JANUARY – MARCH 2021 / VOL 30.1
UNITING THE GLOBAL WILDLAND FIRE COMMUNITY

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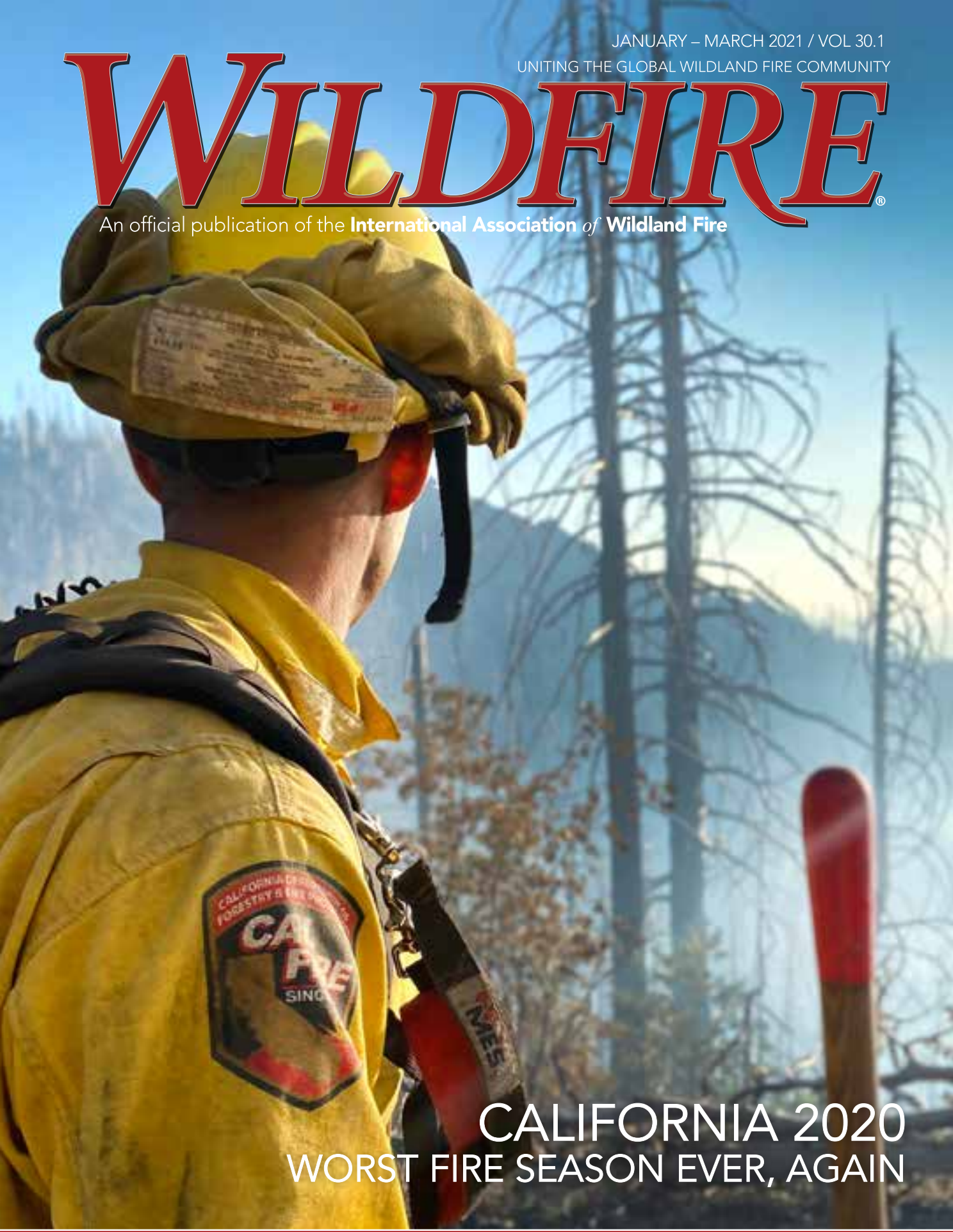
An official publication of the **International Association** *of* **Wildland Fire**



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COLUMNS & NEWS

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PHOTOS

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ON THE COVER August Complex West Zone by Suzi Brady, Cal Fire

January – March 2021 / Vol 30.1

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An official publication of the International Association of Wildland Fire

WILDFIRE (ISSN: 1073-5658) is published by the International Association of Wildland Fire, a 501(c)3 nonprofit organization. The magazine supports IAWF's core mission — "Uniting the global wildland fire community."

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A NEW YEAR AND NEW OPPORTUNITIES

TODDI STEELMAN
IAWF PRESIDENT

2020 will live forever in our memories as a year without precedent. The COVID-19 pandemic. A global recession. A generational reckoning over racial inequity. And one of the hottest years on record.

The year was bookended by historic wildland fires in Australia and in the United States. But those were not the only places to witness momentous fire events. Siberia experienced "zombie fires", underground smoldering fires resurrected from the previous year, which were driven by record setting heat in the Arctic. The Amazon experienced a second year of record burning in the last decade. The Pantanal, the world's largest wetland, also experienced record setting wildland fires.

IAWF IS POISED TO ASSIST IN EFFORTS TO BRING PEOPLE TOGETHER THROUGH OUR NETWORKS, FOSTER DYNAMIC ENVIRONMENTS FOR CONTINUOUS LEARNING AND INSPIRATION, AND CREATE THE OPPORTUNITY FOR A MORE SUSTAINABLE WILDLAND FIRE PARADIGM.

In 2021, we will be looking for what our next "normal" will be. I believe we have an equally historic opportunity to reset our expectations across numerous dimensions, including wildland fire.

In 1920 after the Spanish flu ravaged the globe, the roaring '20s were ushered in as an era of innovation, risk taking and originality. In many ways, it was an era that shifted the mark on what was possible. And if we are clever, we can once again capitalize on a moment in history where transformational change is imaginable.

Change is most likely to happen when we achieve alignment among what our broadscale culture will support, what our institutional structures (laws, policies and established procedures) are set up to achieve, and when we have individual champions who will drive the change forward.

Culturally, coming into 2021 we are primed for the public at large to be in greater support of change to improve wildland fire due to the attention over the previous wildland fire year and the mounting attention to climate change. Compared to where the world was a decade ago, climate change and wildland fire are more in the news and have captured the attention of a public that is eager to see greater action.

Institutionally, we need to be ready to push forward with the best practices, policies, and activities that we know

work. Individual champions drive change in numerous ways and we need to be prepared to continue to learn from their efforts, offering them support, while also pooling our knowledge to mutually inspire each other to maintain the momentum for change.

