Fire Weather Prediction Tool Modernizes Science Behind Forecasts

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Fire weather forecasters need accurate and proven tools to help them anticipate when weather conditions can make wildfires dangerous for fire managers. USDA Forest Service scientists are expanding the options with the development of the Hot-Dry-Windy Index (HDW), a new fire-weather prediction tool based on the key atmospheric variables that affect wildland fire: temperature, moisture, and wind.

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Jay Charney
Right now, we are looking at the Hot-Dry-Windy web server that presents a national map of where Hot-Dry-Windy is particularly high today. Now, since it's the middle of winter there aren't... [INAUDIBLE]

Jonathan Yales
This is Jay Charney, a U.S. Forest Service research meteorologist in Lansing, Michigan. He's a member of the research team behind the recently developed Hot-Dry-Windy Index. It is a new fire-weather prediction tool based on the key atmospheric variables that affect wildland fire: temperature, moisture, and wind. I'm Jon Yales with the USDA Forest Service Northern Research Station, and I spoke with Jay in February about the new tool.

Jonathan Yales
So, Jay, where did the need for the index come from?

Jay Charney
We developed Hot-Dry-Windy to try and respond to the desire on the part of fire weather forecasters and fire managers to have an easy to use number or index or product that gives them an idea of how difficult a fire is going to be to manage on any given day due to weather conditions. Part of the concept of Hot-Dry-Windy is that it's meant to be sort of the first cut. Hot-Dry-Windy isn't meant to be the final answer to anything; it's meant to be an indication that this is a day that could be bad, and then it's up to the incident meteorologist or the fire weather forecaster to dig deeper and say why it might be bad and how the fire manger should best account for that.

Jonathan Yales
And, why does it only take into account temperature, moisture, and wind? Why is it so simple?

Jay Charney
Part of the reason why we designed it to be this simple is that we are using broadscale weather information to define the Index. So, we're not claiming that we're going to tell a fire manager how strong the winds are going to be blowing through their hair or blowing across a fire front. We're saying that the weather conditions in that part of the county, or even that part of the state, could be these certain values that we're forecasting. Very, very fine scale weather, or very local scale weather, could be quite different from what we're forecasting. If we wanted to be very, very detailed about how weather conditions impact a fire we would need a different data set and a different type of forecast than we're using right now. We would need to go down to very fine scales, we would have to take observations all the time, and use a much more complex, interactive model to say how was the fire interacting with the fuels, with the topography, and the weather all at the same time. Because Hot-Dry-Windy is simple, we're able to kind of pull back, and say, the weather conditions we can forecast on this larger scale indicate the potential for this day to be worse than yesterday or tomorrow, for instance.

Jonathan Yales
But, why isn't fuel or topography taken into account?

Jay Charney
The reason why we don't add anything about fuels or topography is we have presented Hot-Dry-Windy as an index that tells you if you already have a fire, or the potential for the fire, on the ground due to fuel and topographical characteristics or conditions, this tells you how much of a factor weather is likely to be for a fire that's basically already going or might have already gone anyway. Hot-Dry-Windy gives you an idea of how much more of a problem the fire could be due to the weather conditions.

Jonathan Yales
And, how about testing? How did you test the index?

Jay Charney
Well, what we have done is that we have gone back over a number of historical fires that happened over the last 15-20 years – for which we have the sort of meteorology of record available – and have computed Hot-Dry-Windy for the days leading up to days that we know that intense or severe or unexpected fire behavior happened on those fires. So, we've calculated Hot-Dry-Windy and tried to determine if Hot-Dry-Windy would have anticipated that day in advance. And what we found was that for a variety of different types of fires, Hot-Dry-Windy appears to have some skill, or some ability, to highlight the bad days on those fires.

Jonathan Yales
Is it still being refined or updated?

Jay Charney
We haven't done what we as scientists would consider a comprehensive analysis of: is it statistically skillful, how well does it actually do? So, looking at additional fires, as many fires as we can find, and analysing the skill statically and saying, what's the likelihood that Hot-Dry-Windy is going to light up when you have fire days is important. There's anecdotal evidence, there's indications that it is useful, but from a scientific standpoint we'd like to have a large number so we can do robust statistics and say, this is how Hot-Dry-Windy behaves. The other issues that we have is that we've analyzed Hot-Dry-Windy mostly from one type of meteorological dataset. There are six, seven, eight different models that are available, and different types of meteorological data, so, what's the difference between looking at Hot-Dry-Windy for this very broad model that we've looked at so far and looking at these other data sources? We're analysing how Hot-Dry-Windy for the same fire behaves – or what sort of numbers come out of it – for the models we already analyzed it and comparing it to others.

Jonathan Yales
For more information on the Hot-Dry-Windy Index see: www.nrs.fs.fed.us/disturbance/fire/hdw

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