

"Uniting the Global Wildland Fire Community"

VOLUME 25.2

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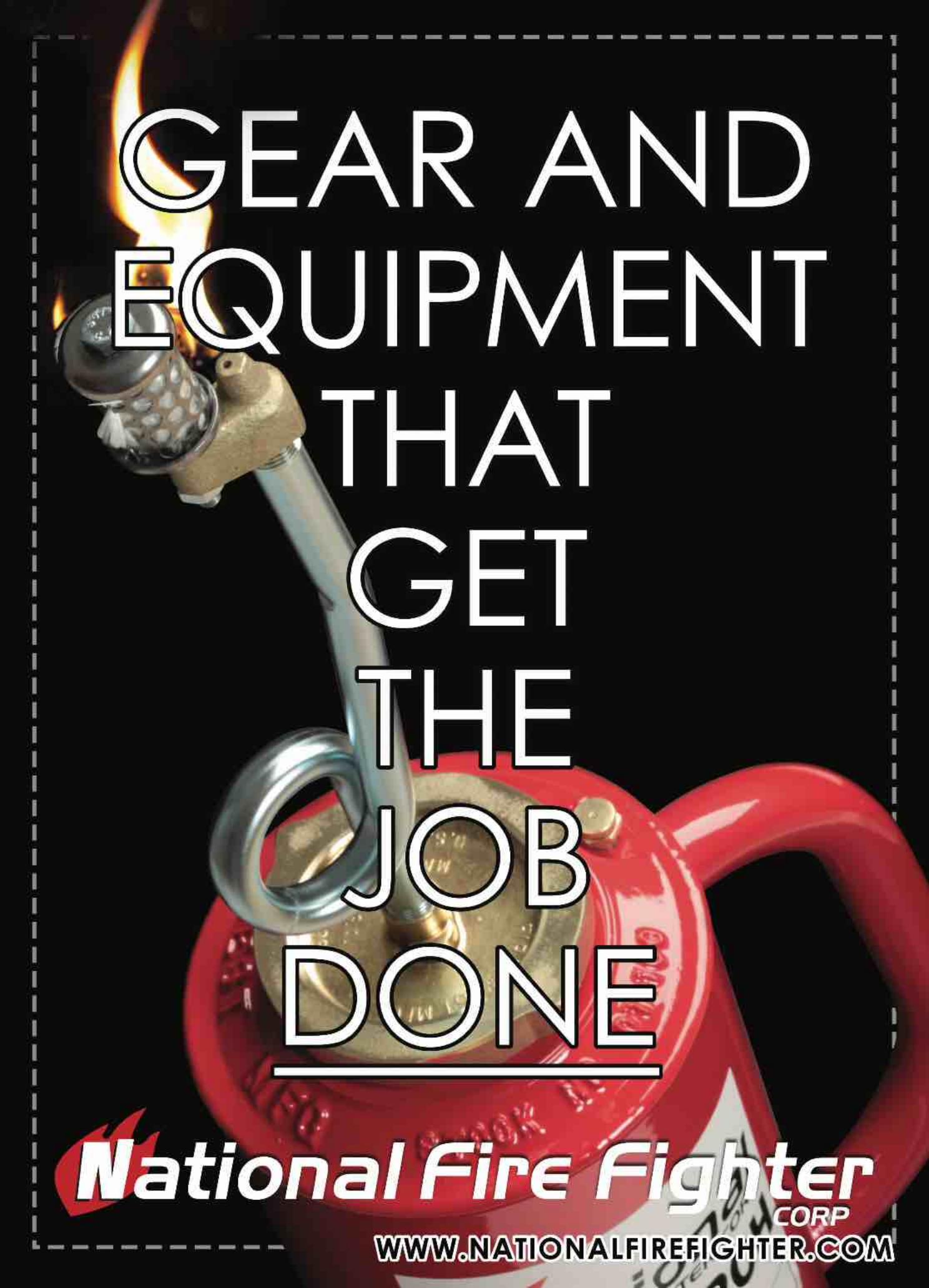
MARCH/APRIL 2016



the **UNBIDDEN**
WILDFIRE
& other **Wicked Fire Problems**



An official publication of the **International Association of Wildland Fire**



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Cushion plants burned above Lake Mackenzie, Tasmania. The fires burned in middle and late January in an ecosystem not adapted to fire. See "The Tasmanian Fires of 2016" for our first-person report. Photo: Rob Blakers.



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In this issue of *Wildfire*, we preview the innovative paired conferences in Melbourne, Australia and Portland, Oregon this April. The conference theme, "Wicked Problem, New Solutions: Our Fire, Our Problem," inspired us to gather a range of articles and columns circling the challenge framed by these conferences.

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When we spot a small fire on a far-off ridge, we start to ask the questions, What should we do? How should we manage it? A narrative of the wicked-problem decisions we face on the ground, by writer Stephen Fillmore. An After Action Essay, page 34. Photo: Ron Steffens.

A More Complicated Wildland Fire Situation –

WHAT ARE WE DOING ABOUT IT?

If we are to be a learning organization, then how do we actively learn?



what the future holds. Each year, we further understand escalating complexity, we gain appreciation of capricious risk, and we take comfort in describing fire management as a year-round global activity with formidable future challenges.

We have seen wildland fire management expand from a single-objective driven program (fire exclusion) to one having multiple objectives responsive to land and resource management plans. As a result, we've also seen dramatic maturing in the program basis, planning and implementation capabilities, science and technology, and policy framework. Yet resting on these gains may limit how well the program can meet future challenges. Certainly, our knowledge has never been greater in many areas of fire management -- such as the natural role of fire; fire behavior and fire effects; science, technology, and operational capabilities; policy dynamics; and management strategies and tactics. We are proud that planning, decision-making, and management response take place commensurate with knowledge, experience, and capabilities.

We continue to talk much about wildland fire management. We know what the past shows us, where we are today, and

But wildland fire management cannot respond to the challenges of the future without actively continuing to grow in its body of knowledge, experience, and capabilities. A passive approach to wildland fire management characterized by such attributes as an over-reliance on past experiences, failure to incorporate new science and technology, continued increases in and support for failed strategies, rigid program requirements, dated training and education, and failure to fully capitalize on lessons learned cannot be endured. We must anticipate and plan for changing situations.

So, is the wildland fire situation becoming more complicated? Frequent news reports during fire seasons foretell of approaching firestorms exceeding anything ever experienced or seen before. Climate change discussions often lead to descriptions of worsening fire activities in terms of numbers, area burned, burning intensities, and duration of wildfire activity. Annual reports highlight increasing numbers of fires, areas burned, and structures destroyed. Many of these things are happening and are complicating management needs and activities.

What can be done about a more complicated program? We refer to increasing wildland fire complexity and risk. Perhaps a review of these areas could help define the wildland fire situation and areas for attention. If complexity is defined as the degree of difficulty in accomplishing objectives, then numerous factors can be viewed as influencing complexity, including:

- How specific circumstances surrounding a particular fire will affect implementation activities, (such as the potential fire duration, factors affecting management responses in terms of planning, ground and aviation tactical activities and safety, and the management response decided upon).
- How difficult and involved the decision is for the specific situation (like the type of objectives to be accomplished, specific land ownership, and external influences that may exert strong influences on the responsible fire organization).
- What the values, concerns, and specific fire, fuel, and weather characteristics are involved.

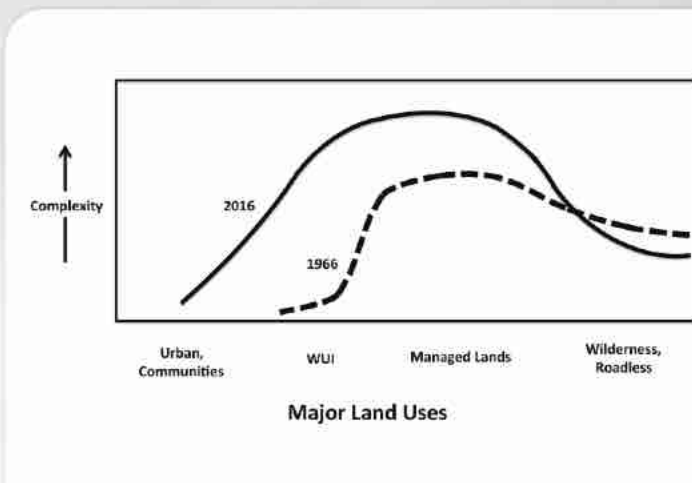
Risk is becoming an increasingly referenced topic and certainly warrants a prominent position in fire management decision-making. Risk can be defined as the probability and consequence (good or bad) of uncertain future events. Many elements can influence risk and include, but are not limited to:

- Types and quantities of values in a given area around fire origin.
- The number of jurisdictional organizations are involved.
- Fuel conditions, weather, and resource availability that shows potential for significant fire activity.
- Social/political concerns or other external factors that could have direct influence on activities.
- Relative effectiveness of assigned resources.
- Types and quantities of aircraft on a fire compared with workload and historic accident rates to gain an indication of potential accidents.
- Protection needs.
- The likelihood that suppression resources (assumes that resources are assigned and direct suppression is the strategy) will achieve progress toward containment or have an effect on protection of threatened structures.

If complexity and risk are an accurate gauge of the wildland fire situation, then increases in these areas power a more complicated fire program. The following simplified diagram of complexity across land uses in and around our wildland areas shows that over the last five decades, complexity has increased. It shows marked increases in the wildland-urban interface (WUI) areas and management lands categories. Complexity has also broadened from being highest in the wildland areas primarily to now being a concern in the WUI and outlying communities. This is representative of the increasing WUI area, altered fuel conditions across most landscapes, and changing protection by wildland and community fire organizations.

The one area that does not show an appreciable increase in complexity is in the wilderness/roadless areas where considerable attention has been given to managing natural fire over the last 40 years. Such management and

fire restoration activities have shown positive effects on fire sizes and intensities (Gila NF in New Mexico, USA; Yosemite NP in California, USA; Bob Marshall and Selway Bitterroot Wildernesses in Montana, USA; and the Frank Church River of No Return Wilderness in Idaho and Montana, USA, as well as other National Parks Monuments and public lands in North America).



