

General Management Evaluation



December 14, 2009

Prepared by:

METI
— ...a Merging of Excellence — 

Management and Engineering Technologies International, Inc.

8600 Boeing Drive, El Paso, Texas 79925

Contract: GS-10F-0349M

Order Number: AG-024B-D-09-0010

CONTENTS

1. Introduction	1
2. How the GME was conducted	2
2.1. Review process and scope	2
2.2. Areas of inquiry	3
2.3. Interviews and document review	5
2.4. Findings, recommendations and evaluation	6
3. What we found – observations and findings	8
3.1. Partnerships, project management, and staffing	9
3.2. Support to agency and partner business needs	15
3.3. Data quality	19
3.4. Communication and marketing	24
3.5. Technology transfer and user support	26
3.6. A future vision for LANDFIRE	30
3.7. Foundation for landscape conservation	33
3.8. Future organization and governance	37
4. Recommendations	42
4.1. Principal recommendations	42
4.2. Detailed recommendations and proposed actions	45
4.3. Performance assessment	51
Appendix A – GME Review Plan	59

1. INTRODUCTION

LANDFIRE, also known as the Landscape Fire and Resource Management Planning Tools Project, is a five-year, multi-partner project producing consistent and comprehensive maps and data describing vegetation, wildland fuel, and fire regimes across the United States. It is a shared project between the wildland fire management programs of the U.S. Department of Agriculture (USDA) Forest Service and U.S. Department of the Interior (DOI).

LANDFIRE data products include layers of vegetation composition and structure, surface and canopy fuel characteristics, and historical fire regimes. LANDFIRE national methodologies are science-based and include extensive field-referenced data. LANDFIRE data products are designed to facilitate national- and regional-level strategic planning and reporting of wildland fire management activities. Data products are created at a 30-meter grid spatial resolution raster data set.

The LANDFIRE Project was chartered by an interagency sub-cabinet group known as the Wildland Fire Leadership Council. The LANDFIRE Project is completing the initial development of continuous data and information products needed for wildland fire and resource management for the United States. A general management evaluation (GME) of the project's operations and future has been requested by Forest Service and DOI wildland fire leaders to set the stage for moving from a development project to a program which will provide for operations and maintenance (O & M) activities. Recommendations and findings from the GME will be used to improve the effectiveness of program efforts. This information will also be used to more effectively integrate potential new partners in the LANDFIRE Program.

2. HOW THE GME WAS CONDUCTED

The GME was conducted by an independent, third-party review team employed or retained by Management and Engineering Technologies International, Inc (METI, Inc.). The review team consisted of:

Mr. Stephen Solem (team leader) – Retired Director of Science Application and Integration for the Forest Service’s Rocky Mountain Research Station

Mr. Jack Troyer – Retired Regional Forester for the Forest Service’s Intermountain Region

Mr. Mark Beighley – Retired Director of the Department of the Interior’s Office of Wildland Fire Coordination

Mr. James Golden – Retired Deputy Regional Forester for the Forest Service’s Pacific Northwest Region

All team members have experience in the evaluation and management of large complex natural resource organizations and programs. The collective professional experience of the GME team in natural resource management totals 144 years.

2.1. REVIEW PROCESS AND SCOPE

The approach used for the LANDFIRE GME emulates general management review procedures used within the Department of the Interior and USDA Forest Service. These reviews are designed to examine management and leadership functions as opposed to the technical nature of the work or activity being performed. The focus is on organizational structure and operational controls that contribute to effective performance and accomplishment of assigned objectives.

In general, these reviews rely on the experience of the GME team to recognize and pursue information generated during the review and to prepare recommendations. The GME team also assessed recommendations using a “maturity model” (see GME Review Plan, Appendix A) that describes performance elements and proficiency levels associated with a mature and fully functioning LANDFIRE Program.

A review plan for the GME was jointly prepared by the LANDFIRE business leads and the GME review team. A copy of the review plan is included in Appendix A of this document. An entrance conference with the LANDFIRE business leads was held to discuss a draft review plan and included an overview of the LANDFIRE Project history.

The GME is founded upon a series of interviews and document reviews focused on four primary areas:

1. Awareness and understanding of LANDFIRE and its data products
2. Utility of data products within wildland fire management and other resource areas
3. Organizational and operational improvements needed within the LANDFIRE Program
4. Organization and management of the overall collection of federal wildland fire management data and applications

A draft report was presented to the LANDFIRE business leads and representatives from the Forest Service and Department of the Interior. An exit conference was conducted to present findings and recommendations. Following the exit conference, comments and suggestions were considered by the GME team, and the final report was prepared.

2.2. AREAS OF INQUIRY

The GME investigated and evaluated the following areas, which are described in detail in the GME Review Plan (Appendix A of this document):

1. Awareness and understanding of LANDFIRE and its data products

The LANDFIRE Project was chartered by the Wildland Fire Leadership Council based on recommendations from the Government Accountability Office, which is different than how typical mission-related work is initiated by sponsoring organizations. In addition, the LANDFIRE Project was specifically chartered and funded to support wildland fire-related business needs contrary to the perceptions of some sponsoring agency executives and was not always fully supported by field leadership.

The GME team was asked to:

- *Evaluate the awareness and understanding of LANDFIRE and its data products among a wide range of current and potential users.*
- *Provide an assessment of communication, technical transfer, and leadership awareness associated with the transition of LANDFIRE from project to program and develop recommendations on how to best organize and address associated issues as the program moves forward.*

2. Utility of data products within wildland fire management and other resource areas

LANDFIRE data products were designed to support wildland fire behavior modeling and fuels management tools and decision support systems currently in use or in development. As originally designed, LANDFIRE data products were also intended to serve as the basis for other resource management programs as well. Since the completion of LANDFIRE National data products for the contiguous U.S., the products have been widely used in wildland fire operations and to support national fire program planning.

An assessment of the utility of LANDFIRE data products to support wildland fire management and other resource area planning and decision making has not been completed.

The GME team was asked to:

- *Provide a general evaluation of the utility of LANDFIRE data products to support wildland fire management business needs.*
- *Assess and describe how LANDFIRE data products are being used to support other resource management areas.*
- *Provide an assessment of LANDFIRE data application issues, user support and technology transfer associated with wildland fire management and other resource management business needs.*

3. Organizational and operational improvements needed within LANDFIRE Program

The organization and governance system associated with the development and initial deployment of LANDFIRE was designed to provide oversight and management control of this multi-party effort. The LANDFIRE Executive Charter explicitly describes the organization and roles for this effort. An assessment of this organization and roles could help inform a future LANDFIRE Program charter and organization, as well as inform the organization of other management areas.

The organization that functioned well to develop and complete initial LANDFIRE data products does not support functions typically associated with the next phases of a program. The present LANDFIRE governance and oversight structure is not designed to effectively address governance issues typically associated with data system deployment and enhancement. The LANDFIRE charter recognizes the need to plan for the transition from the development of data products to “operations and maintenance.”

The GME team was asked to:

- *Provide a general assessment of how well project principals fulfilled their roles and how well the organization functioned.*
- *Provide a general evaluation of future governance issues and recommendations on how best to organize for the future and associated operational considerations.*

4. Organization and management of the overall collection of federal wildland fire management data and applications

The Wildland Fire Leadership Council provides coordination and oversight of all information and analysis tools being developed and deployed by federal wildland fire management agencies. The system consists of multiple components intended to be applied at different organizational levels and is designed to meet a variety of business needs at each of these organizational levels. Governance is presently organized by system component.

Since the LANDFIRE Project was initiated, a suite of wildland fire decision support applications has been developed to support policy and program planning as well as wildland fire operations.

Many of these applications are moving from the development and deployment phase to a program phase at the same time. An opportunity exists to examine more effective organization and operational approaches for LANDFIRE within the context of this system.

The GME team was asked to:

- *Evaluate opportunities for better coordination, organization and management of federal wildland fire data management and analysis applications.*

2.3. INTERVIEWS AND DOCUMENT REVIEW

The GME team conducted a series of interviews with individuals from a variety of organizations having different associations with LANDFIRE and its data products. Interviews were stratified across different user groups and affiliations to ensure a balance of perspectives were sampled. In addition to ensuring an adequate number of individuals in each group were sampled, persons interviewed were selected to maintain a 60/40 split¹ between Forest Service and DOI agency personnel.

Table 1 identifies the different groups interviewed and the distribution of those interviewed between various agencies and partners. In all a total of 110 individuals were interviewed. Forest Service and DOI agency personnel account for 80 interviews, with the final ratio being 58.75% and 41.25%, respectively. The additional 30 interviews were distributed between state agency employees (10), LANDFIRE partners (8) and other external users (12).

The GME team reviewed documents and information posted on the LANDFIRE website (www.landfire.gov). Additional documents were provided for review to the GME team by LANDFIRE Project staff and fall into the following categories:

- LANDFIRE Project Performance Targets and Self-Assessment
- Meetings Management and Recordkeeping
- Schedule Management
- Executive Oversight Committee Activities
- Data Distribution
- Helpdesk Summaries

The LANDFIRE O & M Business Plan (v3.0) and Implementation Plan (v1.5), collectively referred to as O & M plans, were also provided to the GME team.

¹ This ratio represents agreements on how to share costs between the USDA Forest Service and Department of the Interior for the LANDFIRE Project and other joint ventures dealing with wildland fire management.

Individuals interviewed provided additional documents and website references to the GME team. These documents include:

- **LANDFIRE in Wisconsin**, Briefing paper for the Wisconsin State Forester (September 22, 2009)
- **Fire Regime Condition Class Review**, The Wilderness Society (March 23, 2004)
- **Ramping Up Restoration in Nevada’s Schell Creek Range**, TNC Fire Learning Network (December 2007)
- **Genies in the Bottle: Tools to Assess Landscape Health & Predict Benefits of Conservation Strategies - LANDFIRE Tools, Remote Sensing, Predictive Models & Cost-Benefit Assessment**, TNC Fire Learning Network (December 2008)
- **LANDFIRE Existing Vegetation Products—How Useful for Midlevel Forest Needs?** Wendy Goetz and Paul Maus, USDA Forest Service Remote Sensing Applications Center, Salt Lake City, UT (June 2006)
- **Summary Report, Spatial Comparison of LANDFIRE and Mid-Level Existing Vegetation Maps**, Sanford Moss (revised August 2009)

2.4. FINDINGS, RECOMMENDATIONS AND EVALUATION

Observations presented in this report are based upon the perspectives of those interviewed or the authors of the documents reviewed. Findings represent the assessment of those observations by the GME team and serve as the basis for developing recommendations.

Recommendations are developed in response to individual findings or collections of findings. These recommendations represent opportunities for program and operational improvements within the LANDFIRE program.

Principal recommendations are presented in the recommended sequence in which they should be addressed. Detailed recommendations and actions associated with each principal recommendation outline the GME team’s perspective on how best to implement the recommended improvements.

The final step in the evaluation involves an assessment of how changes described in the O & M plans and GME recommendations are likely to affect desired performance of the LANDFIRE program. This assessment compares different courses of action to desired outcomes described in a “maturity model”.

Table 1 – LANDFIRE GME Interview Distribution

Interview Group	FS*	DOI*	BLM	NPS	FWS	BIA	States	TNC	EROS	Users	Totals
Agency Leadership - National	7	1	3	5	3	1					20
Agency Leadership - Regional/State	3		2	0	1	0	3	1			10
Agency Administrators - Forest/Field Off.	8		1	1	1	0					11
Agency Fire Mgmt. - Regional/State	3		0	0	0	0	3				6
Incident Management Team Leadership	3		0	0	1	0	0	0		1	5
Fire Ecologists, Fire Planners, Fuels Specialists, GIS Analysts	7		0	4	2	2	0	1	0		16
Ecologists, Wildlife Biologists, Range Cons., Land Mgmt. Planners, Researchers	7		1	1	0	0	4	3			16
Technical Specialists (EROS/RSAC)	4		0	0	1	0	0	0	0	1	6
External Users (Universities, WGA)										9	9
LANDFIRE Project Staff and Contractors	5	1	1					1	2	1	11
Totals	47	2	8	11	9	3	10	6	2	12	110

*FS/DOI % Split 58.75% 41.25% 80 Total FS/DOI

3. WHAT WE FOUND – OBSERVATIONS AND FINDINGS

Interviews and document review conducted by the GME team generated a series of observations and findings related to the areas of inquiry specified in the GME Review Plan. All those interviewed were open and candid in their comments and provided the GME team with invaluable information. Interviews conducted by the GME team are documented in informal notes and no attempt was made to attribute statements included as observations to particular individuals.

Observations reflect the perspectives of those interviewed or the authors of documents reviewed. In some instances, observations presented are a synthesis of comments from a number of individuals. In other cases, observations reflect statements by specific individuals. Differences of opinion are presented to demonstrate the variety of perspectives expressed by those interviewed.

Findings are the GME team’s conclusions regarding observations.

Observations and findings presented below fall into three general categories and are presented sequentially in the balance of this section:

Project strengths	<ol style="list-style-type: none">1. Partnerships, project management, and staffing2. Support of agency and partner business needs
Opportunities for improvement	<ol style="list-style-type: none">3. Data quality4. Communication and marketing5. Technology transfer and user support
LANDFIRE’s future	<ol style="list-style-type: none">6. Future vision and strategy7. Landscape conservation issues8. Organization and governance

Observations and findings provided the GME team with the foundation to develop recommendations related to the GME’s areas of inquiry.

3.1. PARTNERSHIPS, PROJECT MANAGEMENT, AND STAFFING

Partnerships developed and relationships built by project collaborators became, and continues to be, a source of strength for LANDFIRE. However, some feel that more collaboration with university resources might have resulted in better project design.

Strong project management leadership was critical for success, both in terms of staying on schedule and on budget. The use of “Project Management” principles contributed greatly to this success by instilling a philosophy of discipline and accountability throughout development and production teams. However, the research scientists initially involved in the map production effort were not accustomed to the concepts of project accountability and scheduling. After a shaky start, the project team met production goals and demonstrated good cost management. Having a clear charter was essential to staying on schedule and keeping the project from straying from its goal.

As the development phase wraps up, there are concerns about workforce and skill retention and also recognition of the need for “deep bench strength” in key production roles.

Lastly, political leadership decisions to move forward with the project and mandates regarding the use of LANDFIRE data products that left a bad first impression with the project team, managers, and users continue to haunt the project.

