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LANDFIRE: A NATIONALLY CONSISTENT AND LOCALLY RELEVANT INTERAGENCY FIRE, FUELS, AND RISK ASSESSMENT

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1. INTRODUCTION

The LANDFIRE prototype project, conceived in 1999 and funded in 2002, is being conducted by the USDA Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (MFSL) and USGS EROS Data center in Sioux Falls, South Dakota (EDC) for two large areas in the western United States – Central Utah and the Northern Rocky Mountains – at 30-meter pixel resolution (Figure 1). The objectives of LANDFIRE are to develop a comprehensive suite of standardized, multi-scale spatial data layers and software needed to support the National Fire Plan, the Western States' 10-year comprehensive plan, and the President's Healthy Forest Initiative across the United States. The General accounting office describes LANDFIRE as "the only proposed research project so far that appears capable of producing consistent national inventory data for improving the prioritization of fuel projects and communities." (GAO 2002)

Figure 1 – LANDFIRE prototype mapping zones

In 1999, scientists at the MFSL compiled coarse scale (1km^2 cells) Fire Regime Condition Class (FRCC) and historical natural fire regime maps for the 48 conterminous United States (Figure 2, Hardy et al 2001, Schmidt et al. 2002). Historical natural fire regime and associated FRCC mapping have provided key spatial data for development of the USDA Forest Service and USDI cohesive strategies for restoration of fire adapted ecosystems and for addressing the goals and objectives of the National Fire Plan. Fire regime condition class, a discrete index of departure from historical natural fire regimes, is used for allocation of fire funding, resources, prioritization of fuels and restoration treatments, and evaluation of the successes and failures of wildland fire management activity and other land management practices.

Landscape scale (1,000 – 1,000,000 acres) maps of FRCC, (currently being developed using interagency project scale FRCC methods; http://fire.org/frcc), may be used to evaluate ecosystem resilience and the potential for uncharacteristic wildland fire behavior and effects. These spatial data, when combined with data for population density and infrastructure, can identify communities at risk from uncharacteristic wildland fire. Opportunities for fire and fuel management may be identified when these data are combined with spatial data describing the distribution of native species, wildlife populations, population

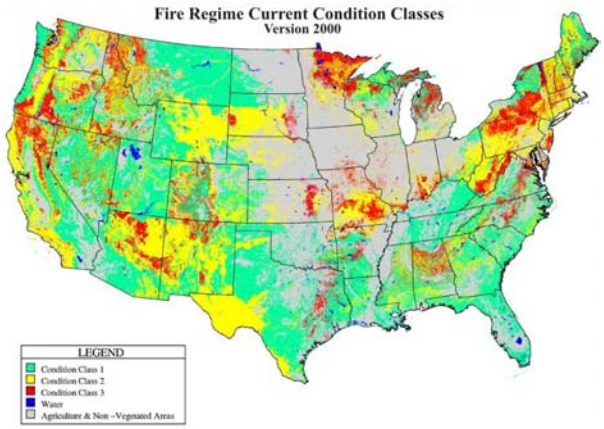

Figure 2 – Fire regime condition class for the conterminous United States (Schmidt et al. 2002)

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density, air shed patterns, and watershed status. Different land management scenarios for prioritization of wildland fire use or fuel management, and associated resource enhancement and risk reduction effects, may be compared when these data are combined with models to simulate potential landscape composition and structure. The Project Scale FRCC methods (Hann et al. 2003) support project-by-project assessment of FRCC, but do not provide the spatial data and models necessary for comprehensive assessments nationwide. In addition, understanding of FRCC and associated landscape composition, structure, and risk of catastrophic fire provides a framework for designing projects on the ground.