So, can we say that the wildland fire management program is really a learning program, a knowledge-based program, responsive to science and technology, and a dynamic organization able to meet changing situational dynamics? If it is to meet future challenges, it must be all of this, and more.

A significant number of research reports, national leader presentations, political hearings, accountability reports, strategic plans, and forward-looking plans already state the problem and actions for the future, although follow-up and implementation is inconsistent. A common statement is that the most extensive and serious problem related to the health of wildland areas is the over-accumulation of vegetation, which has caused an increasing number of large, intense, uncontrollable and catastrophically destructive wildfires.

But there are other issues -- like why we cannot find a way to effectively fund wildfire suppression in the USA, why we cannot accelerate fuel treatments, why we cannot better prepare communities to withstand wildfire, and why we cannot accept and implement the benefits of managing wildfire where applicable instead of full suppression? When we look at the fuel accumulation situation, its impacts, and our level of commitment to resolution, are we disregarding learning, science, and knowledge? Slightly modifying some of the lyrics from AC/DC's classic song, "Thunderstruck," gives an apt feeling of our current state.

**We were caught
In a fire matrix way out of whack
We looked round
And know its hard but have to get back
Our minds raced
And we think what can be done
And we ask
Is there any help, any help to come
Plight of the fuels
Fires on the lands
Thunder and lightning
Tear us apart
We've been - thunderstruck!!!**

We know that the future of wildland fire management will necessitate escalated and diverse actions. We have identified many actions, but have a number of questions facing us. If we are a learning organization, then how do we actively learn? If we are a knowledge organization, where do we get information and how do we apply it? How do we prepare land and resource management professionals to better do their jobs; how do we advance their skills. Can we anticipate and prepare for what the future skills, education, and training needs will be?

The International Association of Wildland Fire (IAWF) recognizes these needs. We are committed to promote increased involvement, improved communication, escalated research, focused education and training, and active management support to help mitigate future outcomes, promote success, and elevate safety in wildland fire management. The 2016 5th International Fire Behavior and Fuels Conference, co-sponsored by IAWF and Bushfire and Natural Hazards CRC

of Australia in Portland, OR, USA, and Melbourne, Australia, is being presented to bring focus to the many issues associated with fuels, fire behavior, large wildfires, the future of fire management, and over two dozen other wildland fire subject areas.

This conference is designed to provide platforms to facilitate discussion of the latest relevant research findings, learn about and from management treatments, stimulate policy discussions, and inspire global fire management interaction. They represent a significant step to assist in the proactive advancement of wildland fire management knowledge, awareness, and capability. There will be over 250 presentations and 50 poster presentations of new research information, practical experience lessons, and case studies; numerous knowledge and skill building workshops; on-the-ground learning field trips and tours; keynote and plenary presentations; and panel discussions by notable experts in wildland fire management and those with firsthand experience of problems, solutions, and outcomes.

These conferences represent the single best source of up-to-date focused learning, continuing education for fire professionals, program currency, and presentation of research and new knowledge information.

However, also associated with these events are the limitations that bureaucratic rules and budget processes place on participation both as presenters and participants. Performing as learning and knowledge organizations, and striving to function at the highest professional levels, are limited by such systems. It would seem that the quest for wildland fire program advancement, professional development, and increased knowledge would drive, not turn away attention; and promote not limit involvement and participation. The bewilderment that comes from problem identification with seemingly conflicting resolution and action seems again to render that feeling -- thunderstruck.



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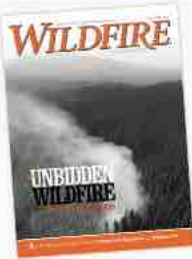
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WELCOME TO THE **Wicked** **Problems** ISSUE



Why "wicked fire problems" are the focus of two simultaneous IAWF conferences and this issue of Wildfire Magazine.



Somewhere in the 1980s "wicked" became an adverb, thus letting us now twist a phrase like "wicked funny" or "wicked hot" (which in Boston means a day above 85 and humid, according to one entry in the Urban Dictionary). But the word is far older — dating back to the 13th century and likely tied to "wicca" — witch, wizard, sorcerer. It may refer to evil but its roots refer more simply to the ones who make magic.

And in the meaning we use in this issue, "wicked problems" fully require the making of magic. The strategic and analytical concept of "wicked problems" offers a range of definitions for what a wicked problem is. But ask any fire manager or firefighter and you'll simply hear, "Our fires are getting wicked hot."

The fires we've experienced — burning hotter, faster, with more complexity and at higher costs, and bringing more risk to landscapes and communities — are rationale enough to consider a "wicked problem" analysis of our wicked fire problems. Add the challenge of managing these wicked hot fires in these wicked hot days of climate change and you'll find more than enough material for a conference theme hosted across two continents (Australia and North America) and touching most every land mass with a flammable fuel.

This issue of Wildfire doesn't attempt to offer the definitive version of "Wicked Fire Problems" but rather an introduction, a sampling of the many discussions and expert presentation that will occur in the joint Fire Behavior and Fuels conferences being held this April in Melbourne, Victoria (AU) and Portland, OR (USA).

The joint conferences will spawn articles and opinions for years to come. For now, though, we feature writers, articles, commentary and imagery looking at fireline safety, the uncertainty of modeling, and our first-person responses to wicked fire problems, in Tasmania with Michael Hill's report on a challenging fire bust, and in an After Action reflection on a single remote wildfire — all of these being fires that ask, as do all of our wildland and bush fires, what should we do with the flames and the fuels and the landscapes and communities so affected by fire?

One compelling aspect of this problem definition: Wicked problems are difficult to define and thus offer no definitive solutions -- yet we are obligated to seek the most work-able solutions among better or worse, good enough and not good enough. In this essay we witness the story of a typical fire problem, framed as a wickedly difficult problem to solve.

Another key aspect, as phrased by Horst W.J. Rittel and Melvin M. Webber in 1973: "The planner has no right to be wrong. Problem solvers dealing with a wicked issue are held liable for the consequences of any actions they take, because those actions will have such a large impact and are hard to justify."

This is a challenge to comprehend — but to phrase it at its most wickedly blunt — we are charged to act (we can't ignore the wicked problem) yet we are also held liable for our actions on problems with no definition or easy solution. Welcome to wildfire and bushfire management, circa 2016.

Also in this issue, we introduce a new leadership structure here at Wildfire Magazine. As I conclude my board service on the International Association of Wildland Fire, I am moving to the role of Managing Editor, and the position of Editorial Board Chair has been assumed by David Bruce from Australia, with Kat Thomson serving as Vice Chair. We'll offer more updates in future issues on how the magazine will be changing, and how you can help too.

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Transitions

I am engaged in a major, personal transition. After many years as a consultant, I am jumping back into agency life as the leader of a fire and aviation management program. Fortunately for me, I've rejoined an organization where I worked for many years and with which I am rather familiar. I've also got the advantage of working with some fine people who I know well, who know me, and with whom I have worked before in a variety of roles and circumstances. I've got management's support and I have the advantage of being both a student of leadership and a seasoned leader. However, I'm still transitioning into a new leadership role, and we all know such a transition can prove a challenge.

Like most leaders transitioning into an organization from the outside, I lack established working relationships with some key people. As one might expect, despite decades in the fire service and previous experience in my new agency, I also lack a detailed understanding of both my new responsibilities as well as the responsibilities of the people I lead. However, I remain very confident and have no intention of failing. In fact, I intend to accelerate my transition, giving myself just 90 days to reach the point where I am contributing more to the organization than I am requiring of the organization to support my arrival.

Like all leaders, I must build credibility and win the trust of both the people I am expected to lead and those who lead me. What do I intend to do? First I remind myself every day that we are all in this together. While my new job is a big change for me, my arrival is similarly affecting a lot of people. Consequently, my goal during my transition, must be to maximize the positive effect I have on people and minimize the degree to which I compromise people's performance. That means I must be at my mindful best by paying attention; communicating clearly and effectively; recognizing that I work with people who are different than me and adjusting for our differences; being patient; and treating people with kindness, courtesy, dignity and respect.

“My goal during my transition must be to maximize the positive effect I have on people and minimize the degree to which I compromise people's performance.”

In addition to being mindful in my interaction with people, I will be asking a lot of questions. I'm giving myself just 90 days to gather information, learn the details of my responsibilities and those of the people I lead, understand the challenges and opportunities our program faces, and just generally improve my situational awareness. Fortunately, I like asking people open-ended questions and, as a consultant; facilitator; mediator; and college instructor I've had lots of practice. I ask questions because I want to prompt people to think carefully, encourage them to tell me what's on their mind, promote dialog between us, and generally get people to engage with me. I hope that, by showing that I am willing to listen and learn, I will demonstrate that I value and respect the people I work with and foster confidence and trust in our relationships. In addition, by asking lots of questions, I can assess, not only the capabilities, but the motivations and adaptability of the people I am expected to lead.

Finally, during my 90-day transition time, I will concentrate on both my strengths and weaknesses. I know a thing or two about myself. For example, I am motivated by a good challenge and by getting results. I also want things to be as good as they can be, and I have never feared questioning the status quo. I also value competence and quality work. I'm pretty driven and, on a good day, I get more work done before lunch than many people do all day. My focus on achieving

results, interest in effectiveness and continuous improvement, desire for competence, and my personal drive all represent characteristics that have served me well and have helped me succeed. However, I realize that those same traits can drive other people crazy and that people can perceive me as judgmental, opinionated, and aggressive. So, during my transition, I will pay a lot of attention to assuring that I take advantage of my strengths without allowing my strengths to become credibility busting weaknesses. Fortunately, we have a pretty diverse team, and I am confident that I can rely on others to help me overcome my weaknesses including a tendency toward impatience and insensitivity. Transitioning into a new leadership role, can prove challenging and stressful. I intend to accelerate my successful transition by:

- Recognizing that I lack established working relationships with some key people and doing what I can to build credibility and trust with those people.
- Developing, as quickly as possible, my understanding of both my own responsibilities as well as the responsibilities of the people I lead.
- Reminding myself every day that, while my new job is a big change for me, my arrival is affecting others too.
- Being mindful in my interaction with people.
- Asking a lot of questions to prompt people to think carefully, encourage them to tell me what's on their mind, promote dialog between us, and generally get people to engage with me.
- Showing that I am willing to listen and learn.
- Demonstrating that I value and respect the people I work with.
- Fostering confidence and trust in my relationships with people.
- Taking advantage of my strengths without allowing my strengths to become credibility busting weaknesses.



