applications found in the Improvement and Innovation program component. The production function is coordinated closely with the program management, and where needed, direct interaction is fostered with the business leadership function.

<u>Advisory Group</u>

The LANDFIRE Advisory Group is coordinated as a Business Leadership activity. The advisory group members are technical experts from private, state, and federal agencies who benefit from LANDFIRE data products, but are not direct participants in the LANDFIRE Program. The role of advisory group members is participatory in nature and is focused on bringing unique external perspectives to benefit the scientific and technical approaches considered in the LANDFIRE Program. The advisory group may express specific needs or issues regarding LANDFIRE data products, as well as promoting the use of LANDFIRE data in their respective networks and organizations.

5.0 Future Direction

Consideration of the future direction of the LANDFIRE program focuses on objectives beyond the present 5-year operating horizon and involves some hypothetical assessment. Nonetheless, it is necessary to evaluate longer-term prospects that engage internal teams, program sponsors, and partners and stakeholders to create the future vision of program efforts. The approach used to evolve prospects to a refined program focus is depicted in Figure 5. The list below is a broad set of focus areas that demonstrate the range of concepts being considered for the future LANDFIRE program.
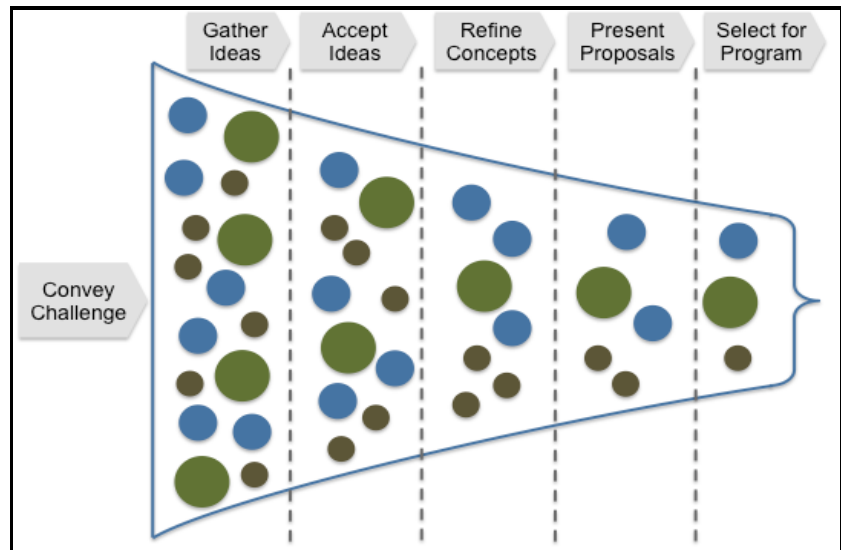

Figure 5. Refinement of future program concepts

- New and enhanced program partnerships, such as deeper collaboration with NOAA, NASA, NRI, NLCD and other organizations involved in earth sciences, with potential to support a national land change monitoring program.

- The National Landscape Conservation Information Framework is a concept to provide a nationally consistent data approach with delivery of data sets to be accessed by multiple parties operating across scales, supporting a wide variety of business needs based on authoritative data sources in a service oriented architecture.

- Inter-agency and multi-department governance guiding the capacity and pace of product development augmented by coordinated requirements and synchronized release schedules.

- Advances in software engineering (including artificial intelligence) to assist in the most challenging aspects in LANDFIRE mapping and production.

- Progress in computing capability (hardware, software, optimization) to enable faster data production cycles and greater efficiency in product delivery.

- Additional participation from a greater range of users, analogous to "crowdsourcing" in personal technology to improve product content, extent, and accuracy.

- Focus on producing and promoting products that are more useful to more users.

- Highly frequent updates to products using advancing technological and scientific resources to support programs for continuous multispectral change monitoring.

- Data to support advances in fire behavior modeling and fire behavior research.

- Enhanced integration of land cover and vegetation mapping programs supported by a centralized hosting infrastructure to minimize redundancy and product misunderstanding.