3.1.1. Developing partnerships and relationships

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ The interagency teamwork has been commendable with much ownership and pride in the product.
- ✓ Great value came from the open-door philosophy between agency employees, academics, scientists, contractors, etc.
- ✓ The number of different entities required to work together to pull off LANDFIRE development on time is nothing short of amazing. It was truly a collaborative effort between multiple government agencies and non-governmental organizations (NGOs). Even though many players had different ideas and approaches, most involved were committed to the strategic concept enough to compromise and adapt as needed to keep moving forward.
- ✓ There was no outreach or engagement with the university community after the prototype. This resulted in a lost opportunity to engage the academic community in the LANDFIRE Project.

- ✓ The pressure for a quick start-up precluded good evaluation of alternative designs and additional partners in the development of a nationally consistent data set. This approach did not address resource management project-level concerns, but it did satisfy many consumers because the data set is consistent and national. As a result, some perceive that the quality of the project was compromised.
- ✓ The Nature Conservancy (TNC) contributed substantial resources to the LANDFIRE Project and views the effort as an important partnership and the data products as a substantial asset to support their conservation programs.
- ✓ The need to manage the interface between Research and Management should not be ignored.

Finding 1-1

The partnerships forged during the development of initial LANDFIRE collaboration provide a solid foundation for future efforts.

Finding 1-2

The quick project start-up precluded participation by potentially significant contributors, particularly those from key academic sources.

3.1.2. Project leadership

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Highly effective team development and management was important and good leadership was critical.
- ✓ The Business Leads had great access to USFS and DOI leadership, and that was important. It was important also to have effective technical team leads.
- ✓ Regarding the leadership of project teams, a more formal process is needed regarding field specialist involvement.
- ✓ Project business leadership should appreciate science quality as part of their job.
- ✓ The Project Manager and Business Leads should have been in place from the beginning. They were always playing catch-up.

Finding 1-3

Effective project management leadership (i.e., Business Lead, Project Manager) was an important ingredient to LANDFIRE success but was late in getting set up.

Finding 1-4

A more formal process is needed for establishing the involvement of field specialists who can contribute to the program's future success.

3.1.3. Production goals and cost management success

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ The LANDFIRE Project team members need to be applauded for their work in completing the national data set on schedule. However, the team should not fall into resting on laurels and fail to make continuous improvements from this point forward.
- ✓ The LANDFIRE Project was completed less than 5% over budget and less than three months later than scheduled; for a 5-year project, that's highly commendable.
- ✓ Production work needs to go to contractors after a proven, defined methodology is worked out as well as a process through which to apply it. This will reduce costs.
- ✓ The decision to contract out AK/HI mapping zone production work resulted from budget limitations and an attempt to provide for a smooth transition for project staff.
- ✓ Rocky Mountain Research Station's (RMRS) philosophy is "science first." This focus often runs afoul of production schedules and accountability. Scientists want to focus on improvement and innovation, not production.
- ✓ Project leadership instituted numerous innovations during the course of the project that improved production efficiency and kept the delivery of map products on schedule. This attention to program oversight is a tribute to performance management.
- ✓ LANDFIRE has the hard evidence to back up production statistics.

Finding 1-5

The LANDFIRE Project management should be commended for its attention to production objectives and completing the project within 5% of the approved budget and within 3 months of the production schedule objective.

Finding 1-6

Project staff and contributors should be employed where their strengths can be best used (e.g., Scientists should be used to define processes and for improvement and innovation work; production work is best done by contractors.)

3.1.4. Business practices

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ The project was managed using “Project Management” principles. Having well-thought-out timetables and deadlines for achieving milestones kept the project moving forward rather than just slipping sideways. It also allowed for the collection of data sufficient to perform a “forensic analysis,” which was used to improve map production efficiency.
- ✓ The project had a history of starts and stops – trying different approaches with different participating organizations. Once the project was about halfway complete, things started to flow in a more consistent and predictable manner. Many attribute this change to the application of “project management” principles (i.e., use of strong project management structure, earned value metrics, formal project plans, deadlines, quarterly status reporting, etc.)
- ✓ LANDFIRE had lots of impacts to RMRS’s infrastructure that were not accounted for in project planning, budget development, and management needs (contracting, employment, business mgmt., etc.).
- ✓ Something project leadership struggled with all through the project was bringing together two government departments (DOI and USDA) and determining who will pay for what and who decides. All budget agreements should be put in writing!
- ✓ There needs to be a better process for determining how funds are acquired, what they are paying for, and tracking accountability of expenses.
- ✓ The initial project budget did not include costs for Administrative Assistant, Science Lead, and Management Analyst positions, so RMRS was short of funding from the start.

Finding 1-7

Budget development, funding procedures, and agreements for LANDFIRE were often incomplete and undocumented.

Finding 1-8

Not all costs were planned for in the budget, causing impacts to other programs that had to adjust mid-year to meet LANDFIRE needs.

Finding 1-9

The use of “Project Management” principles was critical to keeping the project on schedule and on budget.

3.1.5. Project Charter

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ LANDFIRE Project leaders are dedicated to adhering strictly to the project charter, as evidenced by the statement “After 5 years we still pull the charter out every week to validate if we’re within mission.”
- ✓ Only a few pen and ink changes are needed to modify the charter for the Program.
 - Define production team leader roles and responsibilities.
 - Determine success factors – create a list of deliverables and the time-frame in which they will be produced.
- ✓ If LANDFIRE is expanded, the mission must be explicitly defined and the charter refined.
- ✓ Sponsors of LANDFIRE should agree on the list products that will be delivered.
- ✓ The Program charter needs to be different from the LANDFIRE National charter as the tasks are different. The structure of the existing charter is good but needs modification for the Program.

Finding 1-10

The LANDFIRE Project charter was a critical guidepost for decision-making but needs modification for the Program.

3.1.6. Workforce and skill retention

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ The project’s organization was approved in the charter, but not formally established and permanently filled because of the perceived temporary nature of the project. At this juncture, individuals in key positions have either returned to their original duties, moved to other positions, or in the case of many production team members, their employment terms have been reached and they can no longer work on the project.
- ✓ Many skilled team members will be “walking out the door” when development is complete. Managers need to find a way to keep these key skills involved on a part time or call-when-needed basis for continued problem solving and product improvement.
- ✓ Access to some term employees may be limited because of employment authorities, causing the loss of skilled project team members and increased Program start-up costs.

- ✓ LANDFIRE will continue to need a significant skill base to draw from, but probably not from full-time individuals dedicated solely to LANDFIRE.

Finding 1-11

While the LANDFIRE Program will need new skills to provide for O & M activities, there will be a continuing need for many of the same skills used in the development phase. People with experience on the project are uniquely qualified to provide them.

Finding 1-12

There are few permanent full-time government employees currently assigned to the LANDFIRE organization. As the project moves toward the Program, a permanent leadership core will need to be formally established and staffed.

3.1.7. Unintended consequences of leadership direction

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Several individuals mentioned having direction for mandatory use of LANDFIRE data “shoved down their throats,” and the ones doing the shoving had little knowledge about the limitations of the data. Most understand why this was the case – because of the large investment – but it was the abruptness of the approach that was offensive. If the data are relevant, useful, of the right scale, and people have access, then they will automatically be considered for all appropriate applications.
- ✓ Many who haven’t been involved in LANDFIRE over the last approximately 18 months still have a bad taste left in their mouth from the initial decision to fund the LANDFIRE Project and direction to use the products. This lasting first impression is hindering many from using or supporting LANDFIRE, even though many improvements have recently been made and the LANDFIRE Team has attempted to make corrections to validated errors.
- ✓ Biggest issue: The departments (DOI / USDA) are trying to use an ecologically based model to drive a budget algorithm (FPA). “That scares the bejeebers out of everyone in the field.” The decision to use this type of modeling approach for budget allocation should be seriously re-evaluated.

Finding 1-13

LANDFIRE data products were a required use in other wildland fire management budget and systems development projects before the quality of the data products could be validated.

Finding 1-14

Negative perceptions about LANDFIRE still exist as a result of the top-down mandate to fund development.

3.2. SUPPORT TO AGENCY AND PARTNER BUSINESS NEEDS

The LANDFIRE Project was chartered to provide consistent and reliable data for all lands within the U.S. as a foundation for wildland fire management. During discussions with project staff and users, important distinctions between LANDFIRE data products emerged and are useful in understanding how LANDFIRE data are used and concerns expressed about data quality and resolution.

LANDFIRE data can generally be grouped into two types of products:

- 1) Fuels data (e.g., fire behavior fuel models, fire regime condition class, etc.) and other inputs to fire behavior prediction models, and
- 2) Vegetation and other intermediate products (biophysical settings, succession classes, etc.) that served as the foundation for developing fuels data.

Fuels data products were the deliverables specified in LANDFIRE charter and the primary focus of the project.

LANDFIRE data products have been made available for download and use via the USGS National Map LANDFIRE (<http://landfire.cr.usgs.gov/viewer/>), the Forest Service Remote Sensing Service and Application Center (RSAC), and directly from LANDFIRE project staff. Information on LANDFIRE data products, data downloading procedures, and appropriate uses are described on the LANDFIRE website (www.landfire.gov). Data and technical alerts and information on schedule updates are also posted on the LANDFIRE website.

LANDFIRE data products provide a consistent and comprehensive coverage equally available to all users. Data products can be downloaded and applied rapidly to address incident management and other resource management business needs. These data products provide a framework for using local data sets that build from the common data “floor” established by LANDFIRE. This combination of consistent coverage, ready access to data products, and predefined relationships to fire behavior models ensures more uniform application and reduced time and costs over the long haul.

3.2.1. Wildland fire management use of LANDFIRE data products

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ LANDFIRE data provide incident management teams and local agency administrators with a common consistent data platform for evaluating wildland fire management decisions using the Wildland Fire Decision Support System (WFSS). Significant strategic decisions rely upon the accuracy and consistent coverage of LANDFIRE data across multiple ownerships.
- ✓ Wildland fire program planning and budget formulation and allocation procedures are also supported by LANDFIRE data products, which provide a consistent data set across all lands and jurisdictions for these purposes.

- The Fire Program Analysis (FPA) is the primary user of these data for program budget formulation.
 - The Hazardous Fuels Prioritization and Allocation System (HFPAS) uses LANDFIRE data as the basis for determining program priorities and budget allocation for hazardous fuels reduction programs.
- ✓ In those areas of the country with local data sets that duplicate LANDFIRE data products to support wildland fire management, concerns exist about data quality and resolution.

Finding 2-1

In areas with local wildland fire data, LANDFIRE data products are viewed with skepticism because users have no track record with their use and are often unwilling to transition to those data provided by LANDFIRE.

Finding 2-2

Use of LANDFIRE data sets in wildland fire applications such as WFSS has changed agency perspectives regarding wildland fire consequences. The ability to accurately evaluate suppression strategies vs. ecological and resource benefits from wildland fire has greatly increased with this combined capability.

3.2.2. Other uses of LANDFIRE data products

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ LANDFIRE has done a good job of providing consistent data needed to evaluate and manage one of the principle stressors on the landscape (i.e., wildland fire). This platform also provides a basis for evaluating and considering policy and management options for other landscape stressors (e.g., climate change, insect and disease outbreaks, invasive species, etc.).
- ✓ Climate change modeling and assessments will be a growing and important use of LANDFIRE data and there may be a potential to use LANDFIRE for carbon accounting associated with cap and trade systems.
- ✓ The Secretary of Agriculture’s vision for America’s forests “...to concentrate on and accelerate restoration of all landscapes, on all lands...” may prompt assessments and applications using LANDFIRE data to provide nationally consistent approaches.
- ✓ States are using LANDFIRE data sets as the basis for conducting state-level assessments in response to requirements of the Farm Bill and allocation of funding associated with the Farm Bill.

- ✓ State and non-governmental agencies appreciate access to LANDFIRE data with no associated costs during tough budget times, and they are excited about the potential that a continuously improving LANDFIRE Program has to offer as a foundation for their work.
- ✓ The Bureau of Land Management and other DOI agencies are using LANDFIRE data products to conduct a number of state and regional assessments to support agency policy and strategic planning needs.
- ✓ The Nature Conservancy and the Wilderness Society use LANDFIRE data products as the basis for policy analysis and conservation action planning.
- ✓ Insurance companies are now downloading LANDFIRE data for use in assessing wildland fire risk and the consideration of these risks in their actuarial procedures.

Finding 2-3

Uses of LANDFIRE data products for other purposes is increasing and a number of innovative uses of primary and intermediate data products are supporting unanticipated business needs and purposes.

Finding 2-4

Expanded use beyond wildland fire management is creating a constituency of users that are not often represented in LANDFIRE update procedures, and these users do not have an opportunity to express their needs within the LANDFIRE Program. These users are potential partners and could provide funding support for the LANDFIRE Program.

3.2.3. Perceptions and use

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ A number of events that occurred during the early stages of the LANDFIRE Project have negatively influenced perspectives of Forest Service personnel regarding LANDFIRE data. These events include: centralization of GIS expertise under the CIO, decisions by some Regions to defer natural resource photography flights, and the 9th Circuit Court of Appeals decision on the Iron-Honey case concerning data accuracy and resolution with the best available data.
- ✓ Forest Service understanding, acceptance, and use of LANDFIRE data products vary widely within the agency. A combination of perceived and real needs for finer scale and more accurate data, vulnerability to litigation, overall data richness, and autonomy regarding data collection and use within a decentralized organizational culture are contributors to inconsistent use within the Forest Service.

- ✓ Within the Forest Service, personnel outside the wildland fire community often express concerns of the resolution and accuracy of LANDFIRE data and use locally developed data and information to support their business needs.
- ✓ DOI agency leaders and resource managers and other external users, including states, The Nature Conservancy, The Wilderness Society, and universities, place a high value on LANDFIRE data and uniformly refer to these data as the most consistent and reliable data they have available to support their business needs.
- ✓ Because of the number of small, isolated administrative units, representatives of the FWS and some NPS analysts cannot use LANDFIRE data. Similar issues exist in other organizations with small ownerships.

