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# Fighting Wildfires With Computers and Intuition

By MARC LACEY

PHOENIX — As thousands of firefighters used hand tools and hoses to combat the wildfires torching vast stretches of the Southwest, Drew Smith stared into a computer screen at a command center near one of the fiercest blazes and tried to determine which way the flames would veer next.

Some wildfires are mean. Some are wily. Some show exceptional endurance, or fierceness or moxie. The most difficult among them are assigned behavior analysts like Mr. Smith — fire whisperers, as it were — who act as psychologists delving into the blazes' inner selves.

"This fire is an exceptionally aggressive fire based on how large it has become and how fast it's growing," said Mr. Smith, now assigned to the Wallow Fire, which has become the biggest blaze in Arizona history after burning more than 527,000 acres in the eastern part of the state.

Fire behaviorists work alongside meteorologists, given that the weather, especially wind patterns, plays a pivotal role in how a wildfire grows. The topography is also important because fires burn differently depending on whether they are going up a steep slope, across a valley or through a developed area. Then there are what firefighters call the fuels, which are the vegetation and other materials that give fires energy as they move along.

With more than a dozen significant fires now burning through the Southwest, the fire whisperers are busy. At the sunrise briefings that wildland firefighters attend before they go off to the lines, a variety of status reports are offered on the day's work ahead. None, though, is listened to as intently as that of the

behaviorist, who uses computer modeling and intuition to try to predict how the fire will burn that day.

"They seem to get inside the head of the fire, sort of like a Dr. Phil for a fire," said Helen Snyder, who attended the daily strategy sessions that firefighters held in May as the Horseshoe 2 Fire threatened her home in Portal, Ariz. "Everyone hung on their words as they drew mental pictures of the fire."

The fires that Arizona has experienced, some surging forward faster than expected, are testing the mathematical models that behavior specialists use.

*Drew Smith, a fire behavior analyst, looking for clues. Mr. Smith is a kind of fire whisperer who acts as a psychologist delving into blazes' inner selves.*

Joshua Lott for The New York Times

Tom Zimmerman, a fire behavior expert at the National Interagency Fire Center for the United Forest Service in Boise, Idaho, said that the Wallow Fire had on occasion advanced more quickly than the models predicted. "We use each fire to verify the models and make them more accurate," he said.

Even with all the data crunching, fires are still full of surprises. That means that firefighters must be constantly ready for the unexpected and that residents insistent on knowing whether a fire is moving their way or when an evacuation order will be lifted may not get the definitive answer that they seek from fire officials.

Scrutinizing a fire means thinking about it constantly, sometimes even in one's sleep. Fire specialists say they ask themselves what the fire is trying to tell them on a given day, as if it is communicating through its flames. And some of them speak of fires as though they were living, breathing things.

"One of my colleagues used to compare wildfires to coyotes because you can see them off in the distance but as soon as you take your eye off them they will come up and bite you," said Ben Newburn, a fire behavior specialist in Reserve, N.M., who is analyzing the east side of the Wallow Fire.

So vast has that particular fire grown that it has been divvied up into three parts and scrutinized from different perspectives. "Early on, this fire was moving 10 to 12 miles in a single day, and we consider that



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extreme fire behavior," said Mr. Newburn, who works for the Forest Service.

There is a warlike aspect to fighting wildfires, and the fire behavior specialists have all spent considerable

*Firefighters in Eagar, Ariz., took a break before returning to battle the Wallow Fire, which has at times advanced more quickly than fire behavior analysts had projected.*

time as grunts, digging trenches, chopping down trees and setting off controlled burns to keep runaway flames in check. They have also managed fire crews and made the tough calls on when to advance and when to retreat. Now, though, they are like intelligence analysts trying to outthink the enemy.

Despite learning the laws of thermodynamics that govern fires, behavior specialists say there is still plenty of unpredictability to each blaze, which requires them to draw on their long experience. Fires can produce their own weather patterns, for instance, which can then end up altering the course of the fires.

The analysts' critical judgments have significant real-world consequences. They acknowledge that not every call they make is perfect.

Would the Wallow Fire surge toward the small resort town of Greer or sweep by it at a comfortable distance? The fire made a sudden move around firefighters' containment line and ended up damaging some homes and forcing firefighters to quickly retreat.

Would the Monument Fire, a growing blaze in southern Arizona, be held back by containment lines or surge past them? The fire, at just over 28,000 acres on Thursday afternoon, has declined in ferocity but only after destroying dozens of homes by jumping a highway and breaking containment lines.

Would the Horseshoe 2 Fire, fueled by a frost kill of


*Fire officials on Wednesday charted the Wallow Fire.*

*Pine trees in Greer, Ariz., were victims of the Wallow Fire, which became the biggest fire in state history after burning more than 527,000 acres.*

oak this past winter, slow down at the back burns that firefighters were starting or spew burning embers right past them? The back burns did keep the fire in check, and although it has burned more than 220,000 acres since May 8, it was 95 percent contained on Thursday.

Two blazes could have nearly identical characteristics in two subsequent years and act quite differently because of the weather patterns leading up to them. One of the factors fueling this fire season, experts say, is the long drought that preceded it, which left the forest floors dry and susceptible to fire.

"You learn after you've been around fires that they are like people, in a sense," said Mr. Smith, who is a captain with the Los Angeles County Fire Department when he is not on assignment at a wildfire. "No two of them are the same."