- Develop situational fuel data for seasonal changes and changes in climate patterns, and investigate new data to support fire behavior modeling and fuel characteristics.

- Leverage advances in remote sensing technology and Landsat 8 imagery to develop additional vegetation characteristics such as stand structure and understory.
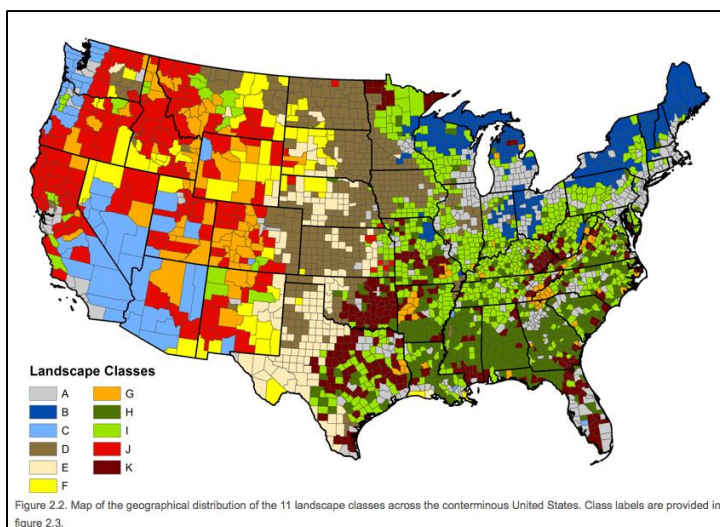
Appendices

Strategic Uses of LANDFIRE Data Products

The National Cohesive Strategy

The Cohesive Strategy was initiated in 2010, through a three-phased approach to intergovernmental planning, risk analysis, and collaboration by federal, state, local and tribal governments and non-governmental partners and public stakeholders. A national characterization included specific regional considerations at the county geographic level. Data spanning a broad spectrum of environmental, socio-economic, and fire related statistics were assembled to support development of the Cohesive Strategy. Data were summarized and consolidated to the county level in order to provide a comparable unit of analysis across data sets.

Landscape Classes

A	G
B	H
C	I
D	J
E	K
F	

Figure 2.2. Map of the geographical distribution of the 11 landscape classes across the conterminous United States. Class labels are provided in figure 2.3.

LANDFIRE data was used to develop eleven landscape classes across the conterminous U.S., include: *Fire Regime Group; Percent Forested Area; and, Fire Behavior Fuel Model 40*.

Fire Program Analysis (FPA)

In 2002, Fire Program Analysis (FPA) was initiated in response to a Congressional request to develop a budget and allocation process for the wildland fire management programs. At a national level, FPA provided fire managers with a common interagency framework for strategic fire management program analysis, planning and budget formulation. FPA produced strategic trade-off analysis tools for decision makers to investigate the implications of investment choices.

| Total Budget (M$)	340,079,973	349,163,537	359,194,348	370,832,492	
National Budget Level WAM	1,081,663,584	1,103,181,682	1,107,052,778	1,107,264,474	1,
National Level Run Number	1	2	3	4	
GB_ID_001	5	5	5	5	
NR_MT_008	5	5	5	5	
SA_FL_003	4	4	5	5	
SW_NM_004	4	4	5	5	
GB_UT_003	3	4	5	5	
NR_ID_002	2	5	5	5	
CA_CA_003	1	5	5	5	
SW_NM_007	1	5	5	5	
SA_TX_004	1	4	5	5	
SW_AZ_001	1	4	5	5	
CA_CA_002	3	3	3	5	
CA_CA_007	1	3	5	5	
NR_MT_001	2	3	4	5	
SW_NM_001	2	2	5	5	
CA_CA_005	1	1	5	5	
EA_MI_002	2	2	3	5	
NW_OR_004	1	1	5	5	
RM_SD_001	1	1	5	5	
SA_KY_001	1	1	5	5	
GB_NV_001	2	2	2	5	
SW_NM_005	1	1	4	5	
SW_NM_006	1	1	4	5	
CA_CA_001	1	1	3	5	