MIKE DEGROSKY is chief executive officer of the Guidance Group, a consulting organization specializing in the human and organizational aspects of the fire service, and an adjunct instructor in leadership studies for Fort Hays State University. Follow him on Twitter @guidegroup or via LinkedIn.



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MCKENZIE RECEIVES IJWF OUTSTANDING ASSOCIATE EDITOR AWARD FOR 2015

Dr. Don McKenzie is the winner of the Outstanding Editor Award of the *International Journal of Wildland Fire* for 2015. Please join us in congratulating Don for his many years of excellent service to the journal as an author, a reviewer, and an Associate Editor.

Dr. McKenzie is a research ecologist with the US Forest Service, at the Pacific Northwest Research Station, and affiliate faculty at the School of Environmental and Forest Sciences, University of Washington. Since joining the Forest Service in 2002, he has led research in the landscape ecology of fire, focusing on the potential effects of climate change on fire regimes in mountain ecosystems, the changes in controls of spatial patterns of wildfire, and the effects of wildfire on future air quality in protected areas. He received a BA in anthropology and psychology from UC Berkeley, and an MS in forest biometrics and a PhD in ecology from the University of Washington.

Dr. McKenzie's theoretical interests are in how processes interact across multiple spatial and temporal scales, and how fire and vegetation dynamics may be non-stationary in a rapidly changing climate. He has worked for over 10 years with watershed-scale fire histories, discovering quantitative scaling laws that reflect the relative strengths of endogenous and exogenous controls on fire regimes. At ecoregional scales, he studies changes in fire climatology and how they will affect fire-regime projections in the future. Specific interests are future spatial patterns of fire severity and how they will change vegetation patterns, and the consequences for air quality, particularly in mountain protected areas, in which the most degraded visibility is almost associated with wildfires upwind. His research focuses on the American West.

As faculty at the University of Washington, Dr. McKenzie has graduated three PhD and three MS students, while serving on committees for many others. His students' diverse topics

include wildfire and succession in alpine treeline ecotones, modelling and projecting current and future megafires, projecting regional carbon dynamics under changing fire regimes, spatial controls on historical low-severity fire regimes, and meta-analysis of the effects of prescribed fire on wildland fuels.

Dr. McKenzie is the lead author of *The Landscape Ecology of Fire*, published in the Springer Ecological Studies series in 2011. He has authored or co-authored over 80 peer-reviewed publications, and is currently working on a general-audience book about the effects of climate change on mountains in the American West. He has been honored twice for "outstanding landscape ecology paper of the year" by the US division of the International Association for Landscape Ecology (US-IALE), and received the US Forest Service Chief's Award for Wilderness Stewardship Science in 2012. He was invited as a sabbatical visitor to the Santa Fe Institute in 2014, and over the past 15 years has been an invited speaker at conferences in Europe, South America, and Australia on the topic of wildfire and climate change.

We are pleased to add the 2015 IJWF Outstanding Editor Award to his list of achievements, we wish him all the very best, and we most sincerely thank him for his exceptional service to *International Journal of Wildland Fire*.

The current issue of the *International Journal of Wildland Fire*, Volume 25(3) 2016, features a "Special Issue: Predicting Post-wildfire Runoff and Erosion Response." Visit the journal at <http://www.publish.csiro.au/nid/114.htm>. Membership benefits for the International Association of Wildland Fire include access to the journal and its archives, via <http://www.iawfonline.org>.



A PREVIEW OF **FORESTFIRE 2016**

ForestFire 2016, the international conference on forest fires and wildland urban interface (WUI) fires,

will be held in Aix-en-Provence from May 25-27, 2016, and is organized by IRSTEA (France's National Research Institute of Science and Technology for Environment and Agriculture) in collaboration with IAWF.

WUI management for wildfire mitigation has become an increasingly critical stake these last years in many regions of the world that are characterized by a Mediterranean climate, but also in areas characterized, so far, by temperate climate, as a result of both climate and land cover change. The same fire process affects wildlands and WUI, although fuel, fire behavior, fire-fighting strategies, vulnerability and values, and even micro-local fire weather conditions may radically differ. Following the first ForestFire conference in 2013, this second conference will try to sum up the scientific knowledge related to the relationships between WUI fires and wildland fires, and

will favor exchanges between researchers and risk managers, security services, land owners and general decision or policy makers on this topic.

During this second edition of ForestFire, over 200 attendees are expected, traveling from all around the world. The program of the conference will include individual presentations during two parallel sessions as well as a poster session. There will also be the opportunity of special sessions such as one on fire science dissemination in which cooperation possibilities with particular institutes will be discussed to describe lessons learned and discuss development of innovative and contemporary fire prevention programs. Presenters will be invited to submit their presentations to the conference proceedings which will be based on a peer-review procedure.

The field trip planned on the third day will encompass an overview of the one-year-old Velaux fire to see the consequences of that disturbance event from both an ecologist's and a firefighter's perspectives; a visit of the regional fire academy as well as of the Center of Risks Simulation; and finishing with a walk through the Museum of Civilizations for Europe and the Mediterranean.

For more information, visit <http://forestfire.irstea.fr>.

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THE TASMANIAN

A needle pine, burned in the Tasmania fires of 2016.
Photo: Rob Blakers.

When it comes to the concept of “wicked problems,” the process and effects of rapidly accelerating climate change may prove to be the defining “wicked problems” of our era -- and one that fire managers must seek to face and resolve. This on-the-scenes first-person report is not the definitive or final report from the fires in Tasmania -- here Michael Hill offers the insights of a long-time firefighter (and Wildfire Magazine contributing editor) on the “what” of this particular incarnation of our wicked climate problem, so we might consider the “what next” -- in Tasmania and elsewhere as our climate-and-fire regimes change.

On January 13, 2016, a storm passing over the mountains of Tasmania hammered the Australian state with over a hundred lightning strikes occurring in a three- to four-hour period. In their wake over eighty small wildfires began to spread across sections of this island's unique landscapes. Some of these fires extinguished themselves naturally, while others took hold and grew to the size of thousands of hectares. These Tasmania fires were relatively unique -- due to the normal high levels of rainfall this island experiences annually, fire events like this for Tasmania are a rarity and as such, deserve a closer look.

Tasmania lies 40 degrees south of the equator and is separated from the southeastern coast of the Australian mainland by the Bass Strait. It is an island resting in the Tasman Sea which is often viewed as a pristine wilderness dotted with small laid-back towns whose economy relies heavily on tourism. The

Tasmanian weather is renowned for changing several times in a day. The dry continent of Antarctica is the next major landfall to the south and as such, Tasmania can experience cold winters. The island receives the second highest annual levels of rainfalls for the nation. Seasonal heavy rainfall usually keeps wildfires here from being much of a concern across this landscape's unique vegetation types, and many plants and animals have evolved uniquely to coexist in this environment over countless generations.

In the world's most southern regions, fossil evidence has been found that suggests temperate rainforests were once widespread in Australia, Antarctica, South America and New Zealand around 45 million years ago. As the global climate warmed and became drier, these forests retreated back to small pockets primarily today left in Tasmania and southeastern Australia.

FIRES OF 2016

By Michael Scott Hill



Cool temperate rainforests and relic vegetation species still exist here in remoter locations that date back to the time when Australia was part of the super-continent of Gondwana. These relics are called the Antarctic flora, and they include the various native pines, cushion plants, the southern beech (*Nothofagus*) and the deciduous beech.

The pockets of relic vegetation species have survived independently in the high country without evolving with fire and are badly impacted when fires do occur. Tasmania however is not a pristine island that evolved without any wildfire as portrayed (often emotionally) by some. For thousands of years native Australian Aboriginals called Tasmania their home, and across countless generations they carried out their hunter and gather lifestyles of which using fire as a method of farming played a key element.

The Tasmanian Aboriginals deeply valued fire, so much so in fact that during their bloody conquest by Europeans, the smoke from the fires that their remnant groups felt necessary to keep burning is what was used to hunt them down. Rain and the

wet cool environment are what kept Tasmania's wildfire risks in check and confined to their flames to lower areas of the island which allowed the Antarctic relic vegetations species elsewhere to thrive.



The button grass plains, burning through the night.

Change is believed to be in the air, however, as a growing number of scientists are pointing their fingers at Tasmania's ecosystems as a new example of global climate change in action once again. David Bowman, a professor of environmental change biology at the University of Tasmania, says "We are in a new place. We just have to accept that we've crossed a threshold, I suspect. This is what climate change looks like." The climate scientist Will Steffen has also linked these Tasmanian fires to a new episode of climate change by stating that over the last 30 years extreme fire weather in Tasmania has increased. This increase isn't believed to be a climate shift as yet. But David Lindenmayer, a professor at Australian National University in ecology and conservation biology, has published climate modeling estimates that could represent itself with an increase in dry lightning strikes.



On February 12, 2016, the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite acquired this image of fire and smoke in northwestern Tasmania. Red outlines indicate hot spots where MODIS detected the unusually warm surface temperatures associated with the fires. Photo: NASA.

This rise in dry lightning activity has already been observed in recent decades in Tasmania, and this summer (January 2016) the dry lightning combined with the unusual drought experienced this summer, has created a situation where cool rainforest sections of the island, which under normal conditions serve as a barrier to stop wildfire growth, here have dried out to allow their vegetation to carry fires across them up into the highly sensitive Antarctic relic species pockets protected as World Heritage Areas (WHA). Lightning fires started by down strikes occurred during the event in the WHAs too, and they, together with the other large wildfires produced during that January 2016 storm, grew to become a serious threat to the survival of these ancient relics growing in their final holdout pocket areas.