Finding 2-5 *DOI agency leadership and staff, as well as State Foresters and conservation organizations, view LANDFIRE data as an asset and as a national data set they can rely on for their business needs.*

Finding 2-6 *Unfounded perceptions regarding data standards for planning and project analyses by Forest Service staff hamper the use of LANDFIRE data for these purposes.*

Finding 2-7 *Significant external events have created concerns regarding data quality and resolution issues not recognized by project staff during the “rollout” of LANDFIRE National data products.*

Finding 2-8 *A common perception that local data are always better (i.e., have greater accuracy and resolution) than national data sets pervades all agencies.*

Finding 2-9 *Because of their small size, many FWS and small NPS administrative units must expand the scope of their analyses to a larger land base to appropriately use LANDFIRE data.*

3.2.4. Appropriate use of LANDFIRE data products

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ The LANDFIRE website contains mixed messages regarding appropriate uses of data products. Although the website stresses that data sets are for strategic planning and policy analysis, examples of uses related to tactical fuels planning and other project-level applications are provided.
- ✓ Use of LANDFIRE data products to evaluate wildland fire incident strategies and tactics appear to conflict with advice not to use these data products for planning individual projects involving hazardous fuel reduction or ecological restoration.
- ✓ Many users and GIS analysts do not understand how to use LANDFIRE data products in raster format. These users are typically familiar with GIS vector formats and do not know how to convert data sets from raster to vector.
- ✓ A great deal of confusion exists over the use of 30-meter resolution data vs. typical project data with “finer” resolution. These concerns are often expressed in terms of data accuracy and resolution.
- ✓ Vegetation data developed by LANDFIRE are of sufficient accuracy and resolution to “drive” fire behavior models, but are not adequate for some ecological restoration and fuel treatment analyses.

Finding 2-10

Mixed messages regarding appropriate uses of LANDFIRE data products are being promoted from multiple sources including training materials, examples on the LANDFIRE website, and within communities of practice.

Finding 2-11

Expanded use of LANDFIRE data products is limited by technical GIS barriers that require user training.

3.3. DATA QUALITY

LANDFIRE is the only nationally consistent data set available for many wildland fire and conservation ecology applications and assessments and has evolved into a foundation for Federal wildland fire budget formulation and allocation. It is steadily increasing in importance and use, which was clearly hoped for and anticipated when it was chartered. Because of its increasing in importance and expanded use, data issues that reduce its utility or make it user “unfriendly” receive a higher profile level of concern.

Users are frustrated with the inability of LANDFIRE National data to reflect landscape disturbances in a timely manner. The use of LANDFIRE as the foundation for budget formulation and allocation has heightened user concerns over data resolution and accuracy.

Current LANDFIRE National data products do not provide enough detailed information on surface and canopy fuels needed as inputs to fire planning and fire effects planning tools used to develop information on potential fire intensity and fire behavior in some areas of the country. In most instances, fire behavior analysts can augment LANDFIRE national data with local data to support wildland fire operational decisions. Predicted fire behavior and fire effects assessments are essential to the development of scientifically sound fuel treatment and ecological restoration project proposals. Surface and canopy fuels information are typically developed using vegetation type and structure information.

A National Vegetation Classification Standard (NVCS) did not exist when the LANDFIRE project began in 2004. As such an ecological systems vegetation classification system was used as the basis for mapping existing vegetation. The decision to use ecological systems for mapping existing vegetation was reached carefully by the Executive Oversight Committee through an extended review process in 2005. This classification limits LANDFIRE's ability to provide vegetation composition and structure information at a level of detail needed to fully support land cover type assessments. More detailed (finer scale) existing vegetation data is critical to current and potential users of LANDFIRE data. As a result, Forest Service Regions are implementing approaches for mapping existing vegetation (vegetation cover types) to meet their needs outside of the LANDFIRE Program. The resulting products do not provide continuous landscape coverage and, in the long-run, will cost more.

Recently the Federal Geographic Data Committee (FGDC) developed a NVCS. LANDFIRE, in collaboration with other programs and partners is currently working on the vegetation classification at the division, group, macro-group level of the NVCS hierarchy and is working toward having it developed and available for future LANDFIRE Program mapping activities. The approach will be similar to the classification efforts LANDFIRE has provided during the project development phase including Society of American Foresters (SAF) and Society of Range Management (SRM) vegetation cover types.

3.3.1. Data resolution and accuracy

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Despite concerns, most users consider LANDFIRE data products to be a unique and valuable nationally consistent data set.
- ✓ LANDFIRE shouldn't be considered simply a mapping effort. The underlying data are even more valuable and can support a variety of other analyses. More needs to be done to make the intermediate data sets available. There are more uses yet to be explored for these data.
- ✓ More field plot data are needed in many areas to improve interpretation accuracy of remote sensing images. It is very important that Natural Resources Conservation Service (NRCS) soils data be made available for use to improve biophysical interpretations for grasslands and shrublands.

- ✓ Use and application of data sets helps identify issues with data resolution and accuracy. But as these issues are brought to the surface by data users, there is no formal process to catalog them and determine how and when to initiate corrections within the LANDFIRE Program.
- ✓ Shrublands and grasslands are particularly problematic. NRCS soils data would specifically address the problem and would reduce cost and improve quality.
- ✓ Plot information is not uniform and needs improvement. New plots are needed in specific vegetation types.
- ✓ The ongoing data calibration process is successful. It is essential to continue it and improve it, if possible.
- ✓ Fire behavior modeling using LANDFIRE data has identified a series of issues. In most cases, fire behavior analysts are aware of them and have developed correction procedures. A list of these data resolution and accuracy issues follow:
 - 1) There are several significant fuels classified as unburnable, including grassland and shrublands, agricultural lands, wetlands, and urban areas; however, on the ground, they are very burnable.
 - 2) Edge mapping between map zones is poor for a number of data layers. This contributes to the view that LANDFIRE National is a set of mapping zones and not a national data set – which it is and must be viewed as such.
 - 3) The most significant weakness seems to be vegetation structure data. Data for “height to live crown base” consistently underestimates crown fires in California and in the West in general. Crown to base height ratio can’t be assessed and verified for accuracy, which leads to errors in predicting fire behavior, and can’t be developed without better vegetation structure data.
 - 4) Fire behavior in fuel models 10 and 18 seems to be consistently underestimated. LANDFIRE data need improvement for use in FARSITE.

Finding 3-1

Use of LANDFIRE data as a foundation for budget formulation and allocation has heightened concerns over data resolution and accuracy.

Finding 3-2

Significant data issues still remain that prevent or reduce the intended use of LANDFIRE data products.

Finding 3-3

LANDFIRE National data can be significantly improved by using NRCS soils data as a basis for biophysical settings data and additional quality plot information for use in remote sensing interpretations.

3.3.2. Data currency

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Disturbances that affect data currency are many and include wildland fire, hazardous fuel and other vegetation treatments, urbanization and other land conversion, insect and disease outbreaks, tornados and other wind events, and other natural processes.
- ✓ Data within wildland fire management decision support systems that can be used to capture landscape disturbances travel on a “one-way street” with no automated feedback loop designed to provide information necessary for LANDFIRE program updates.
- ✓ There is a need to update data locally while ensuring consistent data standards are met.
- ✓ Information on fire perimeters and burn severity are collected as part of the Monitoring Trends in Burn Severity (MTBS) process and are the only example of an electronic linkage between wildland fire systems and LANDFIRE data updates.
- ✓ Specific data issues reside in the Great Lakes area. The half million acre Boundary Waters tornado blowdown event must be reclassified correctly, pine forests must be classified correctly, and the slash fuel model must be used properly.
- ✓ Moving to a continuously updated data set approach rather than a one time or periodically updated data set should be the objective.

Finding 3-4

LANDFIRE relies on cumbersome manual procedures, data calls, and interactions with users to obtain disturbance information used in the update process.

Finding 3-5

With the exception of MTBS, there are no electronic or system linkages between national wildland fire applications and LANDFIRE regarding disturbance information (e.g., perimeters, vegetation/fuel changes, etc.).

3.3.3. Data integrity and objectivity

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Computer processing is currently a problem. The vegetation succession modeling is too complex to consider using for a large area.
- ✓ There is a need for a long-term Science Advisory Group to help identify and evaluate potential program improvements.
- ✓ The Joint Fire Science Program can be used as a vehicle for promoting research and development.
- ✓ There is a need for the LANDFIRE management team to exhibit strong leadership skills in promoting and protecting the integrity of the program data products.
- ✓ Use of a tracking tool developed by Tobin Smail for tracking adjustments to LANDFIRE National data sets during calibration workshops provides essential metadata documentation and information that can be useful during the update process and future applications.

Finding 3-6

LANDFIRE Program managers and staff have effectively served as advocates for data quality and objectivity and have instituted procedures for tracking changes to LANDFIRE data sets as a result of data calibration workshops.

Finding 3-7

Incorporation of state-of-the-art science and technology are highly valued attributes of the LANDFIRE data products.

3.3.4. LANDFIRE should provide data reports and summaries

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ An important opportunity is being missed to provide state-level summaries in response to State Forester needs for information to support policy and program needs.
- ✓ FIA data reports are a key element in FIA success as a data provider and can be used as a model. User-defined reports would be useful and build support for the program.
- ✓ Many states have data clearinghouses. Connecting LANDFIRE with these would increase its use and state support.
- ✓ Researchers would like access to the data sets that went into the models.

Finding 3-8

There is an opportunity to develop standard reports and the capability for user-generated queries as a function of the future LANDFIRE program. This capability will expand user support for and reliance on LANDFIRE products.

3.4. COMMUNICATION AND MARKETING

Widespread use of LANDFIRE and the mix of expectations about its utility have created a demand for better communication of the program's scope and its operational requirements and limitations.

Questions from the user community abound, ranging from inquiries on navigating the LANDFIRE website, accessing the data products, and program updates and data accuracy. Customer service through improved communication is a fertile field for improvement as there are various areas of customer service that could be provided to further the goals of the program.

In general, user understanding and familiarity with LANDFIRE has come from casual and individual contacts. As LANDFIRE moves from the development stage to an ongoing component of the agencies' portfolio of decision support tools, more focus is needed on program communication.

3.4.1. Understanding, acceptance, and support

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Many Forest Service line officers are not aware of LANDFIRE's potential uses. Some have resisted supporting the program because of how the decision was made to fund the project and how this was communicated within the Forest Service. Internal Forest Service support for the program would grow with better understanding of the program and its utility.
- ✓ Other events outside the scope of the program have adversely affected support for LANDFIRE (e.g., Forest Service centralization of GIS skills, R6 decision to not fund resource aerial photography, Iron Honey 9th Circuit Court ruling on use of best data, etc.).
- ✓ There is a belief held by some that LANDFIRE is a one-time data product effort or project, not a data system that will persist and routinely updated.
- ✓ Some still harbor a view that LANDFIRE will be completed and then eventually "go away."

Finding 4-1

Despite many successful applications of LANDFIRE information across the country and across many agencies, LANDFIRE still lacks support in some specific geographic areas and agency organizational levels.

3.4.2. Website as a communication tool

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ It appears that the website was not purposefully designed, and rather became a collection of “bells and whistles.” Many users complained that key information was buried “below the fold.”
- ✓ A common perspective was that the LANDFIRE website is overly complicated and requires numerous steps to get to the data or downloads. The site’s current format is confusing to users who are not tech savvy.

Finding 4-2

The LANDFIRE website is an important communication medium and its success and utility are a key part of improving understanding and use of LANDFIRE data products.

Finding 4-3

Demands by project leadership and limited resources have caused the LANDIRE website to become unwieldy and difficult to navigate and in some instances may discourage use.

3.4.3. Communication of important project information

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ There was no one directly responsible for the role of communication within the LANDFIRE organization.
- ✓ There is widespread lack of understanding regarding expectations for LANDFIRE, including the potential for users to provide correction data for vegetation types. Expectations for data updates vary and often underestimate the opportunities to provide input to LANDFIRE.
- ✓ There are many unrealized potential uses of LANDFIRE, but marketing of the program has not been a priority. There is a need to demonstrate the potential value and applications of LANDFIRE data products to government and non-government decision makers.
- ✓ Users were frustrated by the lack of advance notice for update sessions, workshops, etc. In addition, data calls have been disorganized.
- ✓ Calibration workshops were by far the most effective form of communication, but not attended by the best cadre of local individuals because of lack of timely notice.

- ✓ There is no clear communication strategy or plan which addresses the appropriate uses of LANDFIRE data as well as the limitations of the data – and potential consequences of misuse.
- ✓ The concept of a helpdesk to field questions and concerns and to respond to users has been suggested as a possible method to resolve technical issues in a more timely fashion.

Finding 4-4

Appropriate uses for LANDFIRE data products are not clearly and universally understood, and the misapplication of program data may affect the quality of important decisions.

Finding 4-5

LANDFIRE relied on other organizations (e.g., NIFTT) for communications assistance and helpdesk services.

Finding 4-6

In general, poor program communication has negatively affected customer service and support.

3.5. TECHNOLOGY TRANSFER AND USER SUPPORT

The LANDFIRE Project development strategy was one that produced data and map products sequentially by geographic region. While some geographic regions were still under development, others had been completed and developing a significant user group. In addition, the LANDFIRE data and map products were mandated for use for other projects still in development, such as FPA and WFDSS. These dual, and often competing, missions placed an extra burden on participating scientists and project development staff. Users were wanting and, in some cases, expecting specialized instruction and support before full system development was complete.

This quickly emerging need was eventually recognized by the project development team, but little funding was planned for this purpose until the end of the development phase. As a result, user complaints were often minimally addressed and took a back seat to keeping project development on schedule. This became evident on the project website, where addressing individual issues rather than looking at systemic issues and priorities for resolution became the norm. This “squeaky wheel” approach created a website of “chaos;” a visual example of trying to be all things for everyone in an effort to resolve issues on an incremental basis.

Developing robust technology transfer mechanisms is more critical than ever as LANDFIRE transitions to the Program. The Fire Learning Network is a proven technology transfer mechanism supported by the FS, DOI, and TNC on an equal basis independent of LANDFIRE and should be part of the solution.

3.5.1. Web-based data delivery

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ University of Idaho FRAMES vs. USGS National Map; both have potential as data delivery sites.
- ✓ Data delivery notifications on the National Map page are not 'visible' to data users because they fail to read the information in the links on the page and/or don't know to look. Users go directly to the National map to begin viewing or downloading data.
- ✓ Downloads should be easier for users. Location of "buttons" on the LANDFIRE website should be re-evaluated.
- ✓ There is a need to communicate to the general users what data assets LANDFIRE provides and how to make use of them. Because the data and map products are free, there's an immediate demand – an eager user group ready to put them to use.
- ✓ The LANDFIRE website needs to be simplified and restructured as it is cumbersome and ineffective to use. New users often get frustrated before they get what they need. Experienced users eventually get proficient at finding what they need, but it takes much too long.
- ✓ LANDFIRE website design appears to be a result of responding to individual issues and requests, not an overall design. The LANDFIRE website is overly complicated and for data downloads requires the user to go through three pages before getting to the download source. Should be simpler.
- ✓ With web-based systems, data can be easily accessed from almost anywhere. The LANDFIRE website is never static and updates are available immediately.