IAWF is poised to assist in efforts to bring people together through our networks, foster dynamic environments for continuous learning and inspiration, and create the opportunity for a more sustainable wildland fire paradigm. IAWF will do this by holding key conferences in this coming year, such as the 16th Wildland Fire Safety Summit and 6th Human Dimensions of Wildland Fire (May 24-27), which will take place online on three continents simultaneously, the 4th National Cohesive Wildland Fire Management Strategy Workshop (October 4-8) in Asheville, NC, and Wildland Fire Canada (October 25-29) in Edmonton, AB.

In addition, new ideas and new voices will be supported through the pages of our International Journal for Wildland Fire and our quarterly magazine *Wildfire*.

It is a New Year and one filled with opportunity and promise. The wildland fire challenges we face today developed over decades and they will not be changed for the better overnight. Working together, one year at a time, we can bolster each other into not only imagining, but realizing, a world where wildland fire and humans coexist more easily. I look forward to working together in this coming year as we all strive to be champions of driving forward change on this worthy vision.

TODDI STEELMAN is president of the International Association of Wildland Fire and Stanback Dean of the Nicholas School of the Environment at Duke University, North Carolina, USA

PERSONNEL IS POLICY

MIKE DEGROSKY

With all the media coverage around the nominations of the incoming Biden administration, I have noticed a resurrection of the expression "personnel is policy" a phrase popularized early in Ronald Reagan's first presidential term. Despite its bad grammar, this saying is pretty instructive. So, what does it mean?

Leaders succeed when people support and execute the leader's policies, and work to achieve their objectives. Consequently, it is critically important that leaders pay attention to getting the right people in place through good recruiting, hiring, organization, and assignment.

> "WHEN A LEADER PAYS CAREFUL ATTENTION TO WHO IS ON THEIR TEAM AND WHAT ROLE THEY PLAY, TO PUTTING THE RIGHT PEOPLE IN PLACE, PERSONNEL BECOME POLICY AND POLICY PROPELS WHAT BOTH THE LEADER AND THE ORGANIZATION ULTIMATELY ACCOMPLISHES."

Of course, a leader's latitude to mold their team varies from organization to organization and situation to situation. However, in any organization, the leader has at least some ability to pick the people who will execute their intent. Who the leader chooses to surround themself with drives policy and drives the leadership agenda.

Over my career, I have noticed that effective leaders learn early to make sure they assemble a good team and remember that as they rise through their careers. They understand that who they bring in to implement their goals propels what they ultimately accomplish. Bottom line, an effective leader needs people with the right experience, a commitment to executing and advancing the leader's intent, and the ability to effectively bring others along. When a leader pays careful attention to who is on their team and what role they play, to putting the right people in place, personnel become policy and policy drives what the organization accomplishes.

It can be exciting to watch a determined leader put, onto the levers of power and influence, the people they need to advance their agenda. I particularly love to watch a seasoned senior leader put talented and respected up-and-comers in place, mentor them, and then let them blossom into the influential guides of their organization as they execute its objectives. Effective leaders know that they

"IT CAN BE EXCITING TO WATCH A DETERMINED LEADER PUT, ONTO THE LEVERS OF POWER AND INFLUENCE, THE PEOPLE THEY NEED TO ADVANCE THEIR AGENDA."

need to let the right people drive; the people with the right experience, commitment to executing the leader's intent, and the ability to influence others. I have particularly enjoyed watching skilled leaders put people in place to energetically repurpose the machinery of government in ways that advance public service and the public interest.

HR policies, rules and procedures, particularly those in public agencies, can make it hard to get the right people in place; to mold the team; to pick the people who will persistently execute the leader's intent. Purposefully building a team in bureaucratic organizations can seem daunting, but I hate seeing a would-be leader give up, resigning themselves to a random organization. Fortunately, we need not give up; in any organization, the leader has at least some ability to shape their team. Besides, we must remember that no matter what, whether a leader chooses action or inaction, they end up surrounding themselves with other people, and those people will influence what the leader and the organization ultimately accomplish. So, what is a leader, who wants to get the right people in place, to do?

Recruit. Every day is recruiting day. Stay alert, look for talent, look for ambition, look for potential all day, every day. Look for people with demonstrated potential who support your objectives and who will work to achieve them. When you spot those people, take action. Do not hesitate to approach "high potentials," get to know them, understand their career goals and discuss both opportunities in your organization and how those opportunities align with their career ambitions. Rarely have I seen an organizational leader get the right people in place by relying solely on institutional job advertisement vehicles and picking the best of the people who turn up from them. You have to recruit.

Create opportunity. Details, task teams, committees and other special assignments create opportunities for you to give people a try out, and for them to try working with you and try out the work of your team. Use these opportunities liberally to identify talent and aptitude as well as give people with potential, who may lack needed experience, with the chance to develop the skills to do the work of your unit.

Hire well. Because it is critically important that leaders pay attention to getting the right people in place, effective leaders put a premium on good hiring; prioritizing hiring activity and onboarding over nearly all else. A good hire supercharges a team, and a bad hiring move can hamstring it. In my experience, hiring well starts with assembling a good hiring team; people who, themselves, have the right experience and commitment to leader's agenda; people who get it. In recent years, my favorite hiring team members have been people who I would have made great candidates for the job themselves.

Put people in the right assignments. Recruiting and hiring great people is one thing, hiring them for the right job quite another. I am sure that, like myself, many Wildfire readers have encountered excellent people, fine human beings, dedicated and committed individuals in the wrong job. A leader needs people with a combination of experience, commitment to executing and advancing the leader's intent, and the ability to effectively bring others along. That does not mean that one should not take a shot on a talented up-and-comer, with intent to coach and mentor them. In fact, on balance, I favor hiring for future potential over past experience.

Let people do their jobs. You have put talented and respected people in place, people with the right experience, people with a commitment to executing your intent, people with the ability to influence others, now let them drive.

When a leader pays careful attention to who is on their team and what role they play, to putting the right people in place, personnel become policy and policy propels what both the leader and the organization ultimately accomplishes.

MIKE DEGROSKY is Chief of the Fire Protection Bureau for the Montana Department of Natural Resources and Conservation, Forestry Division. He taught for the Department of Leadership Studies at Fort Hays State University for 10 years. Follow Mike on Twitter @guidegroup or via LinkedIn.

WELCOME NEW BOARD MEMBER

Mike Norton,
Director General, Canadian Forest Service, Natural Resources Canada, Government of Canada, joins the IAWF Board of Directors.