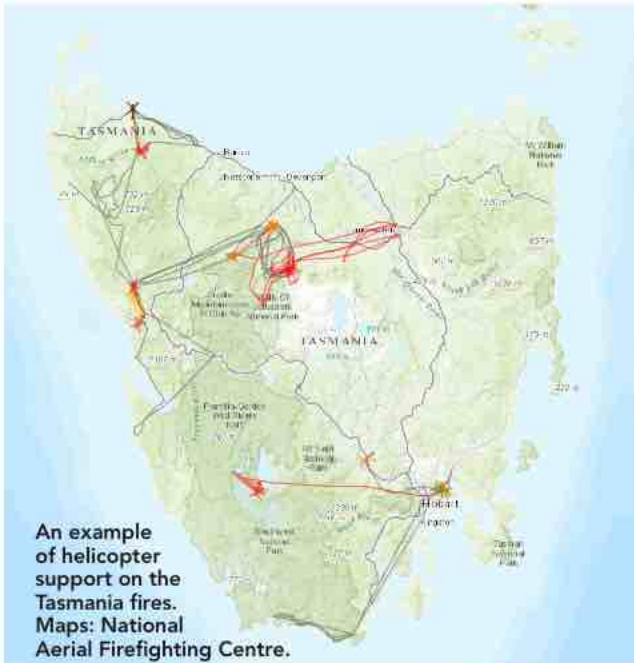
In January when these fires spread out from the places where super-heated lightning bolts had touched down to ignite them off, they collided with vegetation already stressed by drought conditions and their flames carried easily and swiftly. Some of the fires spread out to consume more than others, and in all, they would finally burn over 100,000 hectares of vegetation, of which 14,000 hectares would include the relic species pockets of the World Heritage Areas (WHA).

The effected locations of Tasmania were large areas of the Tarkine, the Mersey Valley and February Plains – within the Walls of Jerusalem and Cradle Mountain – Lake St Clair National Parks, and the Central Plateau. Southwest National Park also experienced the flames as well, and Tasmania's world-famous Overland Track was closed for more than a week.

This small state's firefighting resources were not accustomed to dealing with such an overwhelming scale of wildfires, in

relation to their number of personnel and resources, and they concentrated their efforts first on protecting Tasmania's urban interface structures and infrastructure. Their focus during the early phases of the fires was in protecting life and property triage, while other larger wildfires ran across large areas of the more mountainous and forested remote northwest and up onto the island's high central plateau regions. Milder weather in the second week of the event, as usual, finally slowed the progression of many fires. To gain the upper hand with these improved conditions, an Australian Federal interstate firefighting response was organized to go in and "black line," or secure the countless kilometers of the individual fires. This tactic was deployed to prevent the continuation of fire spreading into more hectares of drought stressed lands, especially in the WHA, and limiting the risk of new future fire runs.

In Australia the majority of the firefighting orientation is towards truck-based urban interface fire efforts. However "across the ditch," as Aussies and Kiwis call the Pacific Ocean between them, many states and New Zealand now have specialist-based teams who have been trained to go into the forests to meet wildfires beyond the safety of their fire hoses. These crews have been named Remote Area Teams, and while a number of them are paid staff, large numbers of these crews serve as unpaid volunteers motivated to protect their communities. During the Federal response to these fires, both types of these crews along with the New Zealanders, were requested to assist Tasmania; as well as were other fire specialist in logistics and aviation. Tasmania's fire support of 2016 then became an interstate disaster assistance response effort, where fellow Australians and New Zealanders came down and across to help out their mates.



An example of helicopter support on the Tasmania fires. Maps: National Aerial Firefighting Centre.

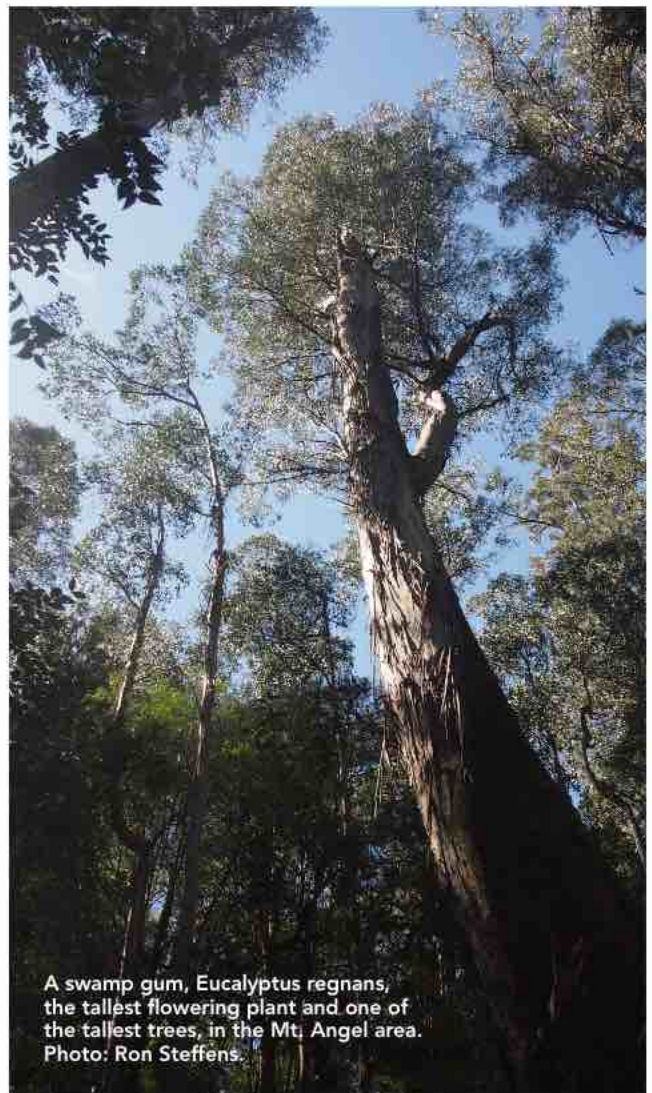


...And fixed wing support with aerial retardant drops from mainland Australia and Tasmania.

completing their important missions.

As a member of one of these specialized crews, the assignment for my team was to drive up into the dirt roads of the island's mountainous sub-alpine zone, and from there, leave our vehicles behind on the roadside and enter the thick forest to climb up into high slopes of broken-slippy shale on our hunt to extinguish any remaining hot spots. We passed along our way, 100 year old burnt out ferns, thickets of blackened brush, mazes of fallen dead and down vegetation, all scattered out beneath massive moss-covered and towering Blue and Swamp Gum trees," some as wide as a small car.

Careful as we went, not to trip or slip, while we crossed over the unstable slide areas. Slides which in places, had been left greatly destabilized by flames, that earlier had consumed the blankets of light green moss that had long bound their fields of broken pieces together.



A swamp gum, *Eucalyptus regnans*, the tallest flowering plant and one of the tallest trees, in the Mt. Angel area. Photo: Ron Steffens.

Matesmanship, or stepping up to looking out for each other, is an important part of both Australian and New Zealand culture. Under the cap of a Federal response during this event across Tasmania, matesmanship was in action on all levels. After the initial dangerous runs of the fires had subsided, the priority shifted to work together to save what was left of the island's highly valued WHA unique vegetation pockets.

The Remote Area Teams assisting were trained to work with helicopters to be deployed into remote locations either by winch, hover exit or landing. On the ground these crews use hand tools, leaf blowers and chainsaws to construct fireline or "blackline" and mop up with pumps and fire hose or by directing in water drops from helicopter buckets. These Tasmanian fires became the perfect opportunity for these teams to successfully showcase their unique bush skills while



Up along the ridgelines far above those slopes, where we also searched, we found ourselves working our way through more heavy jackpotted fuel loadings of partially burnt old logging debris while seeking out and destroying other smoking hot areas left near the fire's burnt edge which, if remaining untended, could cause the fire to restart and run again.

The high plateaus of the WHAs, however, offered much different experiences to other crews assigned to fly in by helicopters up there. These crews found themselves running pumps and using hoses and hand tools -- all in a struggle to dig out and flood with water the pockets of drought-dried and burning peat, hidden beneath burnt black open relic grasslands, all the while being careful to keep from stepping on and killing anymore of the fragile colonies of highly endangered cushion plants, lucky enough to have escaped fire's flames and heat.

Out on the firelines of Tasmania we discovered that if you were lucky it was possible to see small kangaroos or wallabies hopping around, or even to get a glimpse of Tasmania's famous small Tasmania Devil scavengers going about their business, or spiny backed echidnas, adapted to this island's cooler environments by transforming large numbers

of their spikes into hairs to provide warmth. You won't be able to see the equally famous Tasmanian Tiger here anymore (though recently one has been reported spotted on the mainland in Gippsland Victoria, believed to be a descendant of a pair released long ago before its species was considered to have become extinct).

Unique birds were also to be seen out on the fire ground, such as wedge tail eagles soaring above with their mighty wingspans or the colorful True, Swift and Orange-bellied parrots chirping around in the limbs over your head. In the black on the ground we also spotted tiny green Forty-Spotted Pardalotes which look like small finches, popping around in the dust in search of insects which may have survived the fires.

Snakes, however, are what firefighters had to keep an eye out for, and Tasmania is home to three native species; each of which carries venom dangerous to humans, as do several local species of spiders and scorpions. Tasmania's snake species share many of the same variations of patterns and colors, but they can be identified by the structures of their heads. The Tiger snake is by far the most famous species and is usually considered timid, normally retreating at the approach of a human. They are a beautiful, highly toxic, and interesting snake, which despite its name, may be found without any striping. Firefighters were instructed if they were bitten by any of the Tasmanian snakes, their best chance of survival was to bandage the bitten extremity using a compression bandage up to the lymph node, immobilize the limb, stay still and call for help. If the snake did inject toxin during its bite, then likely only the timely delivery of anti-venom, the compression bandage and immobilization would be of help to the firefighter. As such, in



Cushion plants and burned peat on the high plateaus of Tasmania. Photo: Rob Blakers.