Finding 5-1

While LANDFIRE data and products are readily available on the LANDFIRE website, most users have a difficult time finding what they need and downloading data and complete metadata.

3.5.2. Technology transfer

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Technology transfer is definitely a need. Many field users download the information but don't know how to use it or what it can be used for. Many users aren't willing to learn

about the technology and would rather rely on others to procure the data before using the data.

- ✓ Technology transfer is not a function within the LANDFIRE organization. A number of organizational entities provide technology transfer and training within the wildland fire community, but they're all functionally separate. These include: the Fire Modeling Institute (FMI) , National Interagency Fuels, Fire, and Vegetation Technology Transfer (NIFTT) Team, the Fire Research and Management Evaluation System (FRAMES), the Fire Learning Network (FLN), the Joint Fire Science Program, and the 401 Series Training Program.
- ✓ LANDFIRE doesn't have a technology transfer program to consider courses, extension teaching, and partnerships with universities.
- ✓ Technology transfer is essential – for data, models, and tools (the NIFTT suite of GIS tools is an example of what's needed).
- ✓ Technology transfer via the TNC fire learning network (FLN) is an option to examine. The FLN is supported by the FS, DOI, and TNC on an equal basis independent of LANDFIRE. LANDFIRE is being used in 90%+ of the projects in the FLN. How can the FLN assist with LANDFIRE technology transfer?
- ✓ Technology transfer is a weak area that needs to be shored up. Consider the use of technical assistance teams similar to those used by the Fire Modeling Institute.
- ✓ Technology transfer is a two-way process of communication. There are many ways to deliver technology, but there's a need to listen to users to make improvements that meet their needs and that take advantage of the user network and its broad range of experience.
- ✓ Raster versus vector analysis has been a big issue for some users, requiring training to overcome. Users now appear to prefer raster for their assessment processes and have moved away from vector for that scale.

Finding 5-2

LANDFIRE developed a large user group well before the end of the development phase. This created a premature need for technology transfer that wasn't adequately supported.

Finding 5-3

Within the interagency wildland fire community, a number of organizational entities provide technology transfer and training, but they're all functionally separate.

3.5.2. Training and guidance on appropriate uses

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ There appears to be confusion among some users regarding appropriate uses of LANDFIRE and associated website emphasis of some applications.
- ✓ Many users have successfully applied LANDFIRE data to finer-scale modeling applications, but there's no readily available centralized location from which to learn what other users have done to modify the data in this way or to resolve problems similar to theirs.
- ✓ Training needs to be comprehensive regarding how to apply LANDFIRE methodology and data to individual field units' issues and needs. A consulting team is needed to make better use of LANDFIRE products by local units.
- ✓ LANDFIRE makes it easy and tempting to use the data at scales it was never designed for; using it out of context. Users need to take a step back and refocus on proper methods and procedures for using LANDFIRE data.

Finding 5-4

Insufficient training and guidance on data limitations are leading to misuse of LANDFIRE products.

3.5.3. Direct assistance technical support

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ The calibration workshops demonstrated the effectiveness and importance of direct interactions between the user community and the LANDFIRE staff.
- ✓ Getting data correctly formatted for use once downloaded from the website is a skill best learned through direct assistance.
- ✓ TNC's Fire Learning Network is an effective way to get good peer to peer interactions and discuss innovative uses of LANDFIRE data.

- ✓ “Elbow-to-elbow” opportunities are an essential aspect of technology transfer.
- ✓ No one is available to provide assistance; users are on their own.

Finding 5-5

LANDFIRE users found direct assistance technical support (hands-on, face-to-face) an essential component of their learning experience

Finding 5-6

A national technical support team of experts with skills and knowledge to resolve LANDFIRE data and application issues at the GACC level is needed.

3.6. A FUTURE VISION FOR LANDFIRE

As the LANDFIRE Project emerges from the development stage, there is an enormous opportunity to redefine, or to better define, the intent and the scope of the program.

While the initial LANDFIRE charter did an adequate job of describing the scope of the project for the start up and development stages, new information exists now about the potential utility of the program for a variety of uses and how well it meets the objectives that were stated in the charter.

A vision and strategic plan for the program would be beneficial at this juncture to amend the original charter and to choose between maintaining the current focus, or expanding the scope of the program and drawing in more partners. Such a strategic document could define a course going forward that better meets the needs of the program sponsors, as well as addressing some of the increased demand in the field for GIS-based natural resources information. A clearly defined vision could also help to resolve some of the many issues centering on appropriate application of the data.

The emerging demands for LANDFIRE are significant and the possibilities are great. And that is a tribute to the LANDFIRE Program.

3.6.1. Need for a vision

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Popular view is that LANDFIRE lacks a contemporary vision.
- ✓ A vision is necessary to evaluate the tradeoffs which will be required to balance users’ needs and users’ wants.
- ✓ A vision can drive an updated strategic plan, which will determine how best to meet the sponsors’ business needs.

- ✓ There is no list of data business needs in the current charter. There needs to be a place where one can find a clear and specific definition of the purpose and business areas supported by LANDFIRE.
- ✓ Without a clear vision, LANDFIRE could find itself “chasing rabbits” that lead it well away from the expectations of stakeholders.

Finding 6-1

The lack of a contemporary vision for the LANDFIRE Program constrains its future utility and may contribute to significant inefficiencies as well.

3.6.2. Benefits of LANDFIRE vision and strategic plan

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ A vision and strategic plan are needed to define the ultimate scope of the LANDFIRE Program.
- ✓ A strategic plan is needed to guide development of the LANDFIRE Program organization.
- ✓ A well defined vision and strategic plan can help resolve the inevitable tradeoffs associated with choices of thematic resolution and data accuracy.
- ✓ The potential LANDFIRE might provide to support business needs for resource management outside of the fire community can be best addressed in the context of a well defined vision and strategic plan.
- ✓ The current emphasis on landscape conservation strategies is a prime example of how LANDFIRE can contribute to an evaluation of policy and management options across multiple ownerships or jurisdictions.

Finding 6-2

A vision and strategic plan for LANDFIRE, including a well-defined purpose and scope, would be valuable in the transition of the program from the development stage to the operational stage.

3.6.3. Choices: we’ve come to the fork in the road

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ LANDFIRE can be a strategic planning and monitoring platform, or it can remain a data input source for wildland fire applications

- ✓ LANDFIRE could be improved upon to better provide for the monitoring of climate change effects, insect and disease epidemics, etc. This type of expanded role for LANDFIRE could be reflected in a strategic vision.
- ✓ LANDFIRE can serve as a monitoring system to track FRCC changes provided local data can be used in the update process.
- ✓ Use of FRCC as a common method for characterizing wildland fire's role in ecological systems and to measure departure from natural conditions does not apply to all systems, particularly those in the east. Concerns also exist for the use of this methodology for some western ecological systems as well as difficulty in translating this concept to site-level application.
- ✓ LANDFIRE's transition to an ongoing program may be a golden opportunity to establish national standards for data collection.
- ✓ There are regions that are currently developing data at finer scales for project-level planning. The LANDFIRE transition is an opportunity to establish a method by which to link or crosswalk LANDFIRE to regionally-based finer-scale data.
- ✓ There is a great deal of confusion and some dissatisfaction over the methods chosen to describe vegetation (e.g., existing vs. potential natural vegetation).

Finding 6-3

Emphasis on and the growing demand to address landscape conservation and climate change effects monitoring will increase use and demand for LANDFIRE data.

Finding 6-4

There is a great deal of demand for finer-scale data in general, specifically existing vegetation cover and structure, to support other planning and monitoring needs. Some of this demand is being met via Forest Service Regional mapping efforts that do not provide continuous landscape coverage and different classification systems and standards.

Finding 6-5

Critical decisions must be made soon regarding the future course of LANDFIRE. These are best done in a clear and comprehensive manner in a strategic planning process.

3.6.4. Future organization and operations

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ A revised charter from WFLC could contain or preface a vision for the LANDFIRE Program.
- ✓ Consideration of the future organizational design is an important part of the LANDFIRE vision. It would allow for using the “form follows function” principle.
- ✓ A clear vision would facilitate management of the scope of work and management of expectations – two highly important aspects of future program operations.
- ✓ There are potential partners out there who could assist in developing a LANDFIRE vision and strategy.

Finding 6-6

Clearly defined sideboards for the scope and intent of the LANDFIRE Program, as well as for the function of the organization, could help to alleviate some of the mistaken expectations for LANDFIRE and provide a basis for evaluating organizational design and function.

3.7. FOUNDATION FOR LANDSCAPE CONSERVATION

The recognition of the necessity to address landscape conservation issues is growing and is articulated at many levels. Data to address landscape conservation issues must be available across all ownerships to be effective. The Secretary of Agriculture’s vision “to concentrate on and accelerate restoration of all landscapes, on all lands” may prompt initiatives that would use LANDFIRE’s nationally consistent products.

Providing key data products needed to support business needs associated with landscape conservation issues will require additional partners and program support. Fortunately, potential partners associated with establishing this capability abound and are willing to provide program support.

Climate change assessments and monitoring are likely to increase rapidly, as are systems to keep track of carbon associated with cap and trade systems. Large fires across multiple ownerships will clearly continue to be a major stressor on the landscape. The common denominator will be the growing need for national wall-to-wall consistent data. LANDFIRE, if properly positioned for the future, can fulfill an important national need.

3.7.1 Addressing landscape conservation issues

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ LANDFIRE has done a good job of providing consistent data to evaluate and manage the effects of wildfire, a primary stressor of the landscape.
- ✓ LANDFIRE was used as the basis for an important paper by TNC on the status of Oregon's forests that elaborated on FRCC status statewide. It showed that 13 million acres are categorized in FRCC 2 and 3 and calculated annual acreage treatments needed to improve condition class.
- ✓ The LANDFIRE platform also provides a basis for evaluating policy and management changes for other large landscape stressors such as insect and disease outbreaks and for looking at the effects of climate change on vegetation.
- ✓ In the face of climate change, LANDFIRE may help to capture a needed sense of urgency, given that a significant percentage of western watersheds are in FRCC 2 and 3.
- ✓ More aquatic information will be important to protect riparian areas and water resources that will be affected as climate change proceeds.
- ✓ LANDFIRE can help prioritize for treatment riparian areas and critical watersheds.
- ✓ Data accuracy issues that hamper these uses must continually be addressed.

Finding 7-1

LANDFIRE has shown that it can help meet the growing demand to address landscape conservation issues.

3.7.2. Partnerships and program support opportunities

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ LANDFIRE data can help develop wildlife habitat conservation plans in those instances where issues span multiple ownerships and administrative units.
- ✓ LANDFIRE provides a nationally consistent format for monitoring changes in condition class on all lands and is being used for statewide and regional assessments.
- ✓ Universities are using LANDFIRE for a variety of applications. Graduate students and others are taking advantage of LANDFIRE data in a wide variety of studies. Many of these investigations are well beyond the original notions of how LANDFIRE data could be used.

- ✓ TNC is a large-scale and critical national supporter and user of LANDFIRE data. TNC uses the data in innovative ways and is providing national training and application opportunities.
- ✓ Large private-sector companies such as Sanborn, Inc. go to LANDFIRE to fulfill contractual commitments that involve all lands' data. Sanborn is using LANDFIRE for its role in the West-wide Wildfire Risk Assessment.
- ✓ Many users (states and NGOs for example) see LANDFIRE as a kind of "gift" of previously unavailable data that can help to evaluate conservation issues across borders and boundaries.

Finding 7-2

LANDFIRE has clearly found a wide range of committed users who could be potential long-term partners and program supporters.

3.7.3. Data system linkages and integration

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ LANDFIRE used plot data resident in over 120 different systems to develop the basis for remote sensing image classification. Key data sets included: Forest Inventory and Analysis, FWS-GAP, the Forest Service Natural Resource Information System, and BLM rangeland plot information. These data were essential to the LANDFIRE development process.
- ✓ Detailed NRCS soil survey information could not be obtained to assist with the development of biophysical setting data sets. As a result, shrublands and grasslands – which depend on accurate biophysical setting information – exhibit the highest variability of data quality.
- ✓ While the proper use of 30-meter resolution LANDFIRE data is at the state-wide or regional level, LANDFIRE data can be modified, with caution, to support more tactical-level modeling.
- ✓ There is an opportunity to better link LANDFIRE and the Forest Service's Natural Resource Information System (NRIS) plot information during the update process. NRIS is only applicable to National Forest System (NFS) lands which fall short of the nationwide application of the LANDFIRE Program. Similar data sets associated with land cover change are available as parts of NRCS's National Resource Inventory, but these data were not available for use by LANDFIRE.
- ✓ Opportunities exist to link INFORMS (an NRIS generic vegetation modeling and planning tool) to create wall-to-wall vegetation data at the National Forest scale using nearest neighbor technology with the Forest Vegetation Simulator (FVS). INFORMS is a project-scale planning tool that could be used to support ecological restoration and fuel treatment project analyses.
- ✓ LANDFIRE is not electronically linked to landscape change outcomes captured by other national wildland fire decision support tools. LANDFIRE provides input to these systems, but

the resulting decisions and monitoring information are not electronically “plumbed into” LANDFIRE update processes.

Finding 7-3 ***Links to data and information used in LANDFIRE updates developed by other wildland fire applications need improvement. Opportunities to integrate with other data systems are real and significant.***

Finding 7-4 ***The inability to use NRCS soil survey information and land cover change data is a serious weakness in development of biophysical setting interpretations used to develop LANDFIRE fuels information for shrublands and grasslands..***

Finding 7-5 ***Better plot data associated with shrub and grasslands can result in substantial improvements in the accuracy of LANDFIRE products.***

3.7.4. Priority data product improvements

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Nationally consistent land cover information, which includes dominant vegetation type, vegetation structure, and other existing vegetation data, is needed to support a wide variety of business needs. Because development and refinement of the National Vegetation Classification Standard was not resolved before the project began, LANDFIRE does not have a classification system it can use that has been adopted by the FGDC. As a result, the use of higher order classifications in the FGDC vegetation classification system has created a number of issues identified by users:
 - 1) Existing vegetation data is often ambiguous and contains perceived errors because of the more general nature of the data classes mapped.
 - 2) The most significant weakness associated with the current existing vegetation data is a coarser scale description of dominant vegetation and structure.
 - 3) Many Forest Service regions are now gathering existing vegetation data using classification systems that have not been adopted by FGDC. As a result there is no crosswalk or standard way to incorporate these data into LANDFIRE.
 - 4) Most users associate the LANDFIRE vegetation data products with finer scale vegetation cover mapping; however, the resolution of existing vegetation data products developed by LANDFIRE are not equivalent.