The 1999 coarse scale FRCC maps provided information for addressing the magnitude and geographic distribution of dramatic departures from historical fire and fuel conditions. This information was a substantial leap forward in National Fire and Fuels Assessment. However, these highly anticipated and pertinent coarse-scale FRCC data were only intended for use for evaluations at the national level (Hardy et al 2001, Schmidt et al. 2002). The general lack of similar, consistently developed data for finer scales has resulted in misuse of the 1999 coarse scale FRCC data for landscape- and project-level wildland fire and fuels management prioritization and planning (http://fire.org/frcc). Currently available FRCC data are only appropriate for addressing prioritization between regions and states not landscapes and specific fire and land management projects. In 2002 the General Accounting Office published a report detailing the lack of nationally consistent and locally relevant spatial data for making informed decisions and measuring agencies' progress in reducing hazardous fuels (GAO 2002).

LANDFIRE produces nationally consistent and comprehensive fire and fuels maps, including FRCCs, across the conterminous United States at spatial scales fine enough for local fire and land management planning and prioritization. LANDFIRE products are not intended to replace existing data and maps used by land management agencies. Instead, LANDFIRE should complement local efforts and provide a "safety net" for wildland fire and landscape managers that lack high quality spatial data for specific areas. This paper will introduce the LANDFIRE project and discuss how it will be accomplished.

2. METHODS

Many tasks must be completed to successfully meet the objectives of LANDFIRE

- A LANDFIRE reference database containing all previously collected and available georeferenced vegetation, fire and fuel field data is compiled. In addition, Forest Inventory and Analysis data (Gillespie 1999) are incorporated into the LANDFIRE reference database. This relational database forms the foundation for all additional LANDFIRE tasks and products. Supplemental field data are collected in areas with sparse existing plot coverage (e.g., non-forested areas).
- Maps of vegetation composition and structure and ecological characteristics are created from field data, satellite imagery, and ecosystem simulation to describe existing vegetation and biophysical characteristics for each map zone (Figure 3, Huang et al. 2003, Zhu et al. 2003).

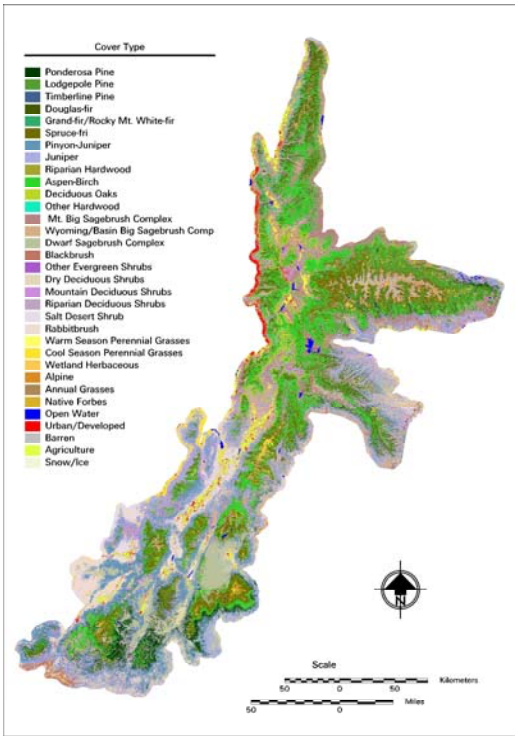

Figure 3 – Existing vegetation for the Central Utah LANDFIRE prototype area.

- New fire behavior fuel models (Scott et al. 2003), fuel loading models (Keane et al. 2003), have been developed, and along with Fuel Characterization Classes (Ottmar et al. 2003, Sandberg et al. 2001) are mapped for prediction of fire behavior and effects. All the necessary spatial data for the FARSITE fire spread model (Finney et al 1998) and Flammap (Finney et al. 2002) are provided.
- Vegetation and landscape models have been developed (Holsinger et al. 2003, Keane et al. 2003, Parsons et al. 2002) to simulate disturbance and ecosystem dynamics over long time periods to characterize historical fire regimes and determine existing departure from historical conditions (FRCCs).
- A new model FIREHARM has been developed (Keane et al. 2003) to integrate vegetation dynamics, weather, and fire and fuel dynamics over time to create maps of potential fire danger, behavior and effects.

3. DELIVERABLES

The following GIS layers, databases, and computer software tools are being developed for the LANDFIRE prototype areas as a demonstration that the methods and protocols developed by the LANDFIRE project can be applied nationwide.