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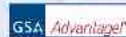
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Australia you'll find that snakes are respected like wildfires, and life is often adapted, where possible, to exist with both.

What's the predicted outcome for those fragile Tasmania vegetations pockets once the flames from this event have cooled and the normal rains have returned to their mountain slopes again? A government inquest is already being called for by environmentalist and politicians to find blame. More money will then be provided in the future for local firefighting efforts, some restructuring will take place, and in the end, perhaps more firefighters will be trained up to work remotely to extinguish future fires that future lightning storms will bring to their island's shores.

I am proud to say that I took part in these efforts and was very impressed to have witnessed first hand such passion displayed. Many people chipped in to work together, especially on a voluntary basis, to help protect Tasmania's unique environment as mates, and for the Australian wilderness. This fairly complex Interstate emergency response in return offers Tasmania a fighting chance on the ground to help preserve its very special, important, and rare wilderness areas.

EDITOR'S NOTE:

On March 9, the premier of Tasmania, Will Hodgman, announced a major research and analysis project regarding fires in Tasmania. As the release states,

The Tasmanian Government will invest in a research project to examine the impact of climate change on the wilderness, and strengthen our fire-fighting techniques in our Wilderness areas. Tasmania has faced one of the worst fire seasons in recent years. The response from our emergency services was immediate and the magnitude was without precedent, and they deserve our praise. Not a single life or property was lost, and only about 1.3 per cent of our Wilderness World Heritage Area was affected. This is despite more than 300 fires, more than 120,000 hectares burned and a record 15 total fire ban days, five more than any previous year. While we can never fire-proof Tasmania, given wildfires are a natural part of the Australian environment, we can work to mitigate the risks, just as our \$28.5 million fuel-reduction program is doing.

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http://premier-dev.dpac.tas.gov.au/releases/research_project_to_protect_wilderness_areas.

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FIRE MODELING IN AN UNCERTAIN WORLD

When considering fire behavior, shouldn't we also consider what can be the "wicked problems" of uncertainty? Here, researcher Rachel Quill offers a look at the uncertainty of wind and how it affects fire modeling.



by Rachael Quill

Uncertainty is all around us. We account for it in all aspects of everyday life; "It takes ten minutes to get there but I'll allow fifteen, just in case." So why is it that when it comes to the "wicked problem" of wildfire, we have put uncertainty to one side for so long?

Traditionally operational fire prediction has been based on deterministic methods - for each set of input conditions there is a single output, with no allowance for uncertainty in the process. After almost 30 years of discussion in the literature, probabilistic approaches to fire spread and behavior modeling are now beginning to emerge. These probabilistic approaches account for uncertainty in fire spread by allowing for random fluctuations in the input variables and predicting a range of fire propagation scenarios. When considered together, these multiple predictions are overlaid to form what is known as an ensemble. Ensemble-based predictions allow fire spread across the landscape to be defined in terms of probabilities, such as likelihood of burning and risk to assets.

However, within these developing frameworks we still rely upon deterministic models and simplified probabilistic inputs. That is to say, we are trying to understand the variability of fire spread without capturing the true variability of the driving factors. With Cruz and Alexander (2013) showing that input errors are one of the major sources of prediction error in fire modeling, it is imperative that we seek to acknowledge the uncertainties of these inputs.

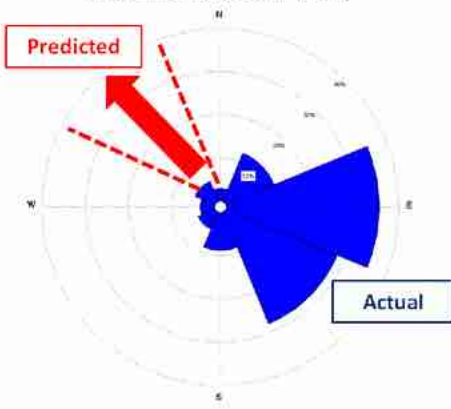
Wind, in particular, is known to account for much of the variability displayed in the spread of wildfires (Cruz and Alexander, 2013). Due to the constraints of operational requirements (i.e. real-time or near real-time prediction), the current physics-based deterministic wind models for fire prediction do not well capture the variability of wind flow in key areas, particularly across complex terrain. In the worst case, on leeward slopes, errors in wind direction of up to

180° have been seen (Fig 1). Even in the new ensemble-based approaches, wind direction is only characterized as random whereas analysis of data collected across complex terrain has shown that wind direction in fact takes a highly structured form. To better capture the uncertainty of fire spread across the landscape, we must characterize the structured nature of wind direction within fire prediction frameworks.

Without capturing the true variability of wind flow across complex terrain, the curse of error accumulation through the modeling process leaves us to question the uncertainty of fire spread predictions in these key regions. Simpson et al. (2013) have already suggested that traditional fire modeling techniques are failing to capture dynamic processes such as Vorticity-driven Lateral Spread (dynamic spread of the fire front on a leeward slope in a direction perpendicular to that of the wind) in areas where flow separation, and lee-slope eddies are not accounted for by the wind models used today. The first step in handling the "wicked problem" of uncertainty in wind modeling is to understand the impacts of the physical environment, such as vegetation or topography, on the statistical representation of wind fields. A statistical representation, rather than the traditional physics-based approach, allows discussion of probability - leading to analysis of scenarios with quantified likelihoods.

Statistical analyses of the impacts of topographical aspect on wind direction clearly indicate thresholds for dynamic behavior. This can of course be understood using detailed physical analysis and has indeed been studied using sophisticated mathematical models (Simpson et al., 2013). However, from the fire fighter perspective, we must look to understand the uncertainty around this behavior and capture it within our operational models under the constraints of real-time prediction.

Wind Direction in a Valley



When considering the impacts of vegetation on wind direction across complex terrain, the story becomes less clear – and the role of uncertainty becomes yet more important. Changing vegetation structures

have distinct impacts on wind direction in some parts of the terrain – and the behaviors are consistent with the current predictions. However, in other areas of the terrain, the impact of vegetation on wind direction is far less obvious – and observed behaviors vary from those currently captured by state-of-the-art models.

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Better statistical understanding of the variations in wind fields across the landscape, will improve on current physics-based methods by better capturing wind dynamics in complex terrain. Development of hybrid models, combining probabilistic information with deterministic approaches to wind modeling will provide better understanding of uncertainty within the fire modeling process while maintaining operational real-time (or near real-time) prediction. The result of such a hybrid model would ultimately provide more information to the fire managers and decisions makers dealing with the "wicked problem" on the ground.

RACHAEL QUILL

holds an MSc in Mathematics and Statistics from Lancaster University, UK, and is currently studying for a PhD at the University of New South Wales (UNSW) Canberra, Australia. She is researching the statistical characterization of wind fields over complex terrain for bushfire modeling applications, with particular interest in the impacts of surface roughness on wind fields as well as the development of probabilistic approaches within fire modeling. She receives funding support from UNSW Canberra and the Bushfire and Natural Hazards Cooperative Research Centre, Australia.



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INTROVERSION IN FIRELINE LEADERSHIP



What if the reflective
introvert is the leader the situation needs?
Photo: Christine McDonald.

Fireline leaders make life and death decisions. When seeking leadership for fireline and for the evolving **wicked problems** that fire managers seek, might we benefit by looking for a different skill set? A call for the value of introverts as leaders.

by Christine McDonald

It's after dark on a northern fire where dark comes late, and I'm exhausted from a day of winning a little in one area and losing a little in another. My legs are tucked into my sleeping bag for warmth and my headlamp shines down on my field notebook. Before I can rest, I need to make notes in preparation for my morning briefing. It's a quick exercise to write out the objectives and assignments that I've already set in my mind, but this ten-minute nightly ritual is key to keeping my secret as a fireline leader: I am an introvert.

In the fire world, we teach leadership skills beginning in a firefighter's first year and we don't relent until they've perfected their morning briefings, their communication of intent, their After Action Reviews (AARs), and eventually find themselves 'in charge'. This can mean they are in charge of a crew, in charge of a division, in charge of operations, or in charge of a multi-agency Incident Management Team (IMT). We build each level of our leadership on the same foundation, that question that every single new firefighter is asked in their first leadership class, "What makes a good leader?"

To summarize the dozen or so most common answers: "an extrovert."

But what if we're wrong? What if some of the best potential leaders are actually watching quietly from the back corners?

Susan Cain, author of *Quiet: The Power of Introverts in a World That Can't Stop Talking*, believes that "we tend to overestimate how outgoing leaders need to be," and offers a host of examples of powerful leadership from the quieter 1/3 of the population, as well as some strong scientific rationale for why introverts make great leaders.

Barack Obama, Warren Buffett, Bill Gates, Rosa Parks, Abraham Lincoln and Gandhi; it's impossible not to respect the success of these famous introverts. A random sample by the Myers-Briggs organization in 1998 found that introverts make up close to 50% of the general population. This would suggest that there are many introverts in your own organization (whether easily recognized or not) who are contributing in big, albeit quiet, ways and who could make a positive addition to your leadership ranks.

In a study of introverted vs. extroverted leadership on group dynamics, it was found that extroverts produce better results when in charge of a team of passive individuals,

while introverted leaders are more effective when those they are leading are proactive initiative-takers (as many fire people are; we do fancy ourselves a type A culture, after all). Susan Cain explains, "Because of their inclination to listen to others and lack of interest in dominating social situations, introverts are more likely to hear and implement suggestions. . . .Introverted leaders create a virtuous circle of proactivity, in other words." (Cain, p. 57)

To quickly dispel some common misperceptions about introverts:

- Introversion is not shyness. Many introverts are perfectly capable in social situations and when public speaking, though they may prefer to feel well-prepared.
- Introverts aren't hermits. They do tend to spend more time alone than extroverts and require a certain amount of solitude to recharge after a lot of interaction.
- Introverts aren't passive. If they are quiet in a meeting, chances are it is because they are carefully considering everything being said and crafting a well thought out response before they speak up.