Finding 7-6

There is a significant demand for improved information on existing vegetation composition and structure not presently provided by LANDFIRE. This demand cannot be met until the FGDC vegetation committee adopts standards appropriate to that scale of the National Vegetation Classification System.

Finding 7-7

A significant split remains between the analysis needs of the ecologist and range conservationist community and information currently provided by the LANDFIRE existing vegetation data products.

3.8. FUTURE ORGANIZATION AND GOVERNANCE

The Wildland Fire Leadership Council initiated and chartered the LANDFIRE Project in response to the collective need to provide a consistent national data set for all ownerships and jurisdictions to support decisions facing the wildland fire management community. The LANDFIRE charter specified the organization and governance structure associated with the project and was designed to provide oversight and management of this multi-party effort.

A number of other nationally supported wildland fire applications have evolved and been deployed that rely upon LANDFIRE data: the Wildland Fire Decision Support System, the Hazardous Fuels Prioritization and Allocation System, and Fire Program Analysis. Developing a coordinated and effective system of tools for wildland fire managers requires executive engagement and focus on the governance and coordination of this system.

Other natural resource management issues are creating a demand for data and analysis tools that are, like LANDFIRE, consistent across landscapes regardless of administrative jurisdiction. LANDFIRE data products are often being used to address these issues. A growing number of users outside the wildland fire management community are using LANDFIRE data products and are asking for a “place at the table” regarding governance and oversight of the program. A number of these users are willing to provide direct program and political support for an expanded LANDFIRE program.

3.8.1. Governance and organization

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ A clear vision or strategic plan for LANDFIRE does not exist that describes the purpose and business needs supported by LANDFIRE. As such, there is no way to effectively evaluate governance and organization structures.

- ✓ A fundamental question is whether LANDFIRE can serve as the foundation for a multi-purpose monitoring and data platform or should be focused on the support to wildland fire applications – or both.
- ✓ Synchronization of LANDFIRE’s data products and data updates with other wildland fire decision support tools, including WFDSS and FPA, must be managed and coordinated at levels beyond the LANDFIRE Program.
- ✓ The need exists for executive-level oversight, but it should stay focused on strategic issues such as national budget, framing the mission, integration with other systems (FPA, WFDSS, HFPAS), etc.
- ✓ Most think it a good idea to consolidate executive oversight for all wildland fire systems...having only one group rather than several. It should be a mix of executives from both the management side and the science side.
- ✓ Prior to the production of LANDFIRE National data products, a consistent national data set to support wildland fire management as well as other resource management issues did not exist. The goal was to bring everyone to a common “data floor.” Issues associated with LANDFIRE products have now shifted to data currency, resolution, and accuracy, as well as consideration regarding how to accommodate different levels of accuracy and resolution above this data floor.

Finding 8-1

Governance and organization problems addressed by the initial LANDFIRE governance structure and organization have changed. A robust consideration of issues facing the future program is needed.

Finding 8-2

Organizational and governance design requires a clear decision on whether to support other resource management functions. Without a clear strategic plan, organizational designs cannot be properly evaluated. There is no basis for “form follows function” from a design standpoint.

Finding 8-3

Consolidated executive oversight for all wildland fire information applications is widely supported.

3.8.2. Organizational transitions

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ The transition from the prototype phase of LANDFIRE to full-fledged production was poorly managed. Production procedures were not developed for all data products and processing procedures until the early stages of production. As a result, initial mapping zone data needed to be re-worked. Some production procedures were “tuned-up” during the production phase and resulted in data delays and a departure from the production schedule.
- ✓ Staffing and production team leadership were provided by RMRS and other units from the prototype effort without a change in organizational structure, supervision, or assignment. This created ambiguity regarding responsibilities and use of employment authorities that constrained later stages of the production effort as well as leadership roles.
- ✓ The transition from project production to a Program providing for operations and maintenance activities faces some of the same issues regarding the “hand-off” from the current production team to the USGS Center for Earth Resources Observation and Science (EROS). Some feel that EROS isn’t ready to “catch the Program ball.” No governance or organizational structure is in place within EROS.
- ✓ EROS has world-class expertise in remote sensing and mapping, but lacks expertise and a connection to wildland fire users. Keeping users involved and grounded is the key and we will lose that connection if the LANDFIRE Programs transitions solely to EROS.
- ✓ Data services and data delivery can be effectively accomplished by the USGS National Map, but the USGS cannot provide user support for LANDFIRE data products.
- ✓ Program leadership and user connections must be maintained within the sponsoring agencies. Program production work can be “contracted” to EROS, but project leadership cannot without serious consequences to the program’s future.

Finding 8-4

Maintaining user and subject matter connections and agency leadership of the future of the program is critical to continued success.

Finding 8-5

Significant concerns exist with respect to the capability of EROS’ ability to support the LANDFIRE Program to provide for O & M activities.

3.8.3. Existing and expanded partnerships

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ Effective partnerships were essential to the development of initial LANDFIRE products and overall success. These partnerships will continue to be important as innovation and enhancements to the program are made and must be maintained.

- ✓ The Nature Conservancy has played a key role in accomplishing development of the LANDFIRE National data products and has provided effective technology transfer via the Fire Learning Network.
- ✓ The Forest Service has developed an inventory and monitoring plan for assessing climate change containing information that may be useful for LANDFIRE governance and organizational decisions.
- ✓ Opportunities for expanded partnerships to support the future LANDFIRE Program abound. Climate change, landscape conservation initiatives, and other efforts that rely upon consistent data across all ownerships and jurisdictions will continue to increase demand for LANDFIRE data products.

Finding 8--6 Partnerships with non-governmental organizations provide a solid basis for program support over the long term.

Finding 8-7 A critical decision regarding LANDFIRE's role as a data provider vs. supporter of wildland fire decision support systems will influence opportunities for future partnerships. Substantial opportunities exist for expanded partnerships and program support; however, an expanded scope creates additional complexity associated with program governance.

3.8.4. User connections

Observations based on the perspectives of those interviewed or the authors of documents reviewed:

- ✓ User support and technology transfer were not a priority during the development of the initial data set, but they are now fundamental to the realization of LANDFIRE's full potential. The support of users for program enhancements and improved data products will provide a solid basis for the future LANDFIRE Program.
- ✓ Advisory groups will play a major role in stimulation of improvements and innovation.
 - A technical advisory group could provide linkage with the latest technical advances in sampling, data management, remote sensing, and other key areas critical to making improvements to LANDFIRE.
 - A user advisory group could assist LANDFIRE managers in improving customer service and accuracy of LANDFIRE products.
- ✓ Most interviewees think that LANDFIRE will need a specific technical advisory group. Some suggested having a LANDFIRE regional technical specialist position at each GACC

(interagency) and then the national group should have representation from the regional specialists in addition to scientists and “super-users.”

- ✓ The Forest Inventory and Analysis program (FIA) uses a combination of user groups and forums to keep users abreast of program changes, issues, and products. These forums create a direct connection with users and provide opportunities for FIA staff to see how data are being applied.
- ✓ The FIA program organization uses a national steering team consisting of executives from different user communities and program staff in conjunction with a management team having a similar composition. The executive team focuses its efforts on program strategy and focus while the management team devotes its efforts to the consideration of technical issues and changes to program execution.
- ✓ FIA also uses Technical Bands, including an active Research and Development program to evaluate changes in methods, incorporate new technology and science, and integrate into the ongoing program of data collection.
- ✓ WFDSS has established data stewards in different regions to review and certify changes to GIS data sets used in application. This system creates a network of regional contacts that users can interact with and allows for local data to be incorporated into the national system.
- ✓ A well-defined linkage between LANDFIRE and Research and Development in the future organization is important. R & D will fuel technological growth and maturity of the program. However, the interface between R & D and the LANDFIRE organization must be closely managed.

Finding 8-8

User confidence and support play an increasing role in the future LANDFIRE Program. Users have a strong desire to be actively engaged in shaping the program’s future.

Finding 8-9

Opportunities exist to provide common technical and administrative support to LANDFIRE, WFDSS, FPA and other wildland information systems. Examples include: communications and marketing, IT compliance, budget and program development, and administrative support.

4. RECOMMENDATIONS

LANDFIRE Program staff and leadership are to be commended for accomplishing project objectives on time and within budget. The initial project effort exhibited strong leadership, attention to project management principles, attention to data quality and integrity, and use of science-based methodologies. The working relationships and partnerships developed in the LANDFIRE Project provide a solid foundation for Department of the Interior agencies, the USDA-Forest Service, and The Nature Conservancy to establish a robust and effective LANDFIRE Program.

This section provides recommendations for consideration as Department of the Interior and Department of Agriculture leaders and executives consider future LANDFIRE Program options and opportunities. The information is organized into three parts:

- (1) **Principal recommendations** – Priority actions and the approach recommended for their implementation;
- (2) **Detailed recommendations and actions** – Specific actions recommended by the GME team; and
- (3) **Performance assessment** – Evaluation of expected performance associated with the transition to different program options.

The window of opportunity to initiate implementation of the recommendations described below is limited. In general, the GME team’s recommendations should be addressed within the next 3-6 months to take advantage of opportunities for expanded support to the program and most importantly establish an organization structure to ensure the future success of the LANDFIRE program.

4.1. PRINCIPAL RECOMMENDATIONS

Recommendations presented in this report should not be considered as a “punch list” of actions that will make improvements in the LANDFIRE Program, but rather as a series of sequential decisions that set the stage for addressing many of the more significant issues encountered (e.g., organization design, project governance, data quality and use, etc.). Issues of budget commitment, stability, and responsibility will need to be addressed in conjunction with these recommendations.

4.1.1. Vision and scope: Develop a contemporary vision and program strategy

The success of the program has generated a significant demand for new LANDFIRE-related products. Natural resource and data management issues that served as the foundation for initiating the LANDFIRE Project have changed during the intervening years. A critical decision must be made soon regarding LANDFIRE’s role as a data provider for a broad range of users (the “LAND” in LANDFIRE) vs. a more narrow focus that supports of wildland fire decision support systems as its primary mission (the “FIRE” in LANDFIRE).

As a first step, a vision must be detailed by the program sponsors and partners, preferably at the executive level, to affirm the purpose of LANDFIRE and to establish sideboards for the future scope of the program. Then, a strategic plan must be developed to set goals and objectives for the program to carry out the vision of the sponsors and partners.

Completion of the initial LANDFIRE National data set provides the opportunity to consider expanding the scope of the program. Development of a more detailed existing vegetation cover data layer would exponentially increase the usefulness of LANDFIRE for both wildland fire management and other resource applications. However, this data product can not be developed until the National Vegetation Classification Standard has been completed and been adopted by the FGDC vegetation data subcommittee.

LANDFIRE should provide the institutional baseline for monitoring the effects of climate change on natural resources, and this isn't possible without consistent data on current vegetation cover at finer scales. This expanded scope will solidify the role of the LANDFIRE Program as a provider of continuous and consistent high quality data products needed to address national and regional conservation issues.

4.1.2. Organization and governance: Assess coordinated governance and organization design

Organization and governance of the LANDFIRE Program must be responsive to the vision and scope defined by agency leadership. Although substantial opportunities exist for expanded partnerships and program support, an expanded scope creates additional complexity associated with program governance.

Strong sponsorship and program leadership are needed at multiple organizational levels to ensure continued success of the LANDFIRE Program. Clearly, overall executive leadership and governance of LANDFIRE and other national wildland fire decision support systems should be combined. The composition of the resulting governance structure must include representation of primary sponsors, partners, and user constituencies.

The LANDFIRE Program should be organized to support its primary mission of providing high quality, objective data products needed to support wildland fire management and landscape conservation approaches and initiatives.

LANDFIRE should be managed by a permanent agency organization that represents the business needs of the sponsoring agencies and partners. "Project management" principles should continue to be used by this organization to ensure production and cost-management objectives are met.

4.1.3. Data quality and integrity: Establish LANDFIRE National data as a base federal program

LANDFIRE data standards and data products should be adopted by wildland fire leadership (e.g., Wildland Fire Leadership Council, National Wildland Fire Coordinating Group, National Association of State Foresters, etc.) as a “base Federal program” and as national data standards for supporting wildland fire management. The following must be associated with this action:

- Transition to the use of national data standards and base federal program must be a significant organizational event to emphasize the importance of adopting standards and to provide visible support for the program.
- Establish national data standards through the Federal Geographic Data Committee. (Note: this is being done indirectly by the use of the USGS National Map as a primary data delivery point.)
- Relationships between national data standards and local data thematic standards and resolution must be well described and communicated.

Make a coordinated and focused effort to improve the quality of the LANDFIRE data and the processes that exist to incorporate better information that can be provided from field users. Ensure that NRCS soil survey data is incorporated into the LANDFIRE production procedures to improve the accuracy of data products for grasslands and shrublands.

Data and resolution accuracy issues exist, and the demand for more detailed existing vegetation data cannot be met. We recommend a commitment to addressing the issues and a coordinated effort to seek resolution of issues prohibiting the FGDC vegetation subcommittee from adopting a data standard for existing vegetation data products. Failure to do so will result in other systems being developed to provide existing vegetation data that do not meet a common standard, address only part of the landscape, and will cost more over the long run than using the LANDFIRE organization to provide this data product for all lands to a common standard.

4.1.4. Communication: Improve coordination and marketing

A dedicated communication and marketing effort is essential to realize full potential, expand the user community, and to improve customer service. Multiple events have contributed to less than favorable views of the project and its products. Communication of program goals, objectives, and status took a back seat to production at the same time a growing constituency of users was seeking better information. This coupled with direction to use LANDFIRE as the basis for FPA and WFDSS have exacerbated concerns over confidence in national data sets and support of the project. Improvements in the support of wildland fire management decision making and other applications as a result of using LANDFIRE data should be profiled and shared with users and agency leaders

A communication strategy must include a clear recognition of the LANDFIRE brand-name as being a fully collaborative effort between federal government and non-government partners, including The Nature Conservancy.