LANDFIRE data used to enable FPA modeling and reporting included: *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; Reference Database; Events Database; and nd, Vegetation Transition Database.*

Interagency Fuels Treatment Decision Support System (IFTDSS)

IFTDSS is a web-based software and data integration framework that organizes previously existing and newly developed fire and fuels software applications to make fuels treatment planning and analysis more efficient and effective. IFTDSS is used by fuels treatment specialists to access several sources of data fuels treatment planning.
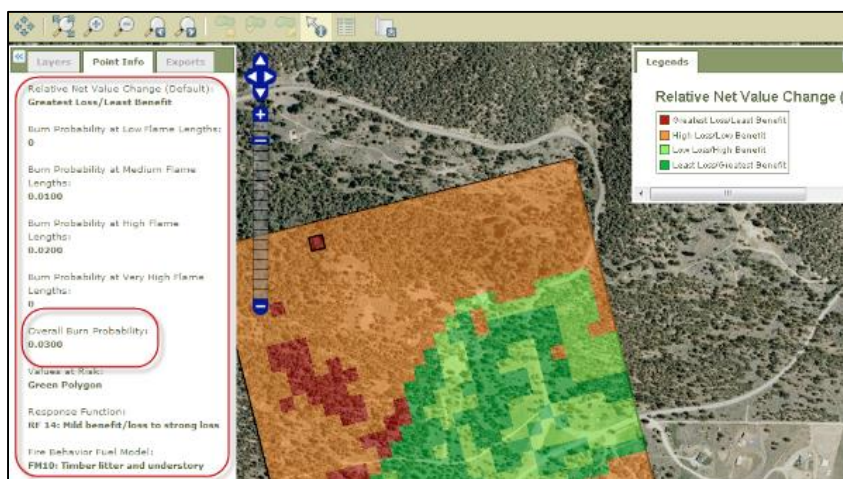
LANDFIRE data primarily used in IFTDSS includes: *Fire Behavior Fuel Model 13; Fire Behavior Fuel Model 40; Fuel Characteristic Classification System fuelbeds; and, LANDFIRE Landscape files*.

Wildland Fire Decision Support System (WFDSS)

WFDSS supports fire managers and fire analysts in strategic and tactical decisions for fire incidents, combining various applications used to manage incidents into a single system, streamlining analysis and reporting processes. WFDSS integrates fire management strategic objectives from fire management and land management plans; and, fire intelligence such as fuel conditions, fire danger and weather analysis, fire history, and probabilistic information into a consolidated data and analysis set.
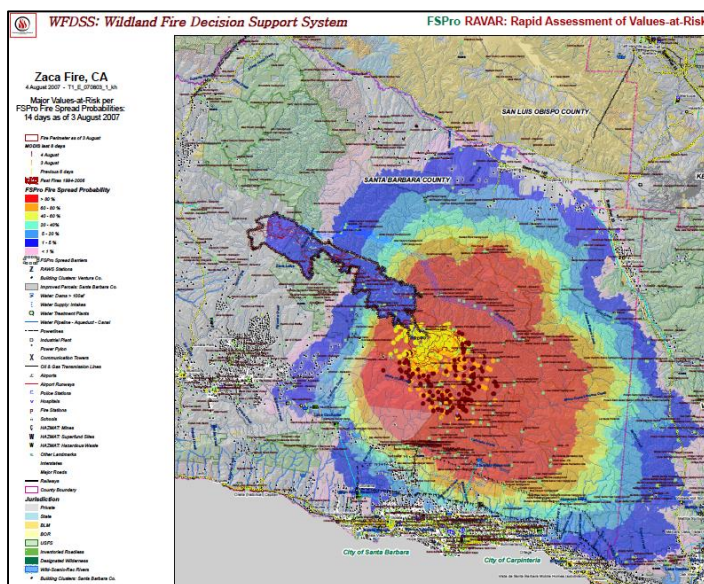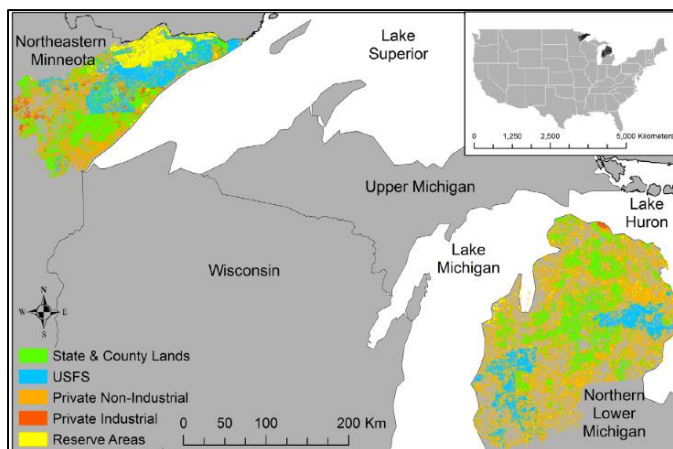
LANDFIRE data primarily used in WFDSS includes: *Aspect; Slope; Elevation; Fire Behavior Fuel Model 13; Fire Behavior Fuel Model 40, Canopy Cover; Canopy Base Height; Canopy Bulk Density; and, Stand Height layers.*