As an introvert in a career where extroversion is highly valued, I have often found myself wondering how this dominant aspect of our personalities affects the ways we do our jobs. In all of the fire-related leadership and human factors training I have done, it has never come up as an explicit topic, and yet I feel that introversion is the aspect of my personality that most strongly shapes my leadership and decision-making styles. In my quest to better understand myself, I have gathered some interesting research on how introverts and extroverts differ.

Neuroscientists have found a consistent and interesting difference in the parts of the brain that are most active in introverts and extroverts. Extroverts are more driven by their amygdala, which is the pleasure-centre of the brain. They often make decisions based on what will deliver the biggest rush of dopamine: fun social interactions, winning a bet, eating chocolate, having sex [1]. It's

An introvert accesses the part of the brain that shouts "watch out!" and "slow down!"
Photo: Christine McDonald.



easy to see how an extrovert might be drawn to the excitement of firefighting and the pride of moving up the ranks into positions of leadership. Extroverts actually experience all of these things as more pleasurable than introverts do and that's why they're continuously driven to seek those rewards. They tend to be more impulsive and to take more chances in doing so [2].

Introverts, on the other hand, are more sensitive to what's going on in the neo-cortex, the part of the brain that shouts "watch out!" and "slow down!" and convinces us that following the whims of the amygdala is not always in our best interest [3]. Being less driven by the amygdala also means that introverts are better able to stay calm through both excitement and anxiety. Firefighting is not among the stereotypical career choices for an introvert, but many of us have made our place here, finding our own ways of balancing the thrills and risks of the job and of managing the complex interpersonal communications it entails.

A simple psychology experiment shows how this difference impacts the way introverts and extroverts react to negative feedback or getting something wrong. The experiment goes like this: You get a button to hold in your hand as you watch a series of numbers flash on the screen. Some of the numbers are good and win you points and some are bad and lose you points, but you have to figure out which are which through trial and error and eventually push the button only for the good numbers. It doesn't take too long to figure out that the number 2 is good and the number 9 is bad. Except that sometimes, both introverts and extroverts will still push the number 9 by mistake. What is interesting is what happens next. When the introvert realizes that they got it wrong, they actually slow down in their next few clicks until they are back on track. Extroverts speed up their clicking and end up making more mistakes. They take more chances in their effort to win and enjoy the reward [4].

It's not hard to imagine the consequences these different reactions could have in the real world of fire suppression, where we are constantly forced to make predictions, act on them, and then adjust and adapt when we don't get it right. In the face of an unexpected event, an introverted IC will naturally slow down and reflect on what went wrong before making his/her next move. The extrovert may charge ahead in search of success, without considering the lessons of a failure.

I work just down the hall from one of the British Columbia Wildfire Service's (BCWS's) most experienced and well-respected incident commanders, himself with very introverted tendencies. We have had many conversations about good fireline leadership, and he gets most fervent about one point: A good leader knows better than to repeat a failed tactic. Not only is "doing the same thing over and over again and expecting a different result" Albert Einstein's definition of insanity but, in the fire arena, it also risks safety with little chance of a successful outcome. In light of what we know about the natural reactions of introverts and extroverts when faced with a failure, we might be best served by the leader who takes a short walk or closes the door for a moment of privacy before pushing the button again.

Of course, extraversion and introversion exist at two ends of a spectrum along which we all fall. Many extroverts have worked to master their dopamine-driven responses and have devised strategies to make them slow down and think before reacting. And many introverts have pushed themselves to speak up more frequently and with more confidence. None of us is bound to one extreme or the other, but where we fall on this spectrum is nevertheless one of the most defining aspects of our personalities.

Introverts are easily overlooked. Our culture has preconditioned us to see someone who speaks quickly and with confidence as more intelligent than someone less assuming, but this is simply not the case [5]. Introverts do not often seek the thrill of the spotlight and tend to find more subtle ways of making their ideas and opinions heard. They are the quiet, thoughtful ones planting seeds in the minds of their extroverted workmates, asking "what if?" and "have you considered this?"

When introverts are given the opportunity to lead, they may take on the responsibility with some reluctance yet they are the ones who will take the time to assimilate all of the available information, who will ask for input and listen intently when it is given, and who will pause to reflect after something goes awry before adjusting the plan. They are leaders who will empower and get the most out of their subordinates. They just might be leaders who could make firefighting safer.

NOTES

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CHRISTINE MCDONALD

has worked in various operational roles with the BC Wildfire Service since 2000 and have been involved in the development and delivery of leadership and human factors training for the BCWS for the past 5 years. As a classic introvert with an academic bend, she enjoys reading on the topic of psychology, personality and group dynamics and tries to always incorporate current research into her training deliveries, as well as use it to shape her personal development as a leader on the fireline.



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DEVELOPING A MORE EFFECTIVE FIRE SHELTER

by Joshua Fody and Tony P Petrilli

One of the **wickedest problems** in wildfire management is firefighter safety, with no single solution offering the safety we require. Here, we offer an update on one aspect of the many entwined solutions essential for maintaining firefighter safety -- the technology that helps protect us from the flames -- featuring a short history of the emergency fire shelter and news on the multi-stage process for updating fire shelters.



Fire approaching firefighters in fire shelters –
Little Venus Fire, Wyoming, 2006.
Photo: Ryan Jordan.

In 1959, the U.S. Forest Service, Missoula (Mont.) Equipment and Development Center began development work to design an emergency fire shelter for wildland firefighters. The first documented use of a fire crew using fire shelters for protection from a fire was in 1964 in Southern California, thirty-six lives were saved by the experimental fire shelters.

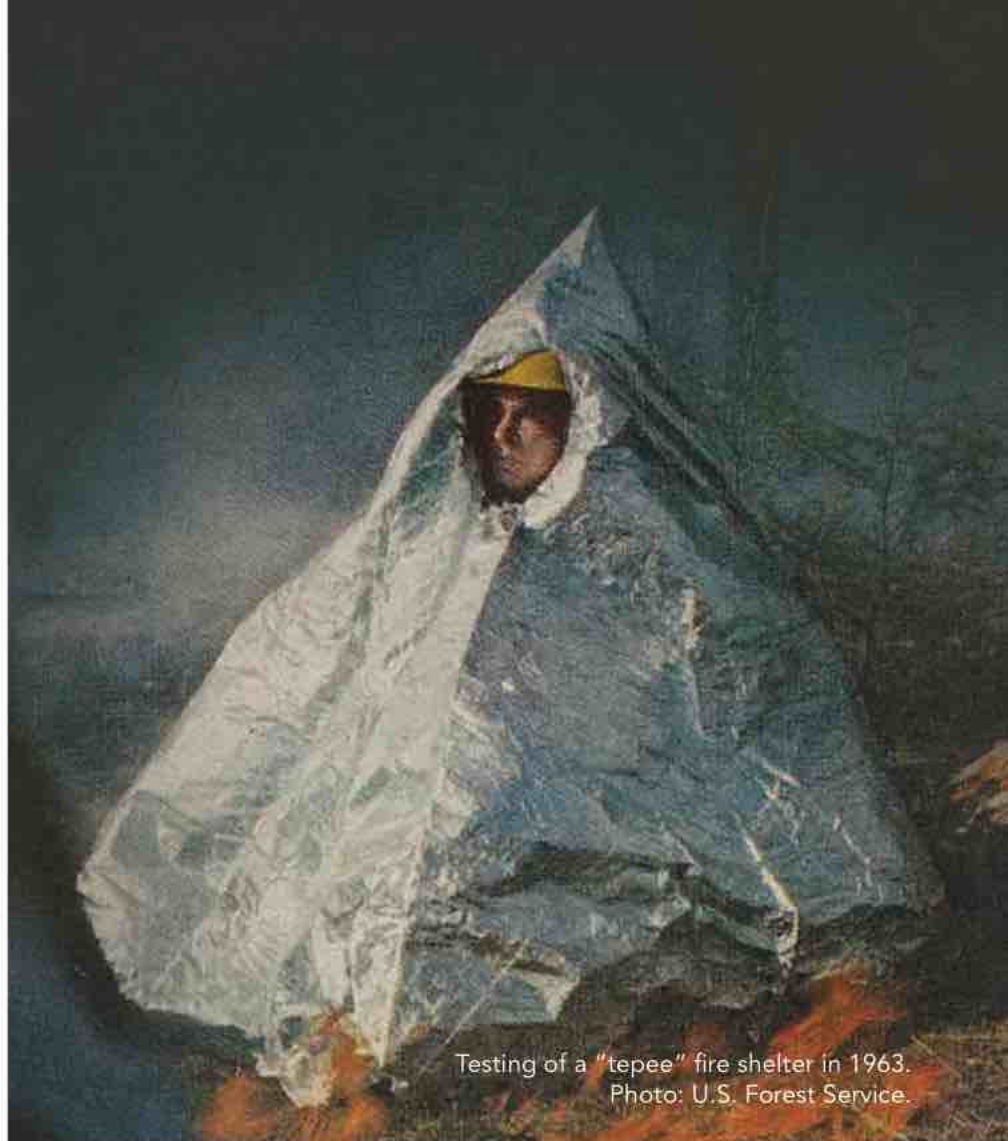
In 1967 fire shelters were mass produced for firefighters to carry when it was deemed necessary. The early version of the fire shelter was aluminum foil laminated to fiberglass fabric with a Kraft paper liner designed into an A-frame structure.

During the 1970s, the paper liner was eliminated in the design. Policy was changed in 1977 to require all US federal firefighters to carry fire shelters while working fires. Minor changes were made to the design during the 1980s and 1990s.

From 1964 into the 2000s, it is estimated the fire shelter saved 300 lives, and prevented serious burn injury to another 300 firefighters; however, 20 firefighters died in fire shelters during that same time period.

In 2000, Forest Service Fire Management officials directed the now named Missoula Technology and Development Center (MTDC) to pursue development of a more protective fire shelter. Many new materials and shelter designs were considered and tested. Interagency Fire Directors selected the New Generation Fire Shelter in 2002. This new shelter shows marked improvement in protection vs. the old-style shelter, but it is not able to provide sufficient protection in the most extreme fire conditions. The shelter is constructed into a rounded shape and is made of two layers of laminated material. The outer layer is made of woven silica laminated to aluminum foil, while the inner layer is made of woven fiberglass material laminated to aluminum foil.