The LANDFIRE website is viewed as a primary medium for communicating information about the program; however, it can be substantially improved and serve as a foundation for communicating with potential users and partners. Those seeking access to LANDFIRE and data downloads face a complex series of steps and often do not obtain important notifications (data alerts) about the data sets accessed. The website should be redesigned to meet current user demands.

The LANDFIRE data delivery system must be universally accessible to all user groups in an intuitively positive format that accommodates greatly increased use and is highly responsive to user recommendations for improvement.

4.1.5. Technology transfer and user support: Establish a coordinated technology transfer program

LANDFIRE Program needs to include a robust technology transfer program fully coordinated with other wildland fire systems that can keep pace with the growing reliance on LANDFIRE products to address evolving agency and partner business needs.

Technology transfer, training, and user support mechanisms for all wildland fire management systems, including LANDFIRE, must be fully integrated, using proven methodologies like those provided through the Fire Learning Network and Fire Modeling Institute.

Technology transfer support to multiple wildland fire applications should be organized under a common and coordinated structure. The technology transfer methods used by the Fire Learning Network and Fire Modeling Institute should serve as the core of this program.

4.1.6. Organizational transition: Plan for and execute an effective organizational transition

Throughout its history, the LANDFIRE Program has endured a number of organizational transitions that were poorly executed. The transition from development and deployment of the initial LANDFIRE National data products to operations and maintenance is an event that must be well managed. Not only must a permanent agency organization be fully defined, it must also be fully staffed and affiliated with a DOI or FS organization “host” and operational at the beginning of the transition.

4.2. DETAILED RECOMMENDATIONS AND PROPOSED ACTIONS

Specific recommendations and proposed actions associated with each of the six principal recommendations have been identified by the GME team or have been suggested by those interviewed. Findings presented in Section 3 that support these recommendations and actions are referenced to provide background to reviewers.

4.2.1. Vision and scope

Development of a strategic plan for the LANDFIRE Program provides opportunities to secure program sponsors and partners. This effort can also serve as the basis for gaining the assistance of universities and scientists who were instrumental in the genesis of the LANDFIRE concept.

- a. Proposed action: Development of a program strategy can benefit from a well orchestrated conversation or “LANDFIRE futures forum” involving existing and potential stakeholders. This forum could be conducted by the universities of Idaho and Montana in cooperation with The Nature Conservancy and should serve as a basis for defining the program’s vision and scope. This effort must be accomplished within the next 3 - 6 months to allow the integration of production changes into the current schedule of updates.
- b. Proposed action: Investigate how to assist the FGDC vegetation subcommittee’s efforts to adopt the National Vegetation Classification Standard necessary to support development of existing vegetation data products by LANDFIRE at multiple levels (scales) within the NVCS hierarchy.

Supporting findings: 1-1, 1-2, 1-10, 2-3, 2-4, 2-5, 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 7-1, 7-2, 7-7, 8-1, 8-2, 8-7, and 8-8

4.2.2. Organization and governance

Organizational and governance design require a clear decision whether to support other resource management functions. Without a clear strategic plan, organizational designs cannot be properly evaluated, and there is no basis for “form follows function” from a design standpoint.

- a. Proposed action: Do not engage in organizational design and evaluation without first understanding the vision and scope of the future program. Vision and scope will emanate from the agency executives and be detailed as goals in a strategic plan.
- b. Proposed action: The vision and resulting strategy should be adopted by the Wildland Fire Leadership Council. The implementation plan and organizational charters that support the vision and strategy should be defined by agencies and partners involved in the Executive Oversight Committee.

Significant concerns exist with respect to the capability of EROS Data Center’s ability to support LANDFIRE operations and maintenance. Of primary concern is the ability of EROS to maintain connections to primary users and subject matter experts. Concern also exists over access to the skill sets and career ladder opportunities for those involved in the LANDFIRE organization and other wildland fire management systems.

- c. Proposed action: Conduct a formal evaluation of the options available for housing and maintaining the LANDFIRE maintenance functions before moving forward on the proposal to use EROS/USGS as the single organizational “host” for the LANDFIRE program. This evaluation should consider the candidate organization’s capability to support LANDFIRE operations and maintenance with subject matter experts and the ability to maintain connections to primary users.

Program leadership and supporting functions must be organized to employ project staff and contributors where their strengths can be best used. A permanent agency organization is needed to provide core program oversight and functions.

- d. Proposed action: A permanent LANDFIRE Program staff must include the following positions and organizational functions:

- **Project leadership** – Permanent agency leader(s) with direct program oversight, accountability, and leadership authority.
 - **Program support** - Project management, communications and marketing, administrative and business support, and IT system compliance
 - **Innovation and improvement** - Production method improvement, incorporation of emerging research and science, and linkages to existing and new applications
 - **Production and deployment** - Updates to LANDFIRE National data products, data distribution and delivery, and data stewardship, including QA/QC procedures
 - **Technology transfer** – Training, user support and helpdesk, coordination with other applications/tools and identification of user needs
 - **Technical development** - Refinement and testing of production methods and recommended production updates and sequencing, and change management proposals
- e. Proposed action: Take advantage of the transition of wildland fire management applications from development to operation and maintenance to provide common support services to wildland fire management applications and programs. These opportunities include: business and administrative support; communications, including website support; technology transfer and user support; coordinated innovation and improvement, including a research and development program; and project management services, including compliance with information management procedures and requirements.

User confidence and support play an increasing role in the future LANDFIRE Program. These relationships are critical to sustained LANDFIRE Program success. The LANDFIRE Program needs to be supported by subject matter advisors and formalized relationships and roles with field users. This focus extends beyond the wildland fire management community to a growing

constituency of users that must be provided an opportunity to express their needs and their consideration in the future LANDFIRE Program.

- f. Proposed action: Future organization of the LANDFIRE Program should consider the use of best practices employed by other successful national programs (e.g., Forest Inventory and Analysis) to maintain connections with users and explore program enhancements.
- g. Proposed action: A national technical advisory team needs to be established to provide a mechanism for proposing solutions to highly technical national data and application issues.
- h. Proposed action: Establish technical leads at each Geographic Area Coordinating Center to provide consistent technical leadership, data stewardship, and expert advice to users.

Supporting findings: 1-6, 1-7, 1-8, 1-9, 1-11, 2-4, 4-5, 7-2, 8-1, 8-2, 8-3, 8-5, 8-7, and 8-9

4.2.3. Data quality and integrity

Data quality and objectivity are essential to the future LANDFIRE Program if these data are used as the basis for program formulation, budget and target allocation, and wildland fire operational support. LANDFIRE data integrity and objectivity must be a cornerstone of the program.

- a. Proposed action: LANDFIRE Program managers must be staunch advocates for data quality and integrity. Allegiance to these principles should govern day-to-day as well as strategic program decision making.

LANDFIRE data products must be dynamically and continuously improved rather than rely on episodic decadal re-mapping and a static update schedule. Data quality issues associated with FPA and WFDSS as well as other emerging uses demand data currency.

- b. Proposed action: Updates must be triggered by landscape-level disturbance information in addition to routine data update schedules. These “triggers” may require a sensitivity analysis be conducted by primary LANDFIRE data users (e.g., FPA) to identify the level of disturbance that affects the outcomes of primary downstream users. Abandon decadal re-mapping efforts in favor of dynamic and continuous updates.
- c. Proposed action: Consider the use of the Fire Research and Management Exchange System (FRAMES) as the common repository for all GACC data layers used in wildland fire decision support systems and as a source for LANDFIRE updates.
- d. Proposed action: Linkages between wildland fire decision support systems and operational data must be established to reduce cumbersome manual processing methods to account for landscape disturbance. Principal system integration connections include:
 - NFPORS – fuel reduction and other vegetation treatments
 - WFDSS – wildland fire management operations

- MTBS – burn perimeter and severity for large wildland fire events
- Annual Forest Health Protection insect and disease mapping
- Urbanization and land conversion information developed by FIA and/or NRCS.

Innovation and improvement must be an integral part of the LANDFIRE Program and can benefit from independent development efforts. However, this effort must be coordinated with the needs of other wildland fire decision support systems and program enhancements made using a rigorous change management system.

- e. Proposed action: Investigate use of the Joint Fire Sciences Research Program for providing coordinated research and development associated with production methods and their synchronization with wildland fire decision support systems.
- f. Proposed action: Establish change management procedures, including executive approval processes, within the context of other wildland fire decision support systems.

Known data accuracy and resolution errors must be aggressively corrected. Plot data and biophysical data necessary to better classify shrub and grasslands, urban areas, and woodlands must be acquired and applied to improve LANDFIRE National data products. Key actions include:

- g. Proposed action: National land cover data, including dominant existing vegetation and structure, should be incorporated into the suite of LANDFIRE data products.
- h. Proposed action: Acquire NRCS soil survey data for use in describing and improving accuracy of biophysical settings associated with grasslands and shrublands.
- i. Proposed action: Improve plot data in image classification and accuracy assessment. Consider the following:
 - Extension of Forest Inventory and Analysis plots to all lands in all states, and
 - Implementation of the BLM proposal to develop better plot information for shrub and grasslands

Supporting Findings: 1-13, 2-1, 2-3, 2-5, 2-6, 2-8, 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, 4-1, 6-4, 7-3, 7-4, 7-5, 7-6, and 7-7

4.2.4. Communication

A dedicated communication and marketing effort must be associated with the future LANDFIRE Program. Communication of program goals and objectives must address issues concerning confidence in national data sets and overall support of the program.

- a. Proposed action: Develop an effective and well-designed communication program that emphasizes a two-way communication with agency leaders and users of the data products.
- b. Proposed action: Agency administrators and incident commanders should be provided an overview of the LANDFIRE Program, its products, and uses during annual training or through their networks.
- c. Proposed action: Describe improvements in the support of wildland fire management decision making and other natural resource decision making as a result of using LANDFIRE data products and make these success stories available to potential users.

The LANDFIRE website is viewed as a primary medium for communicating information about the program; however, it can be improved to better serve the needs of potential users and partners.

- d. Proposed action: Redesign the LANDFIRE website with the assistance of professional website designers. Evaluate alternative designs and requirements with a cross section of users.

Those seeking access to LANDFIRE and data downloads face a complex series of steps and often do not obtain important notifications (data alerts) about the data sets accessed.

- e. Proposed action: Access to LANDFIRE National data products via the website needs to be streamlined and re-designed to better support this function. Data alerts and technical guidance regarding LANDFIRE data products should be embedded in metadata associated with data downloads.
- f. Proposed action: LANDFIRE should provide data reports and summaries for states, GACC areas, and other major geographic areas determined by the Executive Oversight Group.

Supporting findings: 1-4, 1-14, 2-2, 2-4, 2-7, 3-1, 4-1, 4-2, 4-3, 4-6, 5-1, 5-5, 8-4, 8-6, and 8-8

4.2.5. Technology transfer

LANDFIRE Program needs to include a robust technology transfer program fully coordinated with other wildland fire systems that can keep pace with the growing reliance on LANDFIRE products to address agency and partner business needs. The technology transfer system should include a wide variety of mediums and include direct assistance to users (e.g., the approaches used by the Fire Modeling Institute and Fire Learning Network).

- a. Proposed action: Technology transfer support to multiple wildland fire applications should be organized under a common and coordinated structure. The methodologies used by the Fire Learning Network and Fire Modeling Institute should serve as the core of this program.

Communication of user-detected “needs for change” to program staff and leadership must be viewed as an ongoing aspect or product of the technology transfer program.

- b. Proposed action: User forums should be created within the Fire Research and Management Exchange System (FRAMES) and user group meetings (organized by GACC or similar units) held to provide a venue for discussion of program status, user needs, profile examples of proper application, and innovative approaches using LANDFIRE data.
- c. Proposed action: Technology transfer should emphasize: training for GIS analysts and others using GIS tools to ensure data are applied appropriately and efficiently to support agency business needs, and appropriate use of LANDFIRE data products with attention to scale and data resolution.

Improved understanding of how LANDFIRE National data products can be used to identify proposed activities and the role of fine-scale data for assessing project consequences can lead to substantial program savings over time.

- d. Proposed action: Describe the utility of the LANDFIRE National data products to support land and resource management planning business requirements.
- e. Proposed action: Develop information and crosswalks between LANDFIRE National data products and data products with higher thematic and spatial resolution typically used to meet project planning and assessment business requirements.

Supporting findings: 2-1, 2-2, 2-4, 2-6, 2-8, 2-9, 2-10, 2-11, 3-2, 4-4, 4-5, 5-1, 5-2, 5-3, 5-4, 5-5, and 5-6

4.2.6. Organizational transition

The transition from development and deployment of the initial LANDFIRE National data products to operations and maintenance must be well managed.

- a. Proposed action: Define and approve the LANDFIRE Program organization and ensure key positions are fully staffed and operational at the beginning of the transition.
- b. Proposed action: Ensure program funding and budgeting agreements and procedures are complete and well documented.

Supporting findings: 1-3, 1-5, 1-7, 1-8, 1-9, 1-10, and 1-12

4.3. PERFORMANCE ASSESSMENT

As the LANDFIRE Program transitions into a new organization and leadership considers program options, it is important to evaluate whether the associated recommendations and planned actions will achieve desired performance improvements. One method of evaluating program options is to assess past and proposed O&M activities using an information systems perspective. This type of

assessment, commonly applied to complex information and data systems similar to LANDFIRE, uses the concept of a “maturity model”² as its foundation.

4.3.1. LANDFIRE Maturity Model

A maturity model describes performance elements and proficiency levels (best practices) associated with high performance and serves as the basis for an assessment of current program performance and options under consideration. The LANDFIRE Program Maturity Model (see below), describes performance elements and best practices anticipated in a fully functional and mature LANDFIRE Program.

² For a concise discussion of project management maturity models and concepts see ***A Maturity Model for Information Systems - Action-Research Project Management***. Christian A. Estay-Niculcar. 2002. <http://is2.lse.ac.uk/asp/aspecis/20020008.pdf>

LANDFIRE Program Maturity Model – Performance Elements and Best Practices

- 1. Program Management Organization** - Roles and responsibilities for program management functions are recognized within organization structures and fully staffed by professional information managers and subject matter experts as well as fully operational.
 - a. Program leadership and management functions support LANDFIRE Program goals and objectives, are clearly defined, staffed, and fully operational.
 - b. Program executive oversight involves program sponsors and representatives from major user constituencies.
 - c. Project management functions, administrative support, and communications are fully staffed and operational
 - d. Technology transfer support and staffing are operational, clearly defined, and used a variety of mediums for delivery.
 - e. National and regional/mapping zone data stewards are identified and provide technical and QA/QC oversight and are engaged in approving updates to data standards.