- **GIS layers:** Existing vegetation, potential vegetation, stand structure, stand height, canopy cover (Huang 2003, Zhu 2003); biophysical settings (e.g., net primary productivity, actual evapotranspiration (Holsinger et al. 2003); fire behavior fuel models, fuel loading class, crown bulk density, and Fuel Characterization Class (Keane et al. 2003, Ottmar et al. 2003, Scott et al. 2003); fire regime, (frequency, fire severity, condition class; Keane et al. 2003, Parsons et al. 2003), and FARSITE landscape files (Finney et al. 1998).
- **Databases:** DAYMET 18-year daily mapped weather (Thornton et al. 1997), LANDFIRE reference database, successional pathway and disturbance information (Keane et al. 2003).
- **Computer models:** LF-BGC (biogeochemical simulation), WXFire (weather/fuels integration model), LANDSUM (LANDscape fire SUccession Model), and FIREHARM (FIRE Hazard And Risk) (Keane et al. 2003).

4. COLLABORATION

Many government agencies, non-government organizations, universities, and private contractors are involved in LANDFIRE. Most modeling and fire/fuels mapping are conducted at the MFSL. Mapping of vegetation composition and structure is conducted at EDC. The University of Montana Numerical Terradynamic Simulation Group has developed the daily weather DAYMET database, and The Nature Conservancy (TNC) and USDA Forest Service Fire and Aviation Management will develop and refine successional modeling, support field data acquisition. The non-profit organization Systems for Environmental Management will develop and maintain the LANDFIRE Reference Database. During development and as final deliverables become available, TNC and USDA Forest Service Fire and Aviation Management will facilitate applied technology transfer, data and model validation and peer review of products for ground-based practitioners working on specific multi-partner landscape projects.

5. NATIONAL IMPLEMENTATION

Currently the LANDFIRE project is in a prototype phase. Completion of the LANDFIRE project for the United States is a six-year USDOI and USDA Forest Service commitment, with maintenance and updates continuing on a 5-year cycle following the initial 6-year development phase. A decision on whether to proceed with national implementation is pending.

The schedule for national implementation of LANDFIRE follows

Year 1 – 6 Additional LANDFIRE Map zones

Year 2 – 6 Additional LANDFIRE map zones

Year 3 – LANDFIRE deliverables for Western U.S.

Year 4 – LANDFIRE deliverables for 12 additional map zones

Year 5 – LANDFIRE deliverables for Eastern U.S.

Year 6 – LANDFIRE deliverables for Alaska

6. STATUS

As of September 2003 the LANDFIRE prototype is on schedule and budget with the Central Utah map zone scheduled for completion by Spring 2004 and the Northern Rocky Mountain map zone by Fall 2004. National implementation

could begin as early as Winter 2003, with preliminary products online by Summer 2004.

7. CONCLUSION

LANDFIRE is a collaborative, national scale fire and fuels mapping effort based on extensive reference data, satellite imagery, biophysical modeling, and the latest fire behavior and effects science. Currently, the LANDFIRE prototype is being conducted at the USDA Forest Service, Rocky Mountain Research Station Fire Sciences Laboratory in Missoula, MT and the USGS EROS Data Center in Sioux Falls, South Dakota, with delivery for the Central Utah and Northern Rockies map zones scheduled for completion by the end of 2004. The importance of having common base data and classification definitions cannot be over-emphasized, especially in light of Congressional and agency needs to report progress in achieving National Fire Plan objectives across multiple administrative units and land ownerships. Lack of common data and classification definitions results in illogical and inconsistent results and confusion. These base data can also be used for fuel model mapping, and fire effects, fire behavior, management scenario, and wildlife habitat modeling. The basic process of FRCC analysis, mapping, and interpretation provides a valuable set of science-based and consistent analyses that are key to enlightened and effective wildland fire and landscape management. The LANDFIRE products are both national consistent and comprehensive and locally relevant for fuels abatement projects.

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