There have been 159 new shelters deployed, saving 25 lives and preventing 102 firefighter burn injuries; however, 21 lives have also been lost. Nineteen of those lives were of the Granite Mountain Hotshot Crew in an incident near Yarnell, AZ on June 30, 2013.



Testing of a "tepee" fire shelter in 1963.
Photo: U.S. Forest Service.

The Fire Shelter Project Review was initiated in 2014. The project is pursuing advances in materials that may offer increased protection by slowing the transfer of heat through the shelter layers. Historically, many high-temperature resistive materials are relatively heavy, bulky, fragile and/or toxic. These are all attributes that are not suitable for fire shelters. A few entities are submitting promising materials for testing, one of those is the National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC) located in Hampton, Virginia.

For the past decade, NASA LaRC has been conducting materials development of flexible high temperature insulations for use on inflatable heat shields. Projects such as the Hypersonic Inflatable Aerodynamic Decelerator (HIAD) are designing these novel inflatables for the delivery of large payloads to Mars. The use of a large heat shield made of conventional rigid materials, like the one used on the Apollo capsule, is impractical for this type of application. By creating an inflatable structure, heat shields 20 feet in diameter, or larger, can be packed down to less than 20% of their original diameter, allowing them to fit into launch vehicles of a practical size.



The NASA fire shelter development effort became known as Convective Heating Improvement for Emergency Fire Shelters (CHIEFS), and was tasked with improving the fire shelter's resistance to direct flame exposure. The CHIEFS team quickly realized that flexible heat shield materials used for atmospheric re-entry vehicles could not be directly applied to the fire shelter. Flexible heat shields are designed to withstand more than 10 times the thermal load of a typical forest fire and consequently materials are too robust to be appropriate for the tight mass and volume constraints of the fire shelter. However, the experience amassed during the development of flexible heat shields has proven advantageous to CHIEFS research.

CHIEFS began work by developing a small scale convective heating test apparatus based on existing test standards used by the U.S. Forest Service, which employs a propane flame to rapidly screen various material samples. To date, CHIEFS has used this small-scale apparatus to test the thermal performance of more than 300 unique material layups - combinations of multiple individual layers - and in doing so has evaluated more than 70 individual materials.

The individual material layers in a layup can be selected to target the suppression of various modes of heat transfer; the order of these layers is also important. By parametrically varying the composition and ordering of these layups, candidate fire shelter concepts can be optimized to provide maximum thermal protection while maintaining acceptable levels of mass, volume, durability, toxicity, and cost.

Highly efficient, flexible, durable, thin, and lightweight insulations are required to protect these inflatable structures from the enormous heat of re-entry, and there are several similarities between NASA's flexible heat shields and the fire shelter. After learning of the tragedy at Yarnell Hill, NASA LaRC researchers reached out to MTDC to offer their expertise and assistance in the development of new materials and shelter designs for the Fire Shelter Project Review, with the goal of providing a safer shelter for future fire fighters.



Flames engulfing test shelters in controlled wildfire – NW Territories, Canada, 2015. Photo: U.S. Forest Service.

Once past the initial screening, promising candidate materials are manufactured into full-scale fire shelters for further testing. During the summer of 2015, the first round of CHIEFS full-scale shelters – along with shelters submitted to MTDC by other vendors – were evaluated in both controlled wildfires in Canada as well as in a series of controlled laboratory fire enclosure tests. All CHIEFS shelters performed well thermally, and the tests also provided many “real world” lessons, not realized in the earlier small-scale development, that are now being implemented into a second round of CHIEFS shelters.

Currently, CHIEFS is completing fabrication of their next round of full-scale fire shelters. These shelters will undergo preliminary evaluations, and then promising candidate layouts will be evaluated in another round of full-scale shelter testing. This testing will take place along with candidates from other vendors in spring, 2016, at the MTDC. The goal is to have shelters with a significant increase in performance with minimal increase in weight and bulk that then can go forward to field testing. The CHIEFS team has thoroughly enjoyed their collaborative effort with MTDC, and is excited to continue development of more efficient fire shelters and help make our nation's wildland firefighters safer on the ground.

JOSH FODY

was born and raised in Colorado. After serving as an enlisted sailor in the US Navy for 4 years working on the flight deck and in the jet shop performing intermediate level maintenance on aircraft power-plants, he attended CU Boulder for his undergraduate degree and later completed a Master's Degree in Mechanical Engineering at the University of Maryland. His research primarily focused on enhanced evaporator concepts for alternate energy generation. After defending his thesis, he took a job at NASA Langley where he has been working in the Structural and Thermal Systems Branch for the past 2 years as a thermal analyst.

TONY PETRILLI

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An aerial photograph of a vast forest. A thick plume of white smoke rises from a ridge in the center of the image, spreading outwards. The forest is dense and dark green. In the background, a range of mountains is visible under a hazy sky. The title 'the UNBIDDEN' is overlaid at the top. 'the' is in a smaller, orange, lowercase font, and 'UNBIDDEN' is in a large, white, uppercase, serif font.

the UNBIDDEN

It could be any fire burning on that far-off ridge, and we must decide what to do.
Photo: Ron Steffens

WILDFIRE

by Stephen Fillmore



Wicked problems are difficult to define and thus offer no definitive solutions -- yet we are obligated to seek the most work-able solutions among better or worse, good enough and not good enough. In this essay we witness the story of a typical fire problem, framed as a wickedly difficult problem to solve.

IN TRIBUTE TO INCIDENT 406

Like many before it, the wildfire was conceived on a late summer afternoon as a drifting monsoonal cell bunched up, gathered its energy and raked over the mountainous uplift spewing hard rain, wind, and lightning. The neighborhood it was born into was both rough and beautiful; the mountain gazetted into minor peaks, valleys, and draws that spilled down from the ridges into deeper cuts and steeper slopes as the watercourses worked ever downward and outward toward the Pacific Northwest coastline.

The wetness that came with the storm dampened the usual sounds of the forest in the first few hours after the fire's arrival. The last outflows of wind from the collapsing cumulonimbus streamed through the upper canopy, throwing off beads of water that fell as false raindrops. Curtains of steam rose from the surrounding boulders and swirled like midwives around the fragile new fire. The furrowed and moss-draped Douglas-

fir trees loomed over the newcomer like reproaching passersby. The instance of creation had occurred suddenly, with abstract natural violence, and few witnesses. The rain kept the fire diminutive for its first inchoate hours; however the minute gray smoke back-dropped to the bluing sky confessed the fire's existence before it could learn to run. Authorities arrived swiftly; this had all been rehearsed before. Professionals moving with intent made their way through the forest, found the fire, and judged it on its merits. It was like so many others; small, burning valiantly but gently under a fir tree, hemmed in by the dripline where it was still dry and protected. The branches hung low like protective arms around it. The fire was to be easily controlled with minimal effort. The men moved to do what was expected of them. They were there to keep the peace, to keep the neighborhood intact, and to cease the interruption that this impertinent little fire was bringing to the area.

“...the magnitude of the effects of growing a fire can never be known until the privilege of hindsight is revealed.”

An unexpected radio call stayed their hands before they had a chance to begin their rote work. Another man had listened to the fire report, and had visualized the potential of the young interloper. He wanted to meet the fire face to face, and to assess for himself what potential it had in this world.

He arrived at the fire under the late afternoon shadows of dissipating storm clouds. He recognized that the fire, if left untouched, could grow to perform both wonderful and terrible things. The good or ill extent of these effects would of course be largely in the eye of the beholder and decided much later, after the fire had been allowed to mature and then fade. First, however, a group of people existed who must be consulted regarding the future of the new fire. The fire manager noted the position of the fire – near the top of the ridge with sparse fuels above, recognizing that it could not burn wildly uphill, and instead could be tamely and deliberately nursed downhill, slowly moving along the forest floor, eating and growing in manner of disturbance that the old trees remembered only from long ago.

Two good ridgelines flanked the fire; two good ridgelines that would be there to direct and control its actions. Patience would be required to let the fire exhibit its full potential. Patience, time, and the expertise of those who would watch it grow, steer it when it went the wrong direction, and teach it to go the right way. This potential future is what the fire manager saw as he stood there watching the tendrils of flame struggle and writhe. Wistful perhaps, he could admit this to himself, but mostly hopeful that this time was the right time, that this fire was the right fire, and that he would be allowed to let this fire grow into something auspicious.

There would be hiccups. The fire would certainly make some mistakes along the way. A pocket of trees would be scorched more severely than hoped for; maybe an area that was favored by the local owl pair would be diminished. The winds may blow the smoke the wrong direction and the neighbors would consider complaining. The fire manager knew that these disturbances would pass quickly and become a memory and a learning experience. In its exuberance, the fire may even hurt one of the people tending it. The very act of being there sets that circumstance. However, the magnitude of the effects of growing a fire can never be known until the privilege of hindsight is revealed.

He knew there would be other costs as well – financial costs. It is no cheap proposition to bring a fire into this world and let it fully grow. There would be the costs of watching over it for weeks and months and perhaps longer. Would they have the resources available to tend it? Who would watch the fire if they were called away?

Is it more expensive to let a fire grow that can be taught the correct way to exist, or do they wait for the fire that is born at the bottom of the hill, and wants not to be tamed, one that wants to feed hungrily at the fuel, consumed in a gorge like a beggar at the banquet table? The chronic alternative is to endure a fire that casts aside the vain efforts to tame it and who destroys the very house in which it briefly lives, raging only until the ropes of man’s efforts can be slung over its neck and broken like a stampeding horse, slowly, tediously, and with great risk; until finally the fire’s loud voice is muffled, tamed into submission, and all that is left is the charred remains of what once was and will never be again.

“No,” the fire manager thought; “let’s allow this fire to flourish into a productive thing, to see this fire contribute to the goals of nature in its own unique and individual way.” There will be challenges in the endeavor, knowing also that with great challenges come great rewards. And so he made his plans, and came to love the fire for what he knew in his heart it could become.