- 2. User Service and Support** - Customer groups and individuals are clearly identified; needs are documented and routinely assessed; data products and program changes are linked to those needs
 - a. Primary data users are well defined and involved in setting the program priorities.
 - b. Information needs are documented and monitored on a routine basis. Utility of data products are assessed and evaluated by users.
 - c. User forums or meetings are used to provide program updates and to gain user perspectives.
 - d. A formal change management process is used to respond to user-defined needs and priorities.

- 3. Data Quality and Integrity** - Data standards are fully documented, easily accessible, and embedded in data product metadata. QA/QC systems are fully operational and provide for data integrity and security.
 - a. LANDFIRE National data products are fully supported by documented data standards are included in data product metadata.
 - b. Data quality and integrity are maintained and updates triggered by landscape disturbance thresholds and scheduled remote sensing image classification updates (e.g., plot data, BpS upgrades, etc.)
 - c. Data calibration workshops are used to assess regional/mapping zone data quality and for data validation procedures (QA/QC).
 - d. Data quality and monitoring (QA/QC) roles and procedures associated with development of LANDFIRE National data products are clearly defined and staffed.
 - e. Data integrity and security are ensured and evaluated as part of the QA/QC process, are advocated by program leadership, and are fully supported within the program organization.

- 4. Data Access and Exchange Processes** - Data access systems provide agency employees and the public ready access to current LANDFIRE National data products. Data exchange needed for updates is effective and seamless.
 - a. Data downloads via web servers is intuitive, quick, secure, and includes all metadata, including user alerts.
 - b. Access to intermediate data and underlying source data are available via web servers and secure.
 - c. Data needed to support updates is provided through automated systems and verified by data stewards.
 - d. Best available data are used via data exchange procedures and provide the highest quality basis for developing LANDFIRE National data products.
 - e. Relationships between national data standards and local data are documented. Local data do not duplicate LANDFIRE National data products.

4.3.2. Performance Assessment

Using these performance elements and best practices, a series of assessments were performed for the following stages in program development:

LANDFIRE Project (Pre-Program)	Performance of the initial LANDFIRE Project was assessed based on observations and findings presented in Section 3 (past performance)
LANDFIRE Program (O&M plans)	Assessment of the LANDFIRE Program was based on information described in LANDFIRE O&M plans (present course)
GME Recommendations	Areas of expected performance based on the implementation of GME recommendations (course corrections)
LANDFIRE 2020	Expected performance in 2020 for a fully functional and mature LANDFIRE Program (desired condition)

An assessment of each program stage (option) was conducted and a performance level determined. Assessment scores range from “High” where best practices are in place and proficiency demonstrated, “Moderate” when practices are in place but proficiency has not been attained, and “Low” where the practice is not in place or not functioning.

A scorecard representing the assessment of each program stage is presented in Table 2 and provides a graphic representation of areas needing improvement and depicts those areas emphasized in the O&M plans and as a result of implementing the GME recommendations.

Table 2 – Maturity Assessment Scorecards

	Pre-Program LANDFIRE Project				O&M Plans LANDFIRE Program				GME Recommendations				2020 LANDFIRE Program Vision			
1. Program Management Organization																
Best Practices/Assessment	H		M	L	H		M	L	H		M	L	H		M	L
a. Leadership & management functions			X			X			X				X			
b. Executive oversight			X				X		x				X			
c. Project management functions			X			X			X				X			
d. Technology transfer			X				X		X				X			
e. Data stewardship and QA/QC			X				X			X			X			
2. User Services and Support																
Best Practices/Assessment	H		M	L	H		M	L	H		M	L	H		M	L
a. Data users involved in priority setting			X			X			X				X			
b. Information needs maintained			X			X				X			X			
c. User forums and meetings			X				X		X				X			
d. Formal change management process			X			X			X				X			
3. Data Quality and Integrity																
Best Practices/Assessment	H		M	L	H		M	L	H		M	L	H		M	L
a. Data standards and metadata			X			X			X				X			
b. Dynamic update processes				X			X		X				X			
c. Data calibration procedures	X				X				X				X			
d. Data quality roles, QA/QC			X			X			X				X			
e. Data integrity and security			X		X				X				X			
4. Data Access and Exchange Processes																
Best Practices/Assessment	H		M	L	H		M	L	H		M	L	H		M	L
a. Access to data and metadata via web			X			X			X				X			
b. Access to intermediate & other data			X				X		X				X			
c. Automated update and verification			X				X		X				X			
d. Best available data used			X			X			X				X			
e. National standards and local data				X				X	X				X			

4.3.3. Transition Evaluation

How effective the transition is from the current project to different options is the next phase of the performance assessment. Transitions evaluated are from the:

- LANDFIRE Project to the LANDFIRE Program
- LANDFIRE Project to implementation of GME recommendations

The LANDFIRE Program that results from the implementation of the O&M plans (post O&M) continues sound program features developed in the LANDFIRE Project and addresses many of the observations and findings outlined in Section 3 to some degree. In general, a combination of the existing LANDFIRE charter and program budgets limit the ability of the program staff to make improvements necessary to move towards a fully functional LANDFIRE Program.

Highlights and concerns with this transition are presented in Table 3.

Table 3 – Transition to the LANDFIRE Program (Activities as described in the O&M plans)

Performance Element	Highlights and Concerns
1. Program Management Organization	<ul style="list-style-type: none"> - Engagement of executive oversight and coordination with other wildland fire information and decision support systems remain a concern. - Improvements are made in leadership and management functions as a result of clarifying roles and relationships and use of a permanent organization structure. - Technology transfer relies on groups external to the program and is not well coordinated within the wildland fire management organization. - No “field” organization exists for data stewardship and QA/QC of input to LANDFIRE updates. Operations remain ad hoc with no formal authority.
2. User Services and Support	<ul style="list-style-type: none"> - An effort is made to improve the involvement of users in priority setting and needs identified by users, but suffers from the absence of a formal process for engaging users. Interactions remain opportunistic and centered on data calibration workshops. - A rudimentary change management process is incorporated into LANDFIRE operations; however, its focus is on data maintenance and does not fully address program enhancements.
3. Data Quality and Integrity	<ul style="list-style-type: none"> - Users have repeatedly requested continuous dynamic update procedures to meet their business needs. The O&M plan relies upon decadal re-mapping in conjunction with a biennial update schedule as the foundation for keeping data current and is not sensitive to landscape disturbance. - Problems associated with metadata, including data alerts, are not addressed. Metadata must be kept current and provided with data downloads. - Data quality and integrity continue to be emphasized in the O&M plan, but no field responsibilities and data stewardship roles are defined.
4. Data Access and Exchange Processes	<ul style="list-style-type: none"> - Reliance on the USGS procedures for data delivery for the National Map as the primary vehicle for providing data access addresses several concerns. Access to intermediate data products are not addressed by O&M procedures. - Improvements in access to underlying plot and other data used in the update process are reflected in the O&M Plans. - Updates continue to rely on data calibration workshops and manual procedures rather than automated links to wildland fire systems and data sources. - The relationships between national data sets and local data are not addressed and will continue to frustrate users.

Implementation of GME recommendations builds on the features of the O&M plans and LANDFIRE projects strengths. The current LANDFIRE Project charter and planned program funding limitations will need to be revised to achieve the performance levels associated with these recommendations. In some cases, course corrections will need to be made before commitments to host different functions at different locations are made, or commitments that have been made may need to be revised.

Table 4 – Implementation of GME recommendations

Performance Element	Highlights and Concerns
1. Program Management Organization	<ul style="list-style-type: none"> - Establishment of a contemporary vision and strategic plan for the LANDFIRE Program are essential to the design of a program organization. - Coordinated executive oversight and sponsorship of the LANDFIRE Program are critical to continued program success. - A permanent organization structure with shared program support services will ensure program leaders have access to expertise and services needed to be successful. - Coordinated technology transfer and use of TNC’s Fire Learning Network and the Fire Modeling Institute methodologies will strengthen program performance.
2. User Services and Support	<ul style="list-style-type: none"> - Creation of user forums and user groups provides improved understanding of LANDFIRE data products and their uses. These venues provide LANDFIRE Program staff a better understanding of user needs and the ability to consider those needs in program enhancements. - Technology transfer and communication programs are well coordinated within the wildland fire community. - Data stewardship roles and assignments will create a field-based network and provide better formal access to users and local data. QA/QC procedures will be consistently applied. - A formal change management process exists that provides for both the consideration of production improvements and user-oriented enhancements.
3. Data Quality and Integrity	<ul style="list-style-type: none"> - Establishment of national data standards and LANDFIRE as the “base Federal program” will be akin to the decision to adopt ICS for incident operations. - Dynamic update procedures that rely on a combination of landscape disturbance triggers and scheduled updates ensure LANDFIRE data are current. - Data quality will continue to be emphasized. - Data integrity and security are ensured by use of tracking tools (e.g., Tobin Smail’s change tracking tool)
4. Data Access and Exchange Processes	<ul style="list-style-type: none"> - Data access procedures are intuitive and streamlined and include metadata. - Linkages between major systems tracking vegetation disturbances and other landscape changes are established, reducing cumbersome and time consuming manual processes. - Best available data are used to support updates to LANDFIRE National data products. Soils (NRCS), expanded FIA plots (FS), and plot information on shrub and grasslands (BLM), and land cover change (NRCS and FS) are available for use. - Relationships between LANDFIRE National data and local data sets with higher thematic and spatial resolution are well documented and understood by users.

4.3.4. Conclusion

LANDFIRE is beginning to realize its vast potential as the first and only consistent national all-lands data set available for addressing landscape-level disturbances. The success of the LANDFIRE Project and foundation created for working cooperatively across multiple organizations is an investment that must be leveraged to address a broader range of issues facing the Department of the Interior agencies, USDA-Forest Service, and The Nature Conservancy.

The window of opportunity to initiate implementation of the recommendations described in this report is limited and should be addressed within the next 3-6 months to take advantage of opportunities for expanded program support and most importantly establish an organization structure to ensure the future success of the LANDFIRE program. Key points identified by the GME team include:

- ✓ The LANDFIRE Program should be allowed to mature and be visibly and actively supported by Departmental, Bureau, and Agency leadership. A permanent LANDFIRE program organization must be fully staffed, funded, and appropriately governed. Consider co-location with other wildland fire management decision support systems to provide opportunities for sharing common functions, provide career ladders between similar units, and improve cross-unit communication. Transition to this new organization must be well planned and executed.
- ✓ Defining a contemporary vision for LANDFIRE and development of a supporting program strategy is needed to address growing demands for an expanded set of national data products. The resulting vision and strategy can serve as the basis for consistently and efficiently supporting other agency and partner business needs such as monitoring the effects of climate change and development of landscape-scale conservation approaches.
- ✓ Clearing the way for LANDFIRE to develop a more detailed existing vegetation cover data layer to supplement LANDFIRE's vegetation data products will exponentially increase the usefulness the LANDFIRE data products for both wildland fire management and other resource applications. This will require adoption of appropriate data standards by the FGDC vegetation subcommittee for the National Vegetation Classification Standard. Forest Service Regional efforts to develop similar data products should be carefully examined to ensure they are consistent with FGDC standards and are consistent between Regions.

LANDFIRE Program General Management Evaluation

REVIEW PLAN

(Version 5.1)

Scope and Objective

The LANDFIRE Project is in the process of completing the initial development of national data and information products identified to support wildland fire and resource management. LANDFIRE data products are unique in that they provide a consistent set of data across the entire United States regardless of land ownership or jurisdiction.

As the LANDFIRE transitions from the project to the program to provide for operation and maintenance of the data sets, a general management evaluation (GME) was organized to investigate and evaluate four primary focus areas.

1. Awareness and understanding of LANDFIRE and its data products
2. Utility of data products within wildland fire management and other resource areas
3. Organizational and operational improvements needed within LANDFIRE program
4. Organization and management of the overall collection of federal wildland fire management data and applications

Each of these areas of inquiry will address past performance as well as examine future LANDFIRE operations and maintenance issues, including coordination with other federal wildland fire and natural resource applications that comprise the wildland fire information and analysis system (wildland fire I&A system).

LANDFIRE provides the wildland fire management community and other natural resource managers with data products needed to support their business functions. As an information management system, LANDFIRE can be evaluated from a variety of perspectives. Because of its focus on wildland fire business requirements, past evaluations have concerned themselves with the technical aspects of the program. This GME will examine some of these connections but will also focus on aspects of information management systems. **Appendix A** provides a general outline of information system maturity assessment elements that will be addressed during the GME.

Recommendations and findings developed during the GME will be used to improve the effectiveness of the program efforts and the incorporation of new technologies and methods for developing data products and their application. This information will also be used to identify and effectively integrate potential new partners in the LANDFIRE project.

Review Approach

The LANDFIRE GME will emulate general management evaluations and reviews used within the Department of the Interior and USDA Forest Service. These reviews are designed to examine management and leadership functions as opposed to the technical nature of the work or activity being performed. The focus is on organizational structure and operational controls that contribute to effective performance and accomplishment of assigned objectives.

The GME will use a structured inquiry based upon background materials provided by the LANDFIRE business leads and project manager coupled with on-site and telephone interviews. A preliminary schedule of interviews is outlined in **Appendix B**.

Areas of Inquiry

The GME will investigate and evaluate the following areas:

1. Awareness and understanding of LANDFIRE and its data products

The LANDFIRE Project was chartered by the Wildland Fire Leadership Council based on recommendations from the Government Accountability Office. This is different than how typical mission related work is initiated by the sponsoring organizations, and the LF project was not always fully supported by executive level management of the sponsoring organizations. It also helped cast LANDFIRE as an exclusively fire related project.

- *Evaluate the awareness and understanding of LANDFIRE and its data products among a wide range of current and potential users.*
- *Provide an assessment of communication, technical transfer, and leadership awareness associated with the transition of LANDFIRE from project to program and develop recommendations on how to best organize and address associated issues as the program moves forward.*

2. Utility of data products within wildland fire management and other resource areas

LANDFIRE data products were designed to support wildland fire behavior modeling and fuels management tools and decision support systems currently in use or in development. As originally designed, LANDFIRE data products were also intended to serve as the basis for other resource management programs as well. Since the completion of LANDFIRE National data products for the contiguous US these data products have been widely used in wildland fire operations and to support national fire program planning.

