The Wildland Fire Assessment System (WFAS): A webbased resource for decision support

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Abstract

The Wildland Fire Assessment System (WFAS) is an integrated, web-based resource to support fire management decisions. It has an extensive nationwide user base of federal, state and local land managers. The system provides multi-temporal and multi-spatial views of fire weather and fire potential, including fuel moistures and fire danger classes from the US National Fire Danger Rating System (NFDRS), Keetch-Byram and Palmer drought indices, lower atmospheric stability and satellite-derived vegetation conditions. It also provides fire potential forecasts from 24 hours to 30 days. Point data for many products are provided in addition to spatial data for more localized applications. WFAS is under revision to refine existing products and to increase the utility of more spatial data products such as gridded surface meteorology and MODIS satellite data. Many of these new products will incorporate internet mapping services to allow users to resolve spatial products to a region of interest. These revisions will also provide higher resolution data for regional and local applications with higher spatial and temporal resolution. Planned changes will support decisions made at national, regional and local levels.

Science and Technology Summary

The Wildland Fire Assessment System (WFAS) integrates multi-spatial and multitemporal observations and forecasts into a system that provides both update-to-date assessments and short to long range forecasts of many of the components that determine areas of high wildfire potential (Burgan et al. 1997). It is one of the few systems that combine surface weather observations, satellite-derived measures and forecasts into a single, user-friendly format that is useful in fire management applications. WFAS products are organized into four major categories:

- 1. Fire Potential & Danger
- 2. Weather
- 3. Moisture and Drought
- 4. Experimental Products

Each of these categories contains point data and / or spatial maps of key variables that relate to the potential ignition and spread of a wildfire. Some of the key products in each of these categories are defined below in further detail.

Fire Potential & Danger

The Fire Potential & Danger category displays spatial representations of Adjective Fire Danger Classes from the United States National Fire Danger Rating System (NFDRS) (Deeming et al. 1977). These fire danger classes are set by local fire managers and integrated into the Weather Information Management System (WIMS) (USDA Forest Service 2003). WFAS extracts key NFDRS values from WIMS and displays these data spatially across the continental United States



and Alaska. Both current and next-day forecasted fire danger classes are provided as part of the WFAS daily processing stream. Haines index maps are also provided because wildland fire spread is enhanced by atmospheric instability (Haines 1988).

Weather

Weather is a key driver of both fire potential and post-ignition fire behavior, so many products are provided that describe the current and projected fire weather environment. The system provides national maps of wind speed, 24-hour precipitation, temperature and relative humidity derived from > 1000 Remote Automated Weather Stations (RAWS) throughout the country. In addition to oncedaily observations, WFAS also provides access to 30-day fire weather forecasts generated at the USDA FS, Pacific Southwest Research Station. For many products the point-source observations are provided in addition to spatial maps.



precipitation, temperature and relative humidity for 06 April 2005. Maps created by WFAS using data from the Weather Information Management System

Moisture & Drought

Moisture and drought often determine the intensity of a fire season and thus are important aspects for fire managers to consider. WFAS provides NFDRS-calculated dead fuel moistures over a range of size classes which depict wetting and drying trends over different time intervals. The system also integrates satellite-derived greenness measures such as relative greenness (RG) which expresses the state of live vegetation in relation to its long-term minimum and maximum and departure from average greenness (DA) which expresses vegetation condition relative to the long-term mean for that time of year (Burgan and Hartford 1993). This is one of the few products that are available to land managers that provide a landscape-level look at the condition of live vegetation.

Experimental Products

WFAS provides an avenue for the technical transfer of new innovations in the spatial assessment of fire potential to fire managers. This category includes operational products that are deemed immediately useful for fire managers but that might have an insufficient life-cycle or are too narrow in spatial scope to justify their inclusion into the operational WFAS. Some experimental products may eventually become part of the standard system.



Figure 3 - Experimental 24 hour forecasts of the Energy Release Component-G, an index calculated as part of the National Fire Danger Rating System.

Future Enhancement

The system is currently under development to enhance the utility of spatial data in fire management decision-making. In the future, WFAS will provide products to better support decision-making at multiple time and space scales. Currently, most WFAS

products are generated at the national level but planned enhancements will generate more products at regional and local levels. We will extend the processing to include maps created over geographic regions. These products will be suitable for inclusion in regional seasonal assessment reports. We will also begin to display fire potential at multiple scales. We will evaluate the potential of extending the current fire danger calculations at regional and local levels with spatial fire behavior calculations from the FlamMap system which integrates models for surface fire spread, dead fuel moisture, transition to crown fire and crown fire spread (Rothermel 1972, Van Wagner 1977, Rothermel 1991, Nelson



Figure 4 - Regional subset of relative greeness for the Southern Area GACC for the period 30 Mar 2005 to 05 Apr 2005.

2000). These products will provide a more detailed look at the potential fire behavior across a landscape and these calculations will be performed at a higher resolution than other products. Finally, we hope to provide more data products from other satellite-platforms such as MODIS which are more tailored for the study of vegetation than sensors such as AVHRR.

Summary

WFAS is one of the only systems of its kind that integrate widely-scattered information resources that are relevant to fire managers. It provides multi-temporal and multi-spatial assessments of fire weather, fire potential and the condition of live vegetation across a landscape. Future enhancements will improve the utility of WFAS data products for regional and local level applications. These resources should provide valuable information to fire managers to improve decisions made at multiple scales.

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Biographies

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- Patricia L. Andrews has been a member of the Fire Behavior Research Unit at the Missoula Fire Sciences Laboratory since 1973. She has contributed to the development of several fire behavior models and she is responsible for the new BehavePlus fire modeling system. She has developed methods for evaluating fire danger indexes and has worked on development of the Wildland Fire Assessment System (WFAS). Her current research focus is on the assessment of live fuel moisture.
- Larry Bradshaw is a Meteorologist with the USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory in Missoula, Montana. Larry has been the meteorologist for the Fire Behavior Research Work unit since 1992. Recent works include design and implementation of the USDA Forest Service-sponsored Wildland Fire Assessment System (WFAS) web site, co-author of the research paper on the fire behavior associated with the 1994 South Canyon Fire, and project manager for the FireFamily Plus program development.

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