Ever a servant to the complexities of this world, he knew that the authority that would allow him to fulfill his vision did not exist with him alone. Standing by the fire’s edges, dreaming his dream, he gave his orders, and the men walked back to their equipment to head for home. And so, for this one long evening and night, the fire would be left to exist freely, alone and without bounds.

In the morning, the fire manager went to see the others, to explain his visions for the fire. He spoke of the possibilities that this fire could afford them. He extolled the positive effects of what letting the fire burn could do for the landscape, for the culture, and for the lessons that would be learned and shared.

While listening, the others thought of the past. They remembered a fire that they had tried to nurture before. That fire grew, and then surprised them; had figuratively burned them, and had not acted according to their expectations. They did not forget the lesson that fire has the potential to go different from that which they desired.

“This new fire is different,” the fire manager persisted. “This one is not able to race up the hill, this one can be guided the right way, and this one can achieve the things we all hope it will.”

“But,” they retorted, “what will the neighbors think? They could be inconvenienced by this fire, annoyed even, especially when it grows more noticeable as it gets bigger.”

“Let the neighbors get to know the fire early,” the fire manager suggested, “we’ll introduce them when the fire is still small.” The neighbors can take ownership in the growing of this fire and help to assume the risk that they have in living in the same neighborhood.”

“They would never go for it,” they said dismissively. A fire like this was just too inconvenient for everyone to deal with. “Plus,” they asked, “How can you guarantee that the fire will follow your directions and intent? How can you know that it will not take a mind to go a different way than what you want?” The fire manager could only reply that “we know there are no guarantees in a business such as ours.”

“And what about our wildlife,” the biologist asked. “How can you ensure that the trees where they live won’t be harmed? Can you tell me for certain that the fire will behave as you expect?”

“Well, no, I cannot guarantee that, however I know that a fire born at the bottom of the hill, at the wrong time, will almost certainly destroy the nests of all the birds in the forest between the two ridges,” the fire manager replied.

“We’re not talking about a fire in the future,” the others said, “We’re talking about the fire we have now. You have to see that there are neighbors nearby, and that the trees have been there a long time, and we just don’t want to disturb the peace. We understand why you want to let this fire grow, but we don’t think that this is the right time for it. Maybe if it were a bit later in the year, when the winter rain and snow is closer at hand, and we could know that the fire won’t move too far...maybe then we could allow it.”

Inwardly, the fire manager knew that these are the reasons that it always comes down to. How could he argue with the hypothetical wrong time, wrong place, and wrong resources? How could he guarantee that which can never be known, and promise only that he would try his best utilizing the skills he now possessed?

“True,” the fire manager said outwardly, “however we can’t know that there will be a fire later this year, and surely you could see that the plans that I’ve made for the fire are sound. I just need some help for a couple of weeks to help monitor it to the end.”

“Who would come to help us,” the others asked cynically. “It’s just a fire that no one seems to want, and no one wants to put money or energy into it. The resources that we have are out dealing with the trouble fires. Why make more headaches for us? It’s so much easier to just put it out. I know that we have been asked to look for opportunities like this, but let someone else find a way to make it work. We can at least have our guarantee of success with that. The risk is not worth it to us.”

And so it was decided, and so it was that the fire manager walked out of the high office, and into the brightening last light of the morning of the last day that the fire would heave its smoke into the sky. A brief radio call was made to the firefighters who were already perched next to the fire, watching it, perhaps even encouraging it in their own abstract way. They were waiting for the final decision to come down, one way or the other. The call came, they understood the decision, and in a few short hours the heat was gone, the smoke was gone, and the possibilities of a fire on a long summer’s day were gone, too.

AFTERWORD:

Of course, nothing is simple. My good friend and fuels colleague Daniel O’Connor pointed out after reviewing a draft of this essay that “resource fires are the fruit of years and years of successful community protection, prescribed burning, community outreach, and trust gained.” His words are true of course – my point, however, is only that at some point you just have to anchor in somewhere and start working up the hill towards the top.

STEPHEN FILLMORE

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NFPA/FEMA grant supports home ignition seminars

NFPA's wildfire division receives \$350,000 FEMA grant to support firefighter attendance at home ignition zone seminars



The 3 Zones of the Home Ignition Zone.

By Lorraine Carli (NFPA Public Affairs Office)

The National Fire Protection Association's (NFPA) Wildland Fire Operations Division has received a \$360,000 grant from the Federal Emergency Management Agency (FEMA) to support scholarships for fire service professionals at NFPA's Assessing Wildfire Hazards in the Home Ignition Zone seminars, the association's leading workshop on wildland/urban interface (WUI) fire protection issues.

The two-day seminar, which will be held in five different locations across the country beginning in March, will educate attendees about the science behind wildland fire property loss and how to use this data and science to advise property owners about effective mitigation measures they can take to protect their homes. The wildfire mitigation seminar was updated last year to include the latest research on home ignition vulnerabilities from the Insurance Institute for Business and Home Safety (IBHS) Research Center and Dr. Jack Cohen of the USDA Forest Service Fire Lab.

The grant funding will provide 175 U.S. fire service members with scholarships to cover the costs of registration, travel, lodging and meals during the two-day seminar. Upon completing the course, participants will be able to earn an NFPA Certificate of Educational Achievement.

"This seminar provides a sound basis for understanding how homes ignite in wildfires," said Faith Berry, associate project manager, NFPA Wildland Fire Operations division. "By having the latest science about home ignitions at their fingertips, participants can have more constructive conversations with residents in order to educate them on ways they can significantly reduce loss from wildfire."

2016 seminar dates and locations are:

- March 22-23 Doubletree Hilton, Sacramento, California
- April 14-15 Doubletree Suites, Phoenix, Arizona
- April 22-23 Residence Inn, Downtown/Bricktown, Oklahoma City, Oklahoma
- May 5-6 Courtyard Portland Downtown/Convention Center, Portland, Oregon
- May 20-21 The Davenport Grand, Autograph Collection, Spokane, Washington

The wildfire training grant is part of more than \$1 million NFPA received from the Fire Prevention & Safety Grants distributed for fiscal 2014 from FEMA's Assistance to Firefighters Grant (AFG) program.

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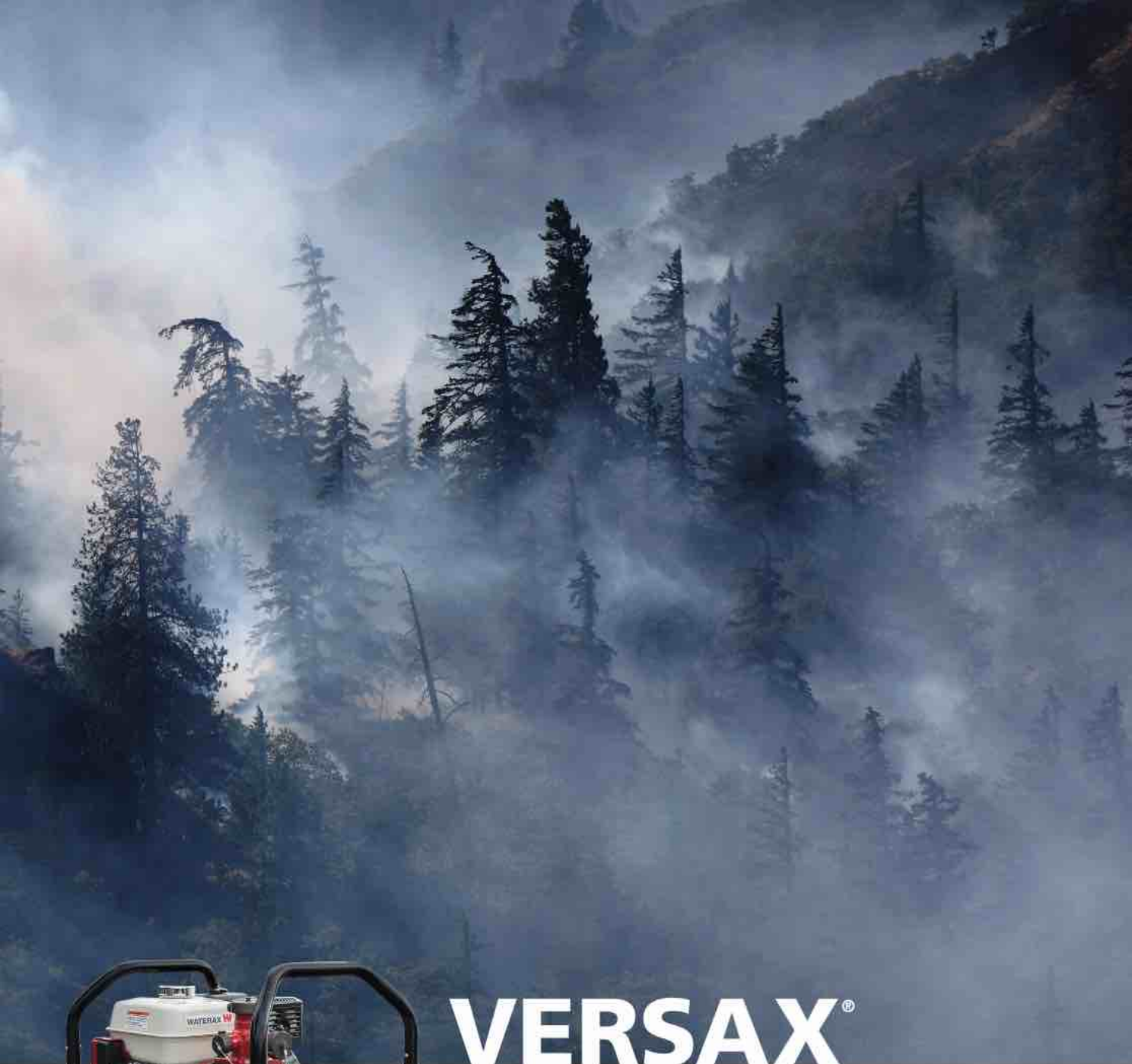
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