An assessment of the utility of LANDFIRE data products to support wildland fire management and other resource area planning and decision making has not been completed.

- *Provide a general evaluation of the utility of LANDFIRE data products to support wildland fire management business needs.*
- *Assess and describe how LANDFIRE data products are being used to support other resource management areas.*

- *Provide an assessment of LANDFIRE data application issues, user support and technology transfer associated with wildland fire management and other resource management business needs.*

3. Organizational and operational improvements needed within LANDFIRE program

The organization and governance system associated with the development and initial deployment of LANDFIRE was designed to provide oversight and management control of this multi-party effort. The LANDFIRE Executive Charter explicitly describes the organization and roles for this effort. An assessment of this organization and roles could help inform a future LANDFIRE Program charter and organization, as well as inform the organization of other management areas.

The organization that functioned well to develop and complete initial LF data products does not support functions typically associated with the next phases of the program. The present LANDFIRE governance and oversight structure is not designed to effectively address governance issues typically associated with data system deployment and enhancement. The LANDFIRE charter recognized the need to plan for the transition from the development of data products to “operation and maintenance”.

- *Provide a general assessment of how well project principals fulfilled their roles and how well the organization functioned.*
- *Provide a general evaluation of future governance issues and recommendations on how best to organize for the future and associated operational considerations*

4. Organization and management of the overall collection of federal wildland fire management data and applications

The Wildland Fire Leadership Council provides coordination and oversight of all information and analysis tools being developed and deployed by Federal wildland fire management agencies. The system consists of multiple components designed to be applied at different organizational levels and is designed to meet a variety of business needs at each of these organizational levels. Governance is presently organized by system component.

Since the LANDFIRE project was initiated a suite of wildland fire data management and applications has been developed to support policy and program planning as well as wildland fire operations. Many of these applications are moving from the development and deployment phase to a program phase at the same time. An opportunity exists to examine more effective organization and operational approaches for LANDFIRE within the context of this system.

- *Evaluate opportunities for better coordination, organization and management of federal wildland fire data management and analysis applications.*

Appendix C contains the detailed outline of areas of inquiry to be used by the GME review team and to be addressed in their evaluation report.

Review Schedule

Primary activities and the proposed review schedule are shown below:

Activity	Target Dates
<p>1.0 Develop and Finalize Review Plan – Review scope, areas of inquiry, team composition and expertise, review schedule and products will be finalized by the LF Business Team.</p>	7/14 - 7/17
<p>2.0 Establish Review Team – Review team members will be identified by the Contractor based upon skills and expertise specified and will concur with the GME team composition.</p>	7/12 - 7/15
<p>3.0 Entrance Conference – An entrance conference will be held in conjunction with a meeting of the LF Business Team. GME team members will be provided background materials and references for review prior to the entrance conference.</p>	7/16
<p>4.0 Conduct Review and Interviews – Interviews with LF project staff and primary partners will be designed to minimize travel costs. Three interview locations will be identified and used to provide effective interactions with the GME review team. Two primary groups will be interviewed (1) project staff and leadership and (2) LF data customers. Specific interview groups and a preliminary interview schedule are provided in Appendix B.</p>	7/16 - 10/16
<p>5.0 Prepare Draft Report – A draft report will be prepared and provided to the COR to facilitate discussion during the Exit Conference.</p>	10/16 - 11/10
<p>6.0 Exit Conference – This conference will focus on the basis for findings and recommendations developed by the GME team. Adjustments to the findings or recommendations will be considered by the GME team in preparing its final report.</p>	12/8
<p>7.0 Prepare Final Report – The final report will reflect agreements on content and wording changes identified during the Exit Conference.</p>	11/16 - 12/18

The schedule described above has been structured to avoid typical conflicts such as the western US fire season and efforts to complete the production phase of the LANDFIRE project prior to the end of FY09. Adjustments to this schedule will be negotiated by the COR and Contractor's project manager.

Consulting Services/GME Review Team Expertise

The GME will be conducted by an independent, third-party review team employed or retained by Management and Engineering Technologies International, Inc (METI, Inc.) pursuant to contract number AG-024B-S-09-0013.

The review team will consist of:

- | | |
|-----------------------------|--|
| Mr. Stephen J. Solem | Retired FS – Director of Science Application and Integration, Rocky Mountain Research Station. (Team Leader) |
| Mr. Jack Troyer | Retired FS – Regional Forester, Intermountain Region |
| Mr. Mark Beighley | Retired DOI – Director Office of Wildland Fire Coordination |
| Mr. James Golden | Retired FS – Deputy Regional Forester, Pacific Northwest Region |

All team members have extensive senior-level management experience and a variety of resource management expertise. In addition, all team members have experience in the evaluation and management of large complex natural resource organizations and programs. Expertise within the review team mirrors the 60/40 split between the USDA-Forest Service and Department of the Interior wildland fire management agencies. Copies of the proposed GME review team's resumes are available upon request.

Government Provided Services and Support

Organization Support and Notification: LANDFIRE project staff and partners will be informed of the GME and its objectives by the LANDFIRE Business Team. This notification will provide the GME team the ability to contact and interview Forest Service and Department of the Interior employees.

Government Provided Services: The government will provide the use of teleconferencing and video conferencing bridges to facilitate GME team interactions and interviews. A contract writer-editor, employed Rocky Mountain Research Station, Missoula Fire Sciences Laboratory, will assist the GME team prepare its draft and final reports.

Interview Sites and Coordination: Interviews of project staff and leadership will be organized by the COR in conjunction with a LANDFIRE Business Team meeting in Denver, CO. LANDFIRE data customers will be interviewed at two primary locations: Boise, ID and Missoula, MT. The COR will organize these

interviews with customer groups. All interview sites will be at government-owned or rented facilities to avoid additional costs associated with renting meeting room space.

Background Materials

The majority of background documents needed to support the GME review team are posted on the LANDFIRE website (www.landfire.gov). In addition to these documents, the following background materials are being provided to the review team.

- LANDFIRE EOC Reports and Documents - 2006 EOC Review Report, EOC Operating Principles
- LANDFIRE Project Plans – Project development plans and annual performance goals.
- LANDFIRE Organization and Staffing Timeline – Materials should identify when were positions and assignments filled during the course of the project? Were key positions vacated during the effort? Were key roles or groups not operational until well into the project?
- LANDFIRE Information System Documentation – Customer or Information Needs Assessment, Data Standards and Protocols, Data stewardship and organization, data access and exchange procedures and agreements.
- After Action Reports - FPA After-Action Reports, WFDSS After-Action Reports and other internal review reports.
- Staff papers prepared by FS and DOI natural resource specialists regarding the utility of or concerns with the LF data products.
- Position Descriptions/Performance Management Documentation - Performance and Annual Work Plans/Letters of Instruction for key positions (Business Leads, Project Manager, etc.) outlining their role and performance objectives. May also include EOC determinations/decisions.
- LANDFIRE Help Desk and data download information summaries from the USGS National Map and LANDFIRE data services supported by RSAC.

Other documents identified by GME review team members will be referenced and provided in conjunction with the GME report.

Appendix A

Information Systems Maturity Level Assessment

Typical elements and maturity level descriptions used in information system assessments that can be applied to the LANDFIRE GME.

Element	High	Moderate	Low
Customer Needs Assessment	<ul style="list-style-type: none"> - Customer groups and individuals are clearly identified; their needs are documented; data collection and management systems are linked to those needs 	<ul style="list-style-type: none"> - System managers have a vague idea of who their customers might be (or used to be); guess about their needs and interests. 	<p>“Customers? What customers? Who cares?”</p>
Data Standards and Collection Protocols	<ul style="list-style-type: none"> - Standardized data collection protocols and data standards are fully documented and easily accessible and used in all data collection procedures at suitable scales. - QA/QC systems are fully operational. 	<ul style="list-style-type: none"> - Data standards are defined, but redundancies exist within a given scale. - Informal and ad hoc QA/QC systems. - Some documentation exists, but it is not complete or easily accessible. No documentation of system changes in place. 	<ul style="list-style-type: none"> - Data standards are not defined, are in a constant state of flux. - No documentation exists outside of personal files and notes of the system developers to implement QA/QC systems.
Data Management Organization	<ul style="list-style-type: none"> - Defined roles and responsibilities for data management functions are formally recognized within organization structures and fully and realistically staffed. 	<ul style="list-style-type: none"> - Data stewardship and administration roles are generally assigned as co-lateral duties, with few dedicated data management positions. 	<ul style="list-style-type: none"> - Data stewardship and administration roles are not assigned, co-lateral or are ad hoc.

<p>Data Base Organization</p>	<ul style="list-style-type: none"> - Formal organizations of professional information managers and technical specialists for all technical elements are fully staffed and operational. - User needs are reflected in a mature change management process. 	<ul style="list-style-type: none"> - Ad hoc data management organizations with a full complement of technical elements. <u>or</u> - Formal organizations are not fully staffed and operational. 	<ul style="list-style-type: none"> - Ad hoc data management organizations. - Organization elements limited to data base development.
<p>Data Access and Exchange Processes</p>	<ul style="list-style-type: none"> - Information systems and data structures provide employees and the public ready access to current economic, social, and ecological data and information using current technology. 	<ul style="list-style-type: none"> - Information systems and data structures allow data entry and exit, but it is cumbersome for users to gain access and to extract information in a usable format. 	<ul style="list-style-type: none"> - Data entered and extracted in proprietary or unique formats, which preclude access or use by customers.

Appendix B

Preliminary Activity and Interview Schedule

Interviews will involve a variety of LANDFIRE project management, partners, and data customer groups. Interviews and interaction with the GME sponsors will be conducted in the following general sequence:

Date	Activity	Location
7/13 - 7/17	3.0 - Entrance Conference with LANDFIRE Business Team	Boise, ID
7/13 - 7/17	4.0 - Interviews with: - LANDFIRE Business Team - principal partners and contributors	Boise, ID
7/20 - 7/30	4.0 - Review background materials and develop detailed interview approach and schedule	Missoula, MT
8/3 - 9/1	4.0 - Interviews with: - LANDFIRE partners and contributors - agency administrators and executives - wildland fire suppression specialists and managers - wildland fire research and development - natural resource specialists - agency administrators and executives, including State Foresters	Telephone
9/2 - 9/18	4.0 - Interviews with: - LANDFIRE project team - wildland fire research and development - natural resource specialists - agency administrators and executives	Missoula, MT Telephone
9/21 - 11/10	5.0 - Develop draft GME report	Telephone and WebEx Conferences
12/8	6.0 - Exit Conference	Denver, Co

Appendix C

General Management Evaluation Areas of Inquiry

The LANDFIRE GME will investigate and evaluate the primary areas of inquiry outlined below. More detailed descriptions and evaluation questions provided below will be used during interviews conducted during the GME.

1. Awareness and understanding of LANDFIRE and its data products

- A. Evaluate the awareness and understanding of LANDFIRE and its data products among a wide range of current and potential users.
 - 1. What recommendations can be provided improve leadership and organizational support for LANDFIRE and similar efforts in the future?
 - 2. How effective was communication and marketing of the LANDFIRE program among different constituent groups?
 - 3. What user support and assistance was provided during the development of LANDFIRE national data products?
 - 4. How was LANDFIRE technology transfer and delivery accomplished?
 - 5. How effective was the LANDFIRE website in communicating the objectives and understanding of data products?
- B. Provide an assessment of communication, technical transfer and leadership awareness associated with the transition of LANDFIRE from development to Operations and Maintenance and develop recommendations on how to best organize and address these issues as the program moves forward.

2. Utility of data products within wildland fire management and other resource areas

- A. Provide a general evaluation of the utility of LANDFIRE data products to support wildland fire management business needs.
 - 1. How well do LANDFIRE data products support wildland fire operations and decision support systems like the Wildland Fire Decision Support System (WFDSS)? Are their concerns with data accuracy and resolution?
 - 2. Are LANDFIRE data products used within fire program analysis and allocation systems like the Fire Program Analysis (FPA) or Hazardous Fuels Prioritization and Allocation System (HFPAS)? Are their concerns with data accuracy and resolution?
 - 3. Are there concerns with specific LANDFIRE data products?
 - 4. How effective are LANDFIRE data products for identifying and planning hazardous fuels treatments?
 - 5. How is user support and technology transfer provided to wildland fire managers?
 - 6. Are their concerns with data access and delivery?
- B. Assess and describe how LANDFIRE data products are being used to support other resource management areas.
 - 1. What uses are being made of LANDFIRE data products in other resource areas?
 - 2. Which data products are being used and are their concerns with data resolution and accuracy?

3. What level of confidence (scientific integrity and accuracy) do other users associate with LANDFIRE data products? Are there particular data products with concerns?
 4. Where do other resource users obtain user support and technical assistance?
 5. How do other users obtain LANDFIRE information? Are their data delivery concerns?
 6. Does LANDFIRE data duplicate information available from other data sources? Which data set is most useful and why?
- C. Provide an assessment of LANDFIRE data application issues, user support and technology transfer associated with wildland fire management and other resource management business needs.

3. Organizational and operational improvements needed within the LANDFIRE program

- A. Provide an assessment of how well the LANDFIRE organization and operational procedures provided for effective performance management during the LANDFIRE development.
1. How well did the project organizational structure support project goals and objectives described in the Charter? (Did the organization perform as expected?)
 2. How did organization implementation issues affect project performance or contribute to operational issues?
 3. What organization and operational improvements could be made to improve future efforts, specifically the LF Program charter for operations and maintenance activities and the future organization?
 4. LANDFIRE development as well as operations and maintenance employ a complex set of procedures to develop and deliver data products. How are system controls designed and achieved within LANDFIRE?
- B. Provide a general evaluation of future governance issues and recommendations on how best to organize for the future and associated operational considerations.

4. Organization and management of the overall collection of federal wildland fire management data and applications

- A. Evaluate opportunities for better coordination, organization and management of federal wildland fire data management and applications.
1. What organizational structure exists to manage and coordinate the LANDFIRE operations and maintenance within the wildland fire management I&A system?
 2. How are system controls designed and achieved within LANDFIRE? How are changes coordinated with other wildland fire management applications?
 3. What opportunities exist to share project management functions with other wildland fire management development teams?
 4. Are LANDFIRE operations and maintenance functions organized to support efficient project execution and aligned with the goals and objectives of the wildland fire I&A system?