Predictive Services: Decision Support for Proactive Wildland Fire Management

Introduction

In many ways, the 2000 fire season was a turning point for wildland fire management. The National Fire Plan (NFP) identified a number of sorely needed actions to improve firefighting, rehabilitation/restoration, community assistance and accountability. The NFP also identified the need for a more proactive approach to anticipating fire activity in order to pre-position resources through the integration of fire weather, fire danger/fuels information and intelligence. A new program was developed called **Predictive Services**. Twenty fire weather meteorologists were hired under the NFP to team up with intelligence specialists and wildland fire analysts to form Predictive Service units at the National Interagency Coordination Center (NICC) and the Geographic Area Coordination Centers (GACCs).

Through collaborative leadership, with input from user groups at all levels, Predictive Services strives to continually improve the quality, accuracy, and relevance of decision support products provided through the multi-agency coordination system to fire managers and users nationwide. This is achieved by the development and issuance of weekly, monthly and seasonal fire weather / fire danger outlooks, daily briefings and various wildland fire resource and intelligence reports. While these products and information are routinely used to support resource allocation decisions, it can also help firefighters elevate their situational awareness, especially when they move from one assignment to the next in locations and/or fuel types they are unfamiliar with. Predictive Service products can be obtained at the following Internet sites: http://gacc.nifc.gov/ and http://www.nifc.gov/nicc/ and

This article will provide an overview of the program, describe information and products you can use both at home and when responding to an incident in an area unfamiliar to you, and point out where to find key information you should know about fire weather, fuels, and fire danger.

About Predictive Services

Predictive Services was born out of a need to provide both short and long-term decision support information to fire managers and firefighters. Prior to the fire season of 2000, meteorologists, fire behavior specialists, fuels specialists, and long-term analysts would often be assembled into regional fire risk assessment teams to assess the current and projected fuel conditions and fire activity over a broad geographic area. The problem with this approach was that these assessments were needed <u>before</u> fire activity developed so appropriate decisions could be made. Instead, what often happened was that much of the information was already out-dated by the time these teams had assembled, analysed data, and finalized a report. In addition, the analysis and projection was often a one-time effort and information was not routinely updated. Fire managers recognized these problems but tight budgets and higher priorities prevented an immediate solution.

The National Fire Plan helped to resolve this issue by providing for the development of the Predictive Services program to **integrate fire weather, fire danger and resource information** for strategic resource allocation and prioritization. Fire management is somewhat analogous to military operations in that one must anticipate the location and time of the battle and pre-position the right amount of resources to deal with the threat.

By pre-positioning forces ahead of dry lightning or high wind events, fire managers can:
- maximize public and firefighter safety,
- reduce losses,
- lower costs.

One of the key points about Predictive Services is the requirement to have dedicated teams focused on fire weather, fire danger and resources. Each Geographic Area Coordination Center (GACC), including the National Interagency Fire Center (NICC), has a Predictive Services unit staffed with one or two meteorologists and an intelligence specialist (Figure 1). The NICC unit at Boise also has a wildland fire analyst and some of the GACCs bring on fire behavior specialists during their fire season as needed.

Figure 1. Map of Geographic Areas

Information Tools

Predictive Services meteorologists utilize a variety of sources of weather information, including two primary systems called FX-Net and the Real-Time Observation Monitor and Analysis Network (ROMAN). Forecasters use personal computer workstations running FX-Net software (provided by the National Oceanic and Atmospheric Administration's Forecast Systems Laboratory) which allows them to quickly and easily view satellite imagery, numerical weather models, observations and radar information. ROMAN is a web-based application (http://raws.wrh.noaa.gov/roman/) for displaying weather observations in a very easy to understand and user-customized format from a variety of observation networks, including Remote Automatic Weather Stations (RAWS) near fire incidents.

Fire analysts utilize several sources of fuels, fire occurrence, and fire danger information. One important tool is the Wildland Fire Assessment System which is an excellent Internet site (www.fs.fed.us/land/wfas) for weather, fire danger, vegetative "greenness" maps, and other fire related information. KCFAST (http://famweb.nwcg.gov/kcfast/mnmenu.htm) provides a key source for fire weather and fire occurrence data. This data is often analyzed using FireFamily Plus, a PC program that imports weather and fire occurrence data to compute and display fire danger indices and a variety of other outputs. Other sites that display experimental gridded NFDRS forecasts include:
http://www.wrh.noaa.gov/mso/fireweather/nfdrs.php
http://www.cefa.dri.edu/data/NatlERC/natlErc.html

Resource information is available via routine geographic area summaries and incident management reports, available at FAMWEB (http://famweb.nwcg.gov/) and the NICC and GACC Websites listed earlier in this article. A program called "CHEETAH" was developed specifically to assist Predictive Service units to assess fire occurrence and resulting resource needs. The CHEETAH program allows analysts to estimate the number resources needed per fire episode in various geographic or sub-geographic areas. For further information about CHEETAH, contact Tom Wordell (see contact information at end of article).

Products and Services

Perhaps the greatest strength of Predictive Services is the ability to distill a large amount of weather, fuels, and fire danger information into short, concise documents which pinpoint problem areas (critical fire weather event, location, time, degree of potential, confidence, etc.) and which areas which will likely show improvement. Many of these products are very useful to managers in the Geographic Area wanting to proactively allocate resources prior to a fire event occurring. They are also very useful to firefighters traveling to an incident outside their local area who want to gain situational awareness of weather and fuels conditions there and know what to expect during the next week.

As an example, Predictive Service units started developing a new 7-Day Significant Fire Potential product during the summer of 2004. This outlook product is updated daily and provides information about fire danger, weather triggers, anticipated resource needs and other useful information for the next seven days. Figure 2 shows an example of this outlook product for Southern California.
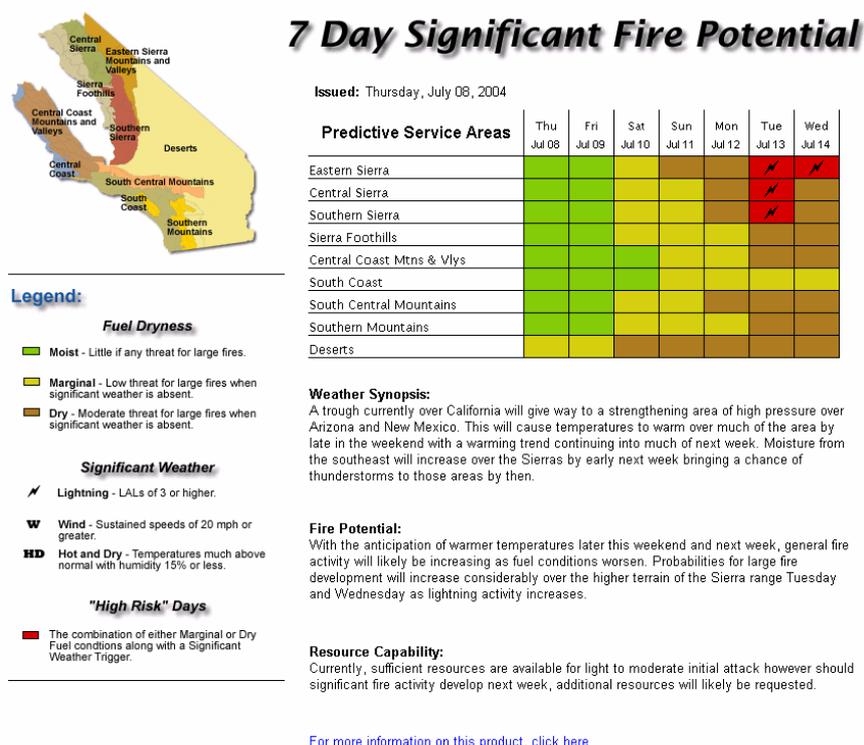
Figure 2. Example of the 7-Day Significant Fire Potential Outlook for Southern California

The geographic 7-Day Significant Fire Potential Outlook product is very useful for knowing what areas are expected to have a combination of dry fuels, significant weather triggers and possible resource needs.

Some of the GACCs are posting the data that is used to generate the graphics for the 7-Day Significant Fire Potential Outlooks. Figure 3 shows an example of how this data is displayed.

7 Day ERC Projection

Predictive Service Area	Fri Jul 29	Sat Jul 30	Sun Jul 31	Mon Aug 01	Tue Aug 02	Wed Aug 03	Thu Aug 04	Historical Ave	Max	97%
Eastern Sierra	82	81	79	76	77	79	81	74	94	92
Central Sierra	66	66	67	68	69	70	71	63	83	82
Southern Sierra	66	65	62	59	58	59	61	57	77	78
Sierra Foothills	81	80	81	81	82	82	83	68	86	83
Central Coast Mtns & Vlys	73	73	73	72	72	73	73	57	76	76
South Coast	53	52	49	47	45	44	45	63	88	86
South Central Mountains	58	58	56	53	52	53	57	58	80	77
Southern Mountains	49	44	43	42	41	41	41	58	88	77
Deserts	83	81	79	76	74	75	76	80	99	102

Figure 3. Example of 7-Day Energy Release Component (ERC) Projection

Some units also issue daily outlook reports and graphics, which summarize the forecasted weather and fire behavior across the area (see Figure 4).

Figure 4. Example of Daily Fire Weather / Fire Behavior Outlook

Monthly and seasonal outlooks are also issued by each GACC and incorporated into national products. Seasonal assessment workshops are typically held during the winter (for the Eastern and Southern States) and spring (for the Western States and Alaska) in order to bring together climatologists, fire managers and Predictive Service personnel that coordinate the pre-season outlooks. Seasonal assessments are issued by NICC periodically year-round and by the GACCs prior to their fire season, including one or more mid-season updates. An example of a monthly national outlook, along with an overlayed plot of the large fires which occurred during that period, is shown in Figure 5. These maps are not intended to depict the areas where all large fires will occur since large fires routinely occur even under normal conditions during fire season. They do, however, attempt to illustrate those areas with elevated fire potential (areas where wildland fire situations will require out-of-area resources).
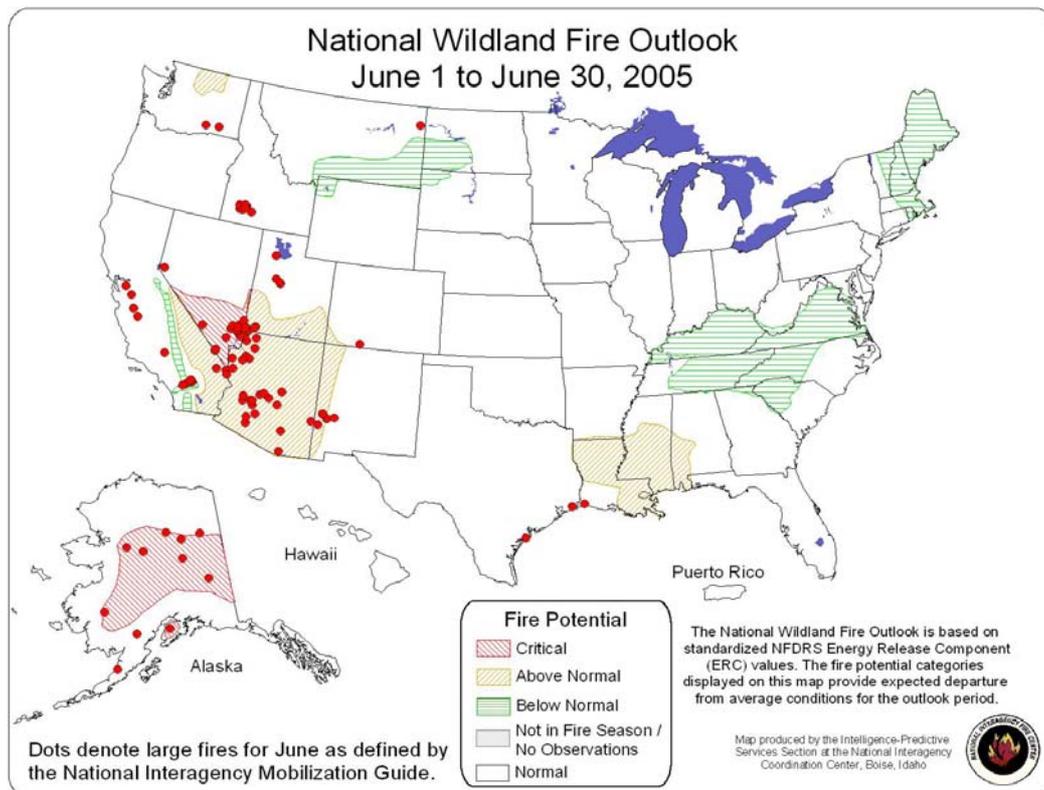

Figure 5. Example of Monthly Outlook overlayed with large fire occurrence (dots)

The Value of Pro-Active Resource Allocation

One event that demonstrates the strength of Predictive Services occurred in the Pacific Northwest during the dry lightning outbreak of August 12, 2001. Four days prior to the lightning event, the Northwest Area Predictive Service Unit warned fire managers about the potential for dry lightning in areas already experiencing very high to extreme fire danger. This information, including various scenarios, confidence levels, and recommendations allowed **managers to pre-position the following resources**:

- Air tankers
- Contract crews and engines
- 5 task forces; each comprised of 2 crews, 5 dozers and a water tender
- Staging of two Type 2 Incident Management Teams

The dry lightning materialized as forecast and resulted in over 200 fires. By August 15th there were 18 fire complexes scattered throughout Washington and Oregon. Fire suppression costs for the Northwest in 2001 were approximately $170 million. By pre-positioning fire fighting resources, fire managers were able to suppress a large number of small fires and thus prevent them from becoming large and costly project-sized fires

Summary

Predictive Services is the integration of fire weather, fire danger and resource information to:

- Assess fuels and fire danger
- Generate daily, weekly, monthly, seasonal fire weather/fire danger outlooks
- Provide long-lead times for critical fire weather events
- Identify fire threat areas.

This allows fire mangers to make sound decisions for both short and long range strategies for resource allocation and prioritization. As was shown in the Pacific Northwest example, Predictive Services can help improve safety, reduce loss, lower suppression costs, and provide key situational wildland fire information to resources responding to incidents in areas they may be unfamiliar with.

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