Mike Norton joined Natural Resources Canada (NRCan) in July 2014 as the Director General of the Northern Forestry Centre (NFC), located in Edmonton, Alberta. NFC is a research centre comprising over 100 employees, with particular strengths in wildland fire, forest health, land reclamation, and climate change. Through extensive partnerships with the public, private and academic sectors, NFC supports the sustainable management of forests as a foundation for a vibrant industry. Mike also holds national leadership roles related to wildland fire. Prior to joining NRCan, Mike was Regional Director, Environmental Services and Contaminated Sites with Public Works and Government Services Canada (2013-2014), where he led a major program remediating contaminated sites across Canada's north and providing other environmental services to federal government departments. Previously, Mike held the position of Associate Regional Director General with Environment Canada (2011-2013). In that role he provided senior leadership and advice on high profile regional issues, managed stakeholder relations, and led several interjurisdictional initiatives on water in addition to senior corporate roles. He started his federal public service career with Environment Canada in 2000. Mike has a Bachelor of Science from the University of Guelph and a Master of Science from the University of Alberta. He lives in Edmonton, and is married with two girls in junior high.

IAWF GRADUATE LEVEL STUDENT SCHOLARSHIPS

Each year, the International Association of Wildland Fire (IAWF) awards two graduate-level scholarships valued at $3,000 USD to Master of Science (M.Sc.) or Ph.D. students studying wildland fire or wildland fire-related topics. Student submitted essays are evaluated by an international panel of fire science experts and one award recipient is chosen for the Masters level and one for the Doctoral level. The IAWF has been presenting this award annually to members of the fire science community since 2007.

Applications are now being accepted through March 19.

https://www.iawfonline.org/scholarships/

RECORDING OF IAWF ANNUAL GENERAL MEETING

We had a great turnout for our Annual General Meeting that we held virtually in December. We are pleased to share the recording of the meeting for those who were unable to attend and for those who want to revisit any of the presentations. In addition to the updates from each of the committees we were honored to hear from Dr. Stephen Pyne, noted fire historian and a strong supporter of the IAWF mentorship program. The transcript from the presentation can be found on page 12.

https://www.iawfonline.org/about-us/

NOTE FROM TIM SEXTON, FIREBREAK AWARD RECIPIENT

I would like to express my sincere appreciation for the Firebreak Award that was recently bestowed upon me. It is a great honor and one I will cherish. I would also like to correct a couple of items in the award narrative. I was the Superintendent of the Redmond Hotshots from 1981 through 1986. In 1981 I led the transformation of the crew to include developmental opportunities for career employees. However, the first superintendent was Carl Rader when the crew was established in 1960. The narrative also discussed the 2009 update to the Federal Fire Policy. While I participated in the update, I was not the leader of it. Rich Lasko led the Forest Service efforts for the update.

Thanks again for the wonderful award!
Sincerely,
Tim Sexton

2020 DISTINGUISHED SERVICE AWARD RECIPIENT

The IAWF Distinguished Service Award recognizes individuals, groups or organizations for their outstanding contributions to furthering the goals of the Association.

We are pleased to announce the 2020 recipient, Dr. Tom Zimmerman.

Tom is retired from the Wildland Fire Management Research, Development, and Application Program, Rocky Mountain Research Station, U.S. Forest Service. He worked at multiple federal land management agencies, including the Bureau of Land Management, National Park Service, and US Forest Service during his career. Tom has conducted training in the United States, China, Canada, and India, and presented papers, either in person or virtually, at conferences in the United States, Canada, Italy, South Africa, and Cyprus. Wildland fire and emergency response constituted a major focus area and Tom has over 30 years of involvement in incident management team operations including service as an Incident Commander and Area Commander on wildland fire incidents and all hazard emergency responses across the country.

Tom was on the IAWF Board of Directors from 2012 – 2017 and was the IAWF President from 2014-2017. During his term and continuing to the present, Tom has chaired or participated on multiple committees, including the Nominations, Strategic Planning, Fund Development, Ember Award Sub-committee, Membership, Finance, Stewardship, and the Diversity and Inclusivity Committee.

Tom has actively participated on and/or chaired 12 conferences planning committees since 2013.

Tom also represents the IAWF as a Member of the Association for Fire Ecology Diversity and Inclusivity Committee, he is the AFE Board liaison, the IAWF Representative to Western Regional Strategy Committee, and the NASA Earth Science Senior Review of NASA satellites.

For the past 8+ years Tom has made himself readily available to further the mission and success of the IAWF. He always finds time to provide support and/or advice to current board members and to the Executive Director, Mikel Robinson. Mikel has expressed her sincerest gratitude to Tom, and said she can't think of anyone more deserving of this award.

Tom's comments about receiving this award:

"Thank you so much for the IAWF Distinguished Service Award. I was certainly surprised and amazed of what a well-kept secret this was and that the award was actually sitting in my house while I had no indication of anything. When Toddi presented it and then my wife brought it into my office, I was so surprised that I was actually speechless for a few moments.

This is such a prestigious IAWF award, I don't know if I can express how humbling it is to receive this recognition from the Board, Association members, and the global fire community. It is an honor to serve and represent the IAWF and a pleasure to be able to be involved in the mission of IAWF. I truly enjoy all the things that I have been fortunate to be involved with, all that IAWF has exposed me to, and all the individuals around the world that I have met and worked with because of IAWF – what an honor to be able to experience such a rewarding, learning, and fulfilling experience!

Everyone involved with IAWF brings a genuine passion and commitment to wildland fire management and the ability to share that passion for such a common good is truly awe-inspiring. I look forward to continuing to serve and represent IAWF in all manners that I can and am motivated and inspired to further our goals for the betterment of global wildland fire management."

IAWF MEMBERS VOICES

In this edition of Wildfire we introduce what we hope will become a regular feature - the thoughts and ideas of our members. We recently emailed IAWF members and asked, "What is one thing you would like to see from IAWF in 2021, either something new or something we should do more of or continue?" Here are some ideas: if you would like to add your say, email us at info@iawfonline.org

The online meeting about a month ago was great. [AGM]. I'd like to see this done around every 6-12 months. It would probably be best in the autumn/ fall/ spring times rather than in the middle of a summer, and it would be good to move the times around occasionally so to not disadvantage any particular time zone.

Given current Covid, climate and economic challenges in 2021 I would love to see some focus given by IAWF to where Wildland philosophy and approaches to leadership and problem solving can be applied to other areas outside of the wildfire sphere. I think the community has a huge skillset to apply to other issues. Hope this helps. A very happy Christmas and New Year to all at IAWF and thank you for the inspiration and sense of inclusion during a very difficult year.

Continued, expanded and more graduate student support! Travel, grant and project funding, job training opportunities, peer mentor placements, etc.!

Two opportunities; First, what will a communication strategy look like that will lead us to "learning to live with wildland fire." Second, We have plenty of leadership examples of leading change and being both successful and failing miserably in dynamic and changing conditions. Let's daylight those, share what is learned even when outcomes are not what was expected. Focus on the social aspects of leadership, call out those leaders who are not afraid to lead!

If at all possible, I would like to see in-person meetings start back up. I'm assuming once the vaccine for COVID-19 has been widely distributed, this could be a possibility. Thank you!

Provide regular updates on how the fire-prone regions of the world are addressing relocation and other types of help for the economically disadvantaged populations during megafires. Our general public needs to be better informed about what the real causes and consequences of these fires are in the populations living in these areas, and the real costs of doing business as usual.

The large joint meetings using technology to bring us together and stimulate our minds. More links to online learning through videos or written articles. The articles you have sent have been very interesting and informative so keep them coming through.

Extend the potential membership of IAWF through associations and partnerships with local firefighter and volunteer associations. For example, with the NSW Rural Firefighters Association. While there are likely to be many common elements to the purposes of both organisations, the 'bigger picture' focus of the IAWF may be of interest to some RFSA members who are currently unlikely to be aware that the IAWF exists. While the IAWF does promote itself at the Australian national events with the likes of the Bushfire and Natural Hazards CRC, the RFSA is focused at the state level, specifically at bush fire, and whose membership is fire fighter practitioners rather than organisations.

Continue covering topics in Air Monitoring and the instrumentation covering smoke monitoring and health effects of smoke.

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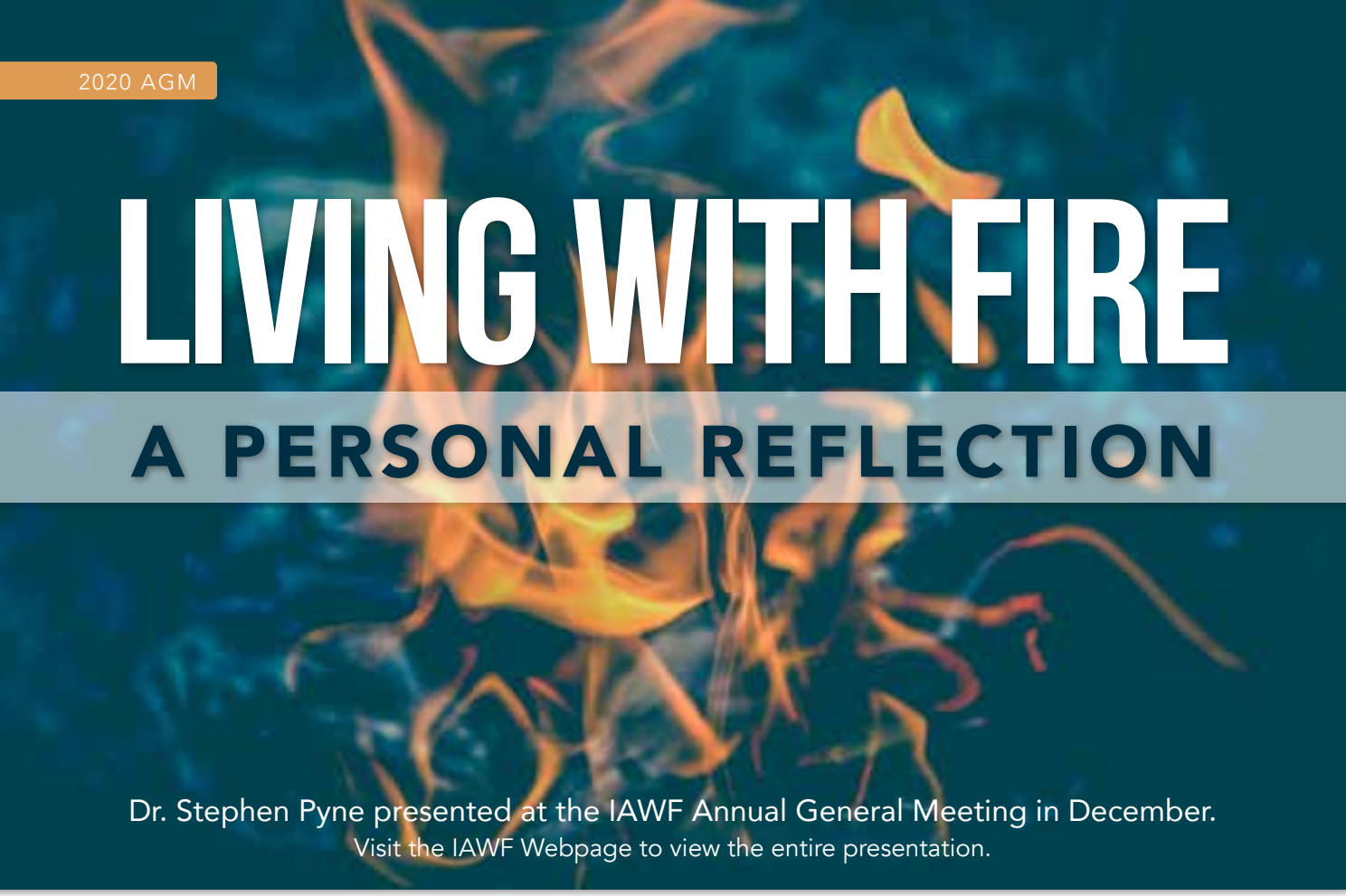

Dr. Stephen Pyne presented at the IAWF Annual General Meeting in December.
Visit the IAWF Webpage to view the entire presentation.

Thank you for the invitation to speak – I'm truly honored. Since by training and temperament I'm a historian, let me indulge my instincts and reflect on how the fire world has changed over the past half century.

My life with fire began in 1967 when I was hired as a smokechaser with the North Rim Longshots at Grand Canyon National Park. I spent 15 seasons in all, 12 as crew boss. Everything I've done since dates back to those seasons. I even met and married my wife on the Rim. Our oldest child spent her first two summers there.

In 1967 the National Park Service, like all federal agencies, operated under a 10 am policy – suppression only and everywhere. On the Rim this meant a lookout, two slip-on units as pumpers, abundant snag fires, and lots of hiking and compassing since roads were few and surface water was rare. We lived where we worked.

Nationally, the US Forest Service was a hegemon that oversaw virtually every aspect of wildland fire. It dominated both hardware and software. It set policy, funded nearly all research, and provided an institutional matrix for other federal agencies and those of the states. The only fire-specific periodical was Fire Control Notes. Mutual aid agreements fashioned a national system with the Forest Service as a keystone agency. Only the BLM in Alaska had a fire program independent of it. The Park Service had two dedicated fire officers for its entire system. International connections meant FAO-sponsored exchanges.

That year the major fires were in the Northern Rockies. Two burned to national publicity in Glacier National Park, and two big fires blew up in the Selkirk Mountains. The Glacier fires gained notoriety because a grizzly bear attack killed two hikers at the same time. The Sundance fire was the largest in the region since 1934; two firefighters died. In 15 seasons on the North Rim our largest fire was 300 acres, on a mesa within the Canyon. The largest regional fire was 1,000 acres.

We were remarkably isolated from knowledge about the outside world. We lived in housing and worked in buildings erected 30 years earlier by the Civilian Conservation Corps. Radio reception was erratic; there were no personal phones and no TV. Once a month the Coconino County bookmobile would roll in. I learned about Apollo 11's lunar landing when Time magazine arrived in the mail a week later.

But fire was equally isolated within the larger culture.

Mostly it meant Smokey Bear, Bambi, and the occasional movie. For American society at large wildfires were a freak of western violence or a California quirk, not an intrinsic fact of national existence.

Yet changes were afoot. The sense that the current regime could not continue was surprisingly pervasive, like a supersaturated solution waiting only a prompt to crystallize. In 1962 Tall Timbers Research Station began its influential fire ecology conferences and the Nature Conservancy conducted its first prescribed burn. In 1968 the NPS reformed its policy to emphasize fire's restoration; ten years later the USFS followed suit. Those top-down reforms made no difference on the Rim.

Today, American fire has undergone a massive makeover. Forest Service hegemony has long vanished; and suppression costs have gutted the agency for most of this century. Institutions, policies, and research are pluralistic. Prescribed fire is common, and in some places, foundational. The US has treaties with its neighbors; a global fire network under the auspices of the UN is near completion.

Today, wildland fire – or more broadly, landscape fire – is firmly implanted in the media's almanac of annual disasters and routinely claims headlines throughout the world. Wildfires had been growing more feral for decades. In California they burned deeply into Santa Rosa and took out Paradise; in Canada, they plunged into Slave Lake and trashed Fort McMurray; in Mediterranean Europe, they savaged Pedrogao Grande and Mati; in Australia, Black Saturday swelled into a Black Summer. In 2020 fire became that other contagion, the pandemic without the prospect of a vaccine.

Underwriting these changes was another form of combustion – this one wholly under human control – as people accelerated their binge burning of fossil fuels. Climate change metamorphosed into a climate crisis. Fire found itself at the center of an Anthropocene. Or perhaps of a Pyrocene, as humanity's burning summed up to the fire equivalent of an ice age. The dialectic between burning living landscapes and burning lithic ones may be the core narrative of our time; it has rendered even climate history into a subnarrative of fire history. A fire crisis has morphed into a fire epoch. What 50 years ago was something sequestered in outbacks and backcountry has become an informing feature of planet Earth.

The International Association of Wildland Fire was organized near the inflection point of this transition. Fire publications, fire conferences, fire effects – all were on the uptick of an exponential curve. Earthly fire was too expansive a topic for any one discipline and too massive for any single agency or nation to handle. In 1989 came the first International Wildland Fire Conference and the publication of International Forest Fire News. The following year the IAWF took on the task of trying to bring all people concerned with landscape fire into a common cause.

Since then the fire scene has quickened. In the United States the fire revolution rebooted after the 1994 season. In 1998, the Secretary of the Interior declared a 'national fire crisis.' In 2002 the term megafire was introduced; in 2020, gigafire. Fire seemed everywhere, with global tongues of flame proclaiming the advent of an environmental apocalypse.

What of the future? The future of fire will depend on what humanity does. So, too, the future of the IAWF will be what its members choose.

It was chartered amid an awakening of fire-related interests. It claims a unique position as a global association of fire folks – practitioners, researchers, managers. Its size and catholicity are its great strengths. It brings critical mass to whatever task it elects to address: it can invest a substantial voice and presence to issues that until it appeared had no constituency to speak for it. It has been both mother ship and midwife to gatherings, journals, and other institutions. What integrated fire management is as a concept, the IAWF is as an organization.

Yet those same strengths are also a weakness. It will be hard to hold all the parts together. The tendency will grow to spin off new societies and specialty journals. It will be particularly tricky to hold researchers and practitioners in a valence of shared enthusiasm. The centrifugal will compete with the centripetal. Or to adopt a fire metaphor, the spreading perimeter will tend to fracture into multiple heads. Science values the new; practice values the inherited. Fire management needs both.

The IAWF is also a mentor. I don't mean only its formal program to match prospective mentors with mentees, a project to which I try to contribute. I mean its role in handling the fire community's accumulated knowledge of all sorts across disciplines, nations, and generations. It's been said we don't own knowledge; we just hold it for a while, passed to us by our predecessors and in turn handed to our successors. That is as true for organizations as for individuals.

The IAWF occurred at a unique historical moment when fire, environmental concerns, critical personalities, and international politics crossed and sparked. It's hard to imagine the association happening a decade earlier or a decade later. If it dissolves, I can't foresee it being reconstituted. So while its role will surely evolve, it will thrive in the years to come if its members continue to do for that future what they have successfully done in the past.

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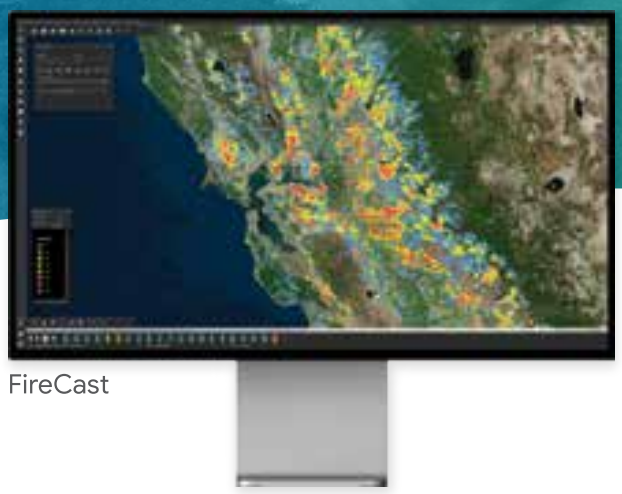

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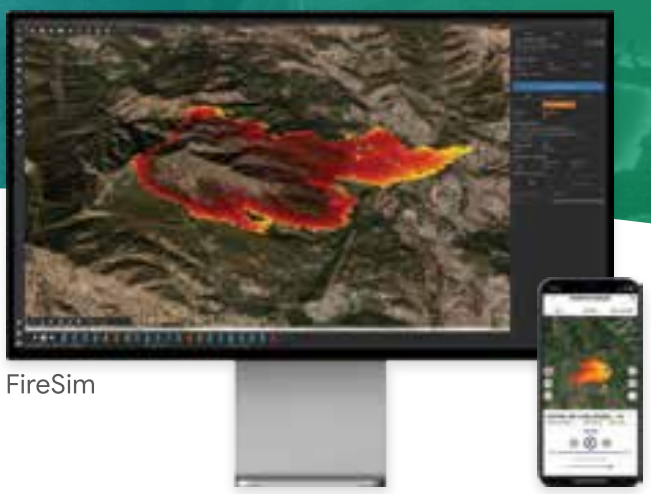

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fiRESPONSE

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We hope you enjoy this Open Access Paper.

Towards resilient health systems for increasing climate extremes: Insights from the 2019–2020 Australian bushfire season

BY APARNA LAL, MAHOMED PATEL, ARNAGRETTA HUNTER, AND CHRISTINE PHILLIPS
COLLEGE OF HEALTH AND MEDICINE, AUSTRALIAN NATIONAL UNIVERSITY

Introduction

Australian climate extremes put enormous pressure on health systems. Heatwaves cause more deaths than all other natural hazards combined (Coates et al. 2014). The recent prolonged drought, which fuelled the early start of the 2019–20 fire season, coupled with the scale of the fires themselves have resulted in an unparalleled ecological crisis (Freund et al. 2017; Boer et al. 2020). An estimated 21% of Australia's forestlands was burnt in a single season, with a huge loss of biodiversity (Boer et al. 2020) and major cities experienced weeks to months of hazardous levels of bushfire smoke. For most of December, Sydney experienced 24-h PM2.5 levels that were 4-fold the acceptable limit, on occasion reaching levels of 500 mg m-3, or 20-fold the acceptable limit (Yu et al. 2020). Canberra, the nation's capital, was among the world's top 10 polluted cities for the last two weeks of 2019 (Fig. 1), reaching a 24-h PM2.5 level of 855.6 mg m-3 on 1 January 2020 (ACT Health 2019). The smoke-related burden in itself is estimated to have resulted in over 3000 excess admissions for cardiovascular disease and respiratory conditions and over 400 excess deaths between October 2019 and mid-February 2020 in eastern Australia (Borchers Arriagada et al. 2020). Of the 1.5 million people living in the bushfire-affected regions, tens of thousands were evacuated by land and sea as the fires encroached. Many were evacuated to evacuation centres with limited connections with healthcare providers, placing further strains upon the health system through lack of power, blocked roads and failures of mobile phone connections. The performance of Australia's healthcare system was ranked second after the UK in the Commonwealth Fund's 11-country comparison in 2017 (Schneider et al. 2017). Yet even this health system struggled under the environmental crisis. Here, we reflect on the challenges and capacity of the health system to deal with such extreme events and identify areas to strengthen the resilience of health systems to better prepare and respond in the future.

Effects of extreme climate events on the Australian health system

A health system consists of all the organisations, institutions, resources and people whose primary purpose is to promote, restore or maintain health (World Health Organization 2015). The three main goals of a health system are to improve the health of the population, to improve the responsiveness of the health system to the population it serves and to provide social and financial risk protection (World Health Organization 2015). A health system achieves these goals through six interrelated core components or 'building blocks' (Fig. 2), which can be used for planning and decisions on funding and priority setting. We outline the immediate and continuing effects of this past summer on the Australian health system, focusing on these six building blocks.

Service delivery

Service delivery was directly affected through loss of facilities and infrastructure. Medical practices were literally burnt down in some towns (Public Health Association of Australia 2020). Pharmacies and medical centres lost power (Brooker 2020).

Fig. 1. Smoke pollution in Canberra from regional bushfires: the same view (a) 21 December (24-h PM 2.5 269.7 ug m -3) and (b) 22 December (24-h PM 2.5 96.9 ug m-3) at 4 p.m. in the evening (measured at the nearest air quality monitoring service, Civic (Central Canberra)) (Source: Aparna Lal).

Fig. 2. World Health Organization building blocks of health systems (World Health Organization 2015).

Five regional hospitals in New South Wales (NSW) and all their patients were relocated. Aged care patients were relocated to other towns, often into other aged care facilities already at capacity (Community Impact Group 2020). Health services that did not burn down were rendered almost non-functional by water scarcity and hot weather. Contamination of drinking water supplies and shortages were common in many bushfire-affected areas (Lal 2020). For rural communities in affected areas, whose resilience was already affected by the ongoing drought (Austin et al. 2018) or the experience of previous major bushfires (Bryant et al. 2018), the 2019–20 bushfires imposed significant mental burdens. The required service mix changed as a result of the fires, with more people requiring mental health services (Public Health Association of Australia 2020).

Nearly one-quarter of the NSW and Victorian Aboriginal populations live in the fire-devastated regions, comprising 5.4% of the bushfire-affected population, compared with 2.3% of the overall population of the states (Williamson et al. 2020). Aboriginal community-controlled health services, which have strong local roots and provide culturally safe care, were disproportionately affected by the bushfires. Some Aboriginal community-controlled health services were transformed into evacuation centres or distribution centres and temporarily unable to provide primary healthcare services (National Aboriginal Community Controlled Health Organisation 2020).

Medicine and technology

Supply chains for medicines broke down with road closures and loss of electricity in places that did not have generators (Brooker 2020). The states of Victoria and NSW were obliged to issue emergency public health orders to enable pharmacists to dispense medications (New South Wales Department of Health 2020; State Government of Victoria 2020). One hospital reported that the pervasive bushfire smoke and heat had caused magnetic resonance imaging and computed tomography scanners to fail, as well as contaminating sterile stocks (Evans 2020).

Health information systems

Health information systems include communications about healthcare provided to people during a climatic crisis and the information systems used by the healthcare services. The emergency information about the need to evacuate contributed to the relatively low loss of life during the bushfires. However, information about how to manage the attendant environmental issues such as ambient smoke, water safety and medication management was less clear (Vardoulakis et al. 2020).

Many people evacuated from unliveable environments and who sought care in other rural health services found the available clinical health information systems insufficient, as 44% of all personal e-health records held no information at all (Australian Digital Health Agency 2020). Pharmacies with functioning electricity and which had data systems with information about patients' medications were able to dispense safely (Australian Digital Health Agency 2020). Clinical services without robust IT systems handed patients handwritten notes on their treatment (Public Health Association of Australia 2020).

Health workforce

The health workforce in rural areas destroyed by fires was already a fragile resource (Health Workforce Australia 2012). The bushfires placed extra strain on health staff who provide care to the community as first responders, to their fellow evacuees in places of evacuation, and as providers of ongoing health care (Public Health Association of Australia 2020).

Health sector funding

Severe climatic events reveal vulnerabilities in health sector funding. Primary care in Australia is delivered through small businesses charging a fee-for-service. Small communities with

reduced incomes due to the effects of bushfire and drought may be unable to support a viable health service (Burns and Manderson 2020). The loss of a medical service in a rural community is a harbinger of the end of the community itself (Kenny and Duckett 2004).

Leadership and governance

Shortcomings in health system leadership and governance in relation to preparedness and response to severe climatic events may reflect limited awareness of the health sector to environmental crises, even as these events become more frequent. Of the health service managers and community members surveyed in NSW in 2018, 71% endorsed the statement that there was scepticism among health professionals about climate change (Purcell and McGirr 2018). Most health services do not have detailed plans for environmental crises such as massive bush- fires. Those with plans are often developed in the wake of a bushfire and are not an integral part of national planning. An example is the detailed set of Victorian resources for preparedness and response in aged care facilities in a bushfire, developed after the 2009 bushfires (State of Victoria Department of Health 2010), but which was not included in the synopsis of national resources for aged care facilities during the 2019–20 bushfires. Community heat response plans are still underdeveloped across much of Australia and water security plans rarely include planning for environmental catastrophes.

Preparing health systems for a more extreme climate

Preparing health systems for resilience and effective functioning in a more extreme climate requires imagination and robust attention to ensure ongoing effective functioning of health services. Resilience is defined as the capacity of the health system to respond to, cope with and recover from health risks in a way that the essential functions and structure of the health system are maintained (World Health Organization 2015). To achieve this, each of the six building blocks has to become climate resilient (World Health Organization 2015).

First, leadership is essential for good governance, evidence-informed policy making and accountability within the health system, as well as for strategic planning to address the complex and long-term nature of climate change risks and their potential effects on the health system. This calls for collaborations to develop a shared vision among diverse stakeholders and coordinated cross-sectoral planning to ensure that policies are coherent and health-promoting, particularly in sectors that have a strong influence on health, such as water and sanitation, nutrition, energy and urban planning. Public health professionals and healthcare service providers must be at the table with other stakeholders when planning for extreme events.

Second, we need to ensure the viability and stability of service delivery. Options for emergency staffing methods if hospitals need to be evacuated (e.g. the role of the defence force) will require planning and preparation. A clear pathway for communication and service delivery options during such events is critical. Learning from our crisis response through reflection will help us to better prepare for the next event.

Third, health systems need to incorporate considerations about workforce capability and sustainability. Our future health workforce needs to understand the link between a changing environment and illness and recognise the potential implications for the well-being of their patients (Finkel 2019). A resilient health workforce will also require systems for relieving first responders directly affected by fires. The whole of the health workforce needs to be involved in supporting continuity of service provision, including aged care and primary care.

Fourth, we need technology to improve the resilience of health systems to extreme climate and related events. This includes providing stable energy sources that will function when the grid is interrupted and building facilities that are able to withstand heatwaves, fires and floods. A key recommendation of the Royal Commission following the 2009 Victorian bush- fires was improving the building code to adequately fireproof hospitals and aged care facilities. Buildings that house health services in bushfire-affected and other high risk zones must be redesigned to withstand severe firestorms (Drew 2020) and have ventilation systems to manage ambient smoke, improve indoor air quality and protect the inhabitants from thermal stress (Haines and Dora 2012).

Processes to ensure the continuity of critical medicines supplied for doctors and pharmacists need to be incorporated into future plans. During the bushfires, pharmacies in the worst affected areas continued to supply medicines, frequently without power, and with no road access for resupply (Brooker 2020). Defence force helicopters were used to bring in medicines to restock dispensaries (Brooker 2020).

Fifth, clear, precise health information using evidence-based risk communication strategies (World Health Organization 2017) should be ready to go. Often the general public can be flooded with excessive information, without timely guidance on what is the most reliable, useful and practical advice. To ensure that risk communication strategies during extreme events are effective, during and after the event, messages must be tailored for specific audiences including Indigenous communities, resi- dents in different geographic areas and people with limited English language facility. Health information systems for clini- cal records must be optimised with increased uptake of personal health records, so that patients have up-to-date clinical records in a disaster.

Finally, the health effects of extreme events span the immediate, short-term and the long-term. This requires continued and stable funding to build expertise and capacity into the longer term health system response. After the fires, health resources were directed towards the immediate threats such as smoke inhalation or to intermediate needs such as psychological distress. Longer

term strategies should include funding to enhance training for carers of patients with chronic health conditions and disabilities and preparing for the effects of heatwaves. Funding for research to study the medium to longer term effects creates an opportunity for co-learning across sectors to build a more resilient health system.

The way forward

The frequency and severity of extreme climate events have increased globally and will continue to escalate in the decades ahead (Diffenbaugh 2020; Swain et al. 2020). We need a radical shift in traditional thinking to build a resilient health system. To do this, we need to identify and address the flaws and failures in the health system when placed under stress. We need to engage with local communities, as well as across sectors, including the private sector. In Australia, the most developed health-focused plans for climate change adaptation are related to the effect of heat, with a national framework and local plans in place (PriceWaterhouseCoopers Australia 2011). Lessons from the 2019–20 bushfire season can be used to develop a national climate and health systems framework for bushfires, which can then be modified for floods, cyclones, drought-related effects and other extreme weather events.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

This research did not receive any specific funding.

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International Association of Wildland Fire

The Missoula Fire Lab Quilters won the 2014 USDA Arts and Agriculture Competition Grand Prize from over 300 entries submitted from across the USDA. The winning quilt, made in 2010, commemorates the 50th Anniversary of the Missoula Fire Sciences Lab. The central pieced pictorial depicts an ecosystem before fire, during fire, and after fire. The outer blocks represent various scientific advances from the Fire Lab. The four corner blocks tie the quilt to the traditional quilting arts.

CALIFORNIA 2020:

WORST FIRE SEASON EVER, AGAIN. NOW WHAT?

AN EFFORT TO DISSECT THE CALIFORNIA FIRE QUILT

BY JOAQUIN RAMIREZ,
Wildland Fire Technologist, principal at Technosylva (San Diego, CA), and Professor at the University of Leon (Spain). IAWF Board of Director since 2020.

	2013	2014	2015	2016	2017	2018	2019	2020
Estimated ac Burned	601,625	625,540	880,899	669,534	1,548,429	1,975,086	259,823	**4,257,863**
Number of Incidents	9,907	7,233	8,283	6,954	9,270	7,948	7,860	9,917
Confirmed Loss of Life	1	2	7	6	47	100	3	33
Structures Damaged/Destroyed	456	471	3,159	1,274	10,280	24,226	732	10,488

Source: Recent evolution of wildfire impacts in California. Source https://www.fire.ca.gov/stats-events/

Table 1. Annual fire statistics for California from 2013 to 2020.

"... WHAT MAKES CALIFORNIA'S FIRE SCENE DISTINCTIVE IS HOW ITS DRAMATICALLY DISTINCTIVE BIOMES HAVE BEEN YOKED TO A COMMON SYSTEM AND HOW ITS FIRES BURN WITH A CHARACTER AND ON A SCALE COMMENSURATE WITH THE STATE'S SIZE AND POLITICAL POWER..." -- STEPHEN J. PYNE, CALIFORNIA: A FIRE SURVEY

We will remember 2020 for the terrible impact of COVID-19 worldwide. Within the wildland fire community, we will not forget that on top of the complexity of dealing with a pandemic, it was the year where more than 4 million acres burned, including some of the more pristine forests of California, doubling the area of the worst fire year in modern history (Table 1). This happened just after the tragic 2018 fire season when Paradise was devastated by the Camp Fire, and 2017 when Santa Rosa and the Napa Valley suffered the consequence of living in a fire-prone landscape.

Measuring the impacts of fires based on the burned area can be misleading. It is not only how many acres burned, but the severity of those fires, with the resulting effects on the soil. As Bob Martin and Dave Sapsis stated in 1992, followed by Scott Stephens' recent studies, the annual burned area in California prior to 1800 was between 5 to 13 million acres per year. Those were mostly low-intensity fires in general, and 2020 is the only season that gets close to that acreage in modern California history. Fires now burn mostly with high severity, referred to as stand replacement fires. These occurred mainly in Northern California, where the accumulation of large fuel loads from fire suppression was exacerbated by climate change, derived stress, and pest infestations. Seasoned firefighters are regularly observing that fires now burn with much greater intensity than any time in their career. A severity analysis of the largest events of this fire season shows that more than two-thirds of the area impacted was from moderate to high severity.

It is not a problem of human-caused ignitions, as the flourishing litigation industry continually tries to demonstrate. A year like this proves that natural ignitions, not human, can create the worst fire season on record. It is a problem of propagation. California burns because it can. It has the fuels and the conditions to burn, and as Stephen Pyne says, it often conflagrates. This was 2020 in a nutshell.

A FAMILIAR SCENARIO, BUT AT A GRANDER SCALE

Coming from Spain, the California landscape looks familiar yet bolder to me. Everything is at a majestic scale. You can understand how the ecosystems have developed their potential in a land with all the components to sustain the most productive vegetation in the northern hemisphere. The tall redwoods on the North coast, and the largest and oldest conifers, the Sequoias and Bristlecone pines in the Sierras, are now suffering the effects of stressful climate and explosive pest infestations.

In milder terrains, the Oak Woodlands are large enough to produce wine barrels that go to Europe. In Spain, we had maintained a resilient fire landscape (aka firescape), the Dehesa. The livestock that maintained this ecosystem now reside in northern European industrial farms. When the first Spaniards discovered this rich complex of shrubs and small trees in California, they called it Chaparral (shrubby oaks), an ecosystem that can sustain extreme

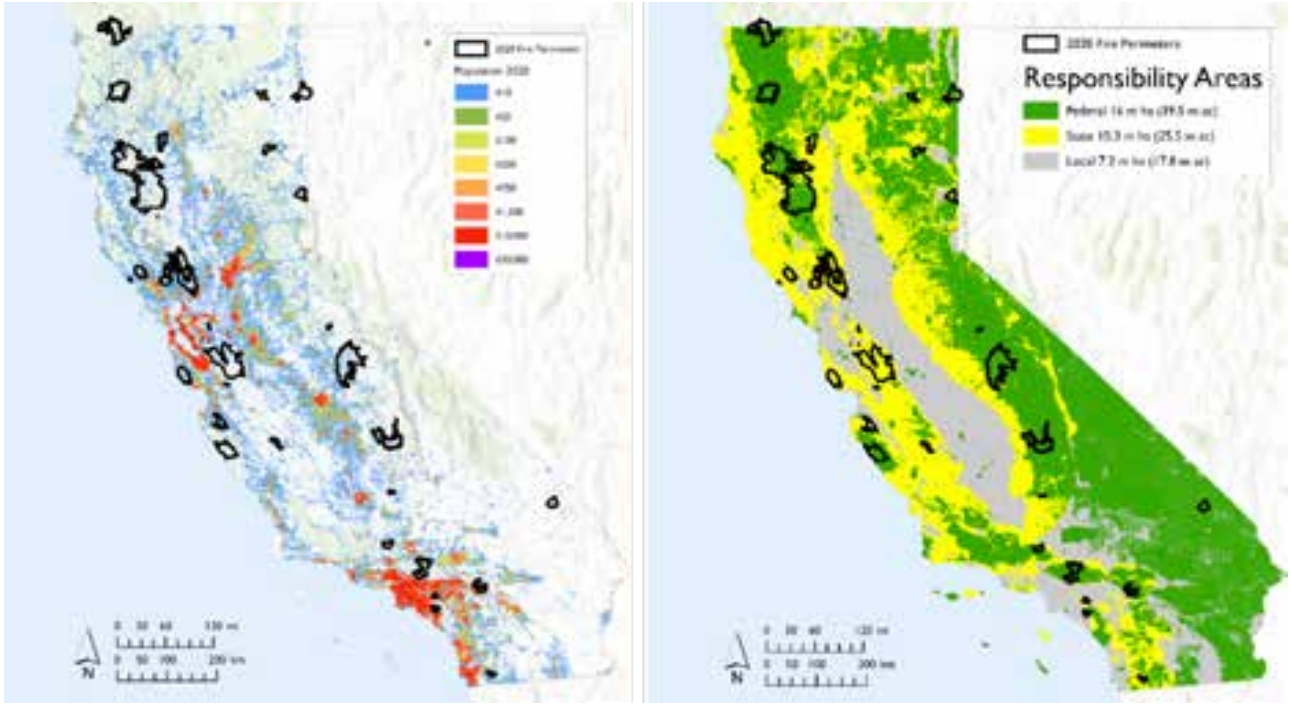

Figure 1. Population density of California and large fire perimeters of 2020. Responsibility Areas (Federal State, Local). Source: NIFC Perimeters, FRAP, Esri

fire behavior during most of the year. Even the deserts sustain the magnificent Joshua Trees, creating dream landscapes that were also dramatically impacted by the fires this year.

Everything seems so familiar. Except for the extreme terrain, everywhere. In the Traverse Range, in Angeles, and San Bernardino National Forests, barely 50 kilometers from iconic Santa Monica beaches, there is a 3,000-meter elevation variation, which provides an impossible scenario for suppression from ground resources. Add the winds, the Santa Ana, the Santa Barbara Sundowners, and the Diablo farther north, that typically occur after the summer season, has prepared the fuels for extreme conflagrations, and you have an extreme scenario, like nowhere else, to sustain fires. All these firescapes burned this year, continuing the dramatic curve that started this century.

THE DYNAMIC HUMAN FACTOR

California, with a 3.2 trillion dollars of GDP in 2019, is the 5th largest economy in the world, just behind Germany. Three hundred and twenty-two Nobel prizes are affiliated with its universities, and it is home to the most innovative companies in the world. This is the birthplace of information technology.

This incredible achievement of Californians just happened in the last 70 years. In 1900, the population of the State was around 1.5 million. In 2020, that population multiplied almost 26 times to reach close to 40 million. In the same period, Spain's population grew 2.5 times. This fast pace of growth created a

Figure 2. 2020 Fire season, with fires larger than 5000 ac. Source: https://data-nifc.opendata.arcgis.com/ & Wildfire Analyst.

