Application of the Fire Danger Pocket Card for Firefighter Safety

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Abstract. A new tool has been developed to help firefighters interpret outputs of a fire danger rating system. The Fire Danger Pocket Card for Firefighter Safety (or Pocket Card) is a laminated, pocket sized sheet containing locally significant historical fire danger information. The concept of and template for the Pocket Card were created by the National Advisory Group for Fire Danger Rating. The idea for the card came from a fire incident in North Carolina at which prophetic fire danger indicators were not understood by firefighters. The Pocket Card displays historical reference points for local areas including daily all-time worst and average index values, date and size for a couple of significant fires, seasonal trends of active and less active fire seasons, and thresholds of other weather or fuel conditions. Given the daily values for the fire danger indices, the Pocket Card enables the firefighter to track the current seasonal trend, to put into context the day's index value, and to quickly gauge the potential difficulty of the day's fire suppression efforts. Due to the local memory displayed, Pocket Cards are valuable to out-of-area crews as well as local firefighters. For this reason, a website (http://fire.blm.gov/nfdrs) has been established for posting and accessing cards.

Introduction

Early in my career, I can remember hearing the Energy Release Component (ERC) broadcast over the radio. As a firefighter, that information was intended for my benefit. Yet I had no idea how it was supposed to help me. Oh, I had a sketchy idea of what the ERC was, but I did not appreciate the importance of the value of the index. I had no historical perspective for a value of, for example, 62 on August 1. Would that value have been below or above average for August 1? Would it be near the highest value ever recorded for August 1? Had any large fires occurred on my district in the past when the ERC was near 62? How should I prepare for today compared to yesterday when the ERC was 60 or last week when it was 50? Chances are I didn't even remember it was 50 last week. Back then I had the opportunity to fight fire out of state, in Montana, Nevada, and South Dakota. Did an ERC of 62 have the same meaning in those locations as it did back home? Like many firefighters then and now, I did not know how to interpret fire danger ratings and apply them as a personal safety aid.

A new tool has been developed to help firefighters like me interpret the outputs of a fire danger rating system: The Fire Danger Pocket Card for Firefighter Safety (hereafter the Pocket Card). The purpose of this paper is to explain what the Pocket Card is and how it is being used to inform firefighters of local fire danger conditions.

Origins and Development

The National Advisory Group for Fire Danger Rating (NAGFDR) is an interagency group chartered to provide the "Keeper of the NFDRS Code" (the U.S. Forest Service) and the NFDRS user community (agencies of the National Wildfire Coordinating Group) with recommendations on the future development and application of the National Fire Danger Rating System (NAGFDR charter). In 1995, the Interagency Management Review Team for the South Canyon Fire charged NAGFDR with developing "an implementation plan to improve technical transfer of fire danger technology" (Final Report of the Interagency Management Review Team). This charge was insightful, because, at least for some firefighters in the United States, fire danger rating has long been viewed as a "high-tech" tool for office planners (Cook). NAGFDR subsequently built a plan which provided fertile ground for development of new ways to reach firefighters on the ground with fire danger information.

The fire season of 1994 was memorable across the country. In North Carolina, for example, the Fish Day fire began on May 21. The fire was difficult to control as it made several major runs and escaped containment lines on three separate occasions. On May 26 the fire abruptly changed direction and resulted in the burnover of nine firefighters. Fortunately, no serious burn injury occurred. These firefighters were surprised by the sudden erratic fire behavior. Gary Curcio, Fire Staff Specialist, North Carolina

Division of Forest Resources and NAGFDR member, was asked to investigate the status of fire danger and to identify what conditions contributed to this near-fatal event. He discovered that locally important thresholds for firefighter safety had been surpassed: the all-time worst values for May 26 were recorded for Ignition Component, Spread Component, and Burning Index. Informed with this and other fire danger information, Curcio believed that everyone involved would have had a better idea of what was likely to happen that day and could have prepared accordingly (Curcio). So he drafted charts of the significant fire danger indicators for the local area of the Fish Day fire and shared the information with NAGFDR.

The concept of Curcio's charts fit directly into the NAGFDR technology transfer plan. A field-ready prototype Pocket Card was developed in July 1997 (Andrews et al). Pocket cards were made for eight Bureau of Land Management (BLM) districts and one California Department of Forestry and Fire Protection (CDF) Ranger Unit before the end of the 1997 fire season. Training in how to make and use them began at Geographic Area- and National-level NFDRS courses. Through October 1998, at least 29 cards have been made.

The Pocket Card

What is it?
The Pocket Card is a visual aid. The name for the card comes from the intention that the card will fit in the pocket of a firefighter's shirt, or be equally accessible. In this form it is a laminated sheet about 5" by 7" that has been folded in half. The resulting four-sided card has two colored charts and two sides of explanatory text, as seen in Figure 1.