Modeling Alternative Scenarios of Land Cover Change and Conservation Outcomes

A land cover change initiative that uses LANDFIRE data is the Forest Scenarios Project, an ongoing collaboration between scientists at the University of Wisconsin at Madison, TNC's Michigan and Wisconsin offices, and the LANDFIRE Program. The project uses landscape modeling and scenario analysis to identify the potential outcomes for forested landscapes under various conservation strategies and climate change projections in two study areas—the Wild Rivers Legacy Forest (WRLF) area of northeastern Wisconsin and the Two-Hearted River Watershed (THR) of Michigan's Upper Peninsula.

LANDFIRE data primarily used in the scenarios project includes: *Existing Vegetation Type, Biophysical Settings, Succession Classes, and Vegetation Dynamics Models.*

Ecoregional Assessments

Several ecoregional assessments rely upon LANDFIRE data products. Notable projects include the Bureau of Land Management Rapid Ecoregional Assessments for the Sonoran Desert, Mojave Basin and Range, and Colorado Plateau, conducted from 2010 to 2012. These assessments used LANDFIRE products for the data needed to cover the entire analysis area. Landscape data layers and reference condition models were used for ecoregional-scale assessment and characterization.
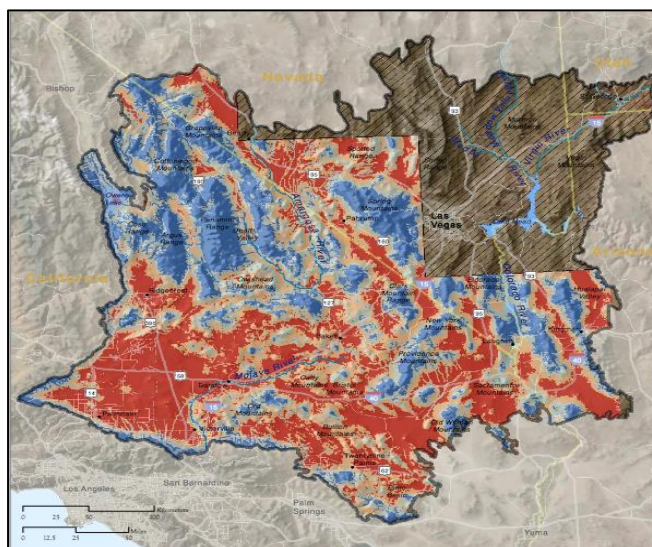
LANDFIRE data primarily used for land cover information includes: *Existing Vegetation Type, Potential Vegetation, Vegetation Condition Class, Biophysical Settings, and Vegetation Dynamics Models.*