The Pocket Card is for firefighters. Other layers of the firefighting corps, such as dispatchers and managers, are also finding utility in the card, but they already have access to the same information through their desktop connectivity and computing. The Pocket Card is the firefighter's field-capable computer screen of significant fire danger information.

The Pocket Card is for making a general assessment of fire potential based on local weather conditions and historical fire occurrence. It is a tool for interpreting fire danger ratings for a local area. Now when I hear the ERC is 62, I will know how that value relates to my local area's potential for fire activity.

What information will you find?
Each Pocket Card is full of historical and interpretive information. The information on the card should be representative of a wide area, such as the North or South portion of a fire zone, as shown in Figure 1. For simplicity, it is not recommended to build a card for every weather station. Rather, choose the most representative, most relied upon weather source as the basis for the card.

In the upper left quadrant of the card, a color graph shows the historical worst and average seasonal trends for the fire danger rating output that best correlates to local fire activity. For the Burns Interagency Fire Zone -- North, that output is the Energy Release Component (ERC). A dashed line is drawn to identify an historically significant threshold for the ERC, in this case the 97th percentile. This line reminds firefighters that only 3% of the days with recorded weather during the fire season reached an ERC above 69. So when it happens, heads up, watch out, and don't expect to catch the fire today!

In the lower left quadrant are two more seasonal trends for the ERC. One is for a year with relatively low fire activity and the other is for a relatively busy fire season. If possible, days when locally significant fires occurred are labeled on the seasonal curve for either year. These fires should be memorable to local firefighters for some reason, perhaps final size, length of campaign, erratic fire behavior, or worse: entrapments, fatalities. The point is not to dramatize, but to help trigger a memory, to heighten awareness or to inspire caution. The fires plotted do not have to fall neatly above the dashed threshold value; in fact in many fuels, significant fire activity occurs well below this level. The fuel model most representative of the area covered by the card and used in calculating the trends is shown as well.

In the background of both seasonal trend charts is a red-to-yellow-to-green color scheme. The width of each color band is adjustable to reflect local conditions. These colors serve to interpret what type of firefighting activity is generally possible given a value of the fire danger index within that band. The interpretations are found in the upper right quadrant next to the traffic signal and they are also adjustable to meet local needs. The traffic light or hauling chart concept is recommended, that is, red means "stop," or "direct control by any means is not likely"; yellow means "caution," or "this is your upper limit of effectiveness"; green means "go," or "proceed but always be wary of change."

Also in the upper right quadrant is a description of where the card has meaning. If possible, a map should be included to assist those from out of the area who may use the card. Sources of weather data used to make the card are also identified. Explanations are given for the maximum and average trends and for the designated percentile, including the length of weather records used in the analysis. Other local thresholds that raise the pucker factor or Shout Watch Out are also provided. The measures and their values are important locally and may not be elsewhere. These may include windspeed, relative humidity, temperature, live fuel moisture, 1000-hour fuel moisture, Keetch-Byram Drought Index, or number of days since last significant rainfall. The Boise National Forest chose to be more explicit about ERC thresholds: when it is above 40, initiating fires will be Class E (300-999 ac) in size; fires starting when ERC is over 50 will burn until the snow falls.

In the lower right quadrant more information is provided to enhance understanding of the seasonal trend graphs. Bullet-style definitions of and insights to the index plotted in each graph are shown. Experience and facts relating to the years and fires plotted in the lower left quadrant are detailed. This may include brief explanations of the magnitude of activity in both years, the start date and final size of each fire plotted, information about why these fires are locally memorable.

How can it help you?

Ultimately the goal of using the Pocket Card is to increase firefighter safety through greater awareness of local conditions and fire potential. There are at least two ways that use of the Card can achieve this goal. First, the Pocket Card provides an interpretation of fire danger rating for the local situation. Employing appropriate interpretations for the traffic signal colors, one can quickly gauge, for example, whether or not initial attack will be successful, what the duration of a fire may be, how many resources to dispatch to a fire. By plotting the current seasonal trend against the average and all-time worst, one can confirm whether the fire season's progression is early, normal, or late, as well as whether the season is above or below average.

Second, the Pocket Card offers a supplement to experience. The seasonal trend curves are based on archived weather data. If you have worked in one area for many years, the Pocket Card should support your memory of the fire seasons, the significant fire events, and the typical and worst-ever seasons. In no way should the card replace your experience. For firefighters who have been on location only a couple of years, or have worked many fires but never before in your area, the Pocket Card provides instant long-term memory. Now they have a reference to a very active fire season trend that everyone talks about, but which they did not experience. They have real examples of fires that occurred and their associated fire danger conditions. And they have other local thresholds, like measured live fuel moisture in sagebrush, to consider; the kind of indicators that are often like a sixth sense for locally experienced firefighters.

Applications

After only one full fire season of existence the Pocket Card is showing up in all sorts of places. Efforts to repackage the message of the card will further support NAGFDR's goal of increased awareness of fire danger at the firefighter level.

When you are dispatched to a fire outside your local area, how will you find the Pocket Card representing the area to which you are going? To facilitate access to everyone else's Pocket Cards, a website has been created. The host address is http://fire.blm.gov/nfdrs. You can also get there from the NWCG homepage at http://www.nwcg.gov then select Resources, or from the US Forest Service fire technology transfer website at http://fire.org then select Online and FDRPC. At this site you can find 1) Pocket Cards from the US, organized by geographic area and agency, 2) an explanation of what the card is and how to use it, 3) a guide to creating your own card and how to get it posted, and 4) instructions on how to print the card you want. Since Pocket Cards are meant to be constructed locally, the completeness of the inventory depends on the number of cards submitted to the website. Pocket Cards outside the United States are welcome.

The Pocket Card is ideal for briefings: daily briefings for the home unit crew, briefings for incoming crews, Incident Command daily briefings, and informal updates from enlarged seasonal trend graphs posted in dispatch and crew quarters.

In Utah, the Bureau of Land Management fire engines carry a spiral bound set of 5 cards in their glove box, one for each of the BLM districts in the state. Pocket cards or the seasonal trend relationships found on the card are also being posted on local wildland fire websites (for example: Northern Rockies Coordination Center: http://www.fs.fed.us/r1/fire/nrcc).

In order to reach everyone who should be aware of this tool, Pocket Cards will be presented at many required annual refresher events in the coming year and should become a regular topic of discussion.

It should be noted that possession of a Pocket Card is not quite enough to obtain its potential benefits. Daily updates of the index plotted on the cards seasonal trend and of the local thresholds are necessary for the card to have current value. For this reason the indexes on the card should match with those that are regularly reported and posted for the area represented by the card.

Building a Pocket Card

The prototype Pocket Card requires no less than four software programs to create it. Despite this situation, the strong field support for this product has demonstrated the need for an operations-friendly method of building a card. In February 1999, the first version of the software program Firefamily Plus will be released. This one program will do almost all the work and make pocket card production significantly easier. Instruction for Firefamily Plus will be available at Geographic Area- and National-level NFDRS training. Two other noteworthy improvements Firefamily Plus will offer over the prototype are the option to develop the seasonal trends from a group of weather stations rather than just one and the option to construct the card with the Canadian Forest Fire Danger Rating System processor.

Conclusion

Pocket Cards are a picture of your local fire danger history. Given a daily or forecasted index, every firefighter can broadly assess their situation. They can answer the daily question: "What kind of day am I going to have today?" If the answer to this question helps us as firefighters decide how to go about today's business safely, then the objective of the card is fulfilled.

The indexes plotted on the card are not limited to those of the US National Fire Danger Rating System. Most any measure will do, including Keetch-Byram Drought Index, measured live fuel moisture, Drought Code, Buildup Index, and days since last significant precipitation.   The primary consideration is that the chosen index is important locally and followed closely.

I encourage you to make a card for your local unit and have them ready for next fire season. Share it with your staff and with your cooperators. Share them with those who may someday come to help you by submitting it to the Pocket Card website. Help make fire danger rating valuable to those who need it most, our firefighters.

References

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National Advisory Group for Fire Danger Rating Charter, revised June 4, 1996.

Figure 1

FIRE DANGER -- Burns Interagency Fire Zone (North)
Maximum, Average, and 97th Percentile

(ERC plotted vs. May, June, July, Aug, Sept, Oct)

Years to Remember: 1993 1990

August 6 Fires

Fuel Model G -- Decadent Conifer Stands

Fire Danger Area:
The Northern portion of the Burns Interagency Fire Zone, represented by aged short needled conifer stands (Fuel Model G) North of Hwy 20. Based on Crow Flat RAWS 353515

Fire Danger Interpretation:
Direct control by any means is not likely
Represents manual control limit
Generally controllable fire behavior

Maximum -- Highest ERC by day for 1978 - 1998
Average -- Shows peak fire season.
97th Percentile -- Only 3% of the days from 1978 - 1998 had an ERC above 69.

Local Thresholds-- *Watch out* : Combinations of any of these 4 factors can greatly increase fire behavior.
Windspeed > 10 mi/h, RH < 12%, Temperature > 88°F
1000-hr <11%

Remember what Fire Danger tells you:
✓ ERC gives general seasonal trends calculated from precip, temp, and RH.
✓ Windspeed is not part of the ERC calculation.
✓ Watch local conditions and variations across the landscape--Fuel, Weather, Topography
✓ Listen to weather forecasts--especially WIND.

Past Experience:
In 1990, 52 fires burned 106,445 acres.
In 1993, 44 fires burned 21 acres.

Fires which began on August 6, 1990:
Whiting Spring	5,880 ac
Pine Spring Basin	73,228 ac
Buck Spring	23,788 ac
#604	1,608 ac

Developed by NAGFDR--National Advisory Group for Fire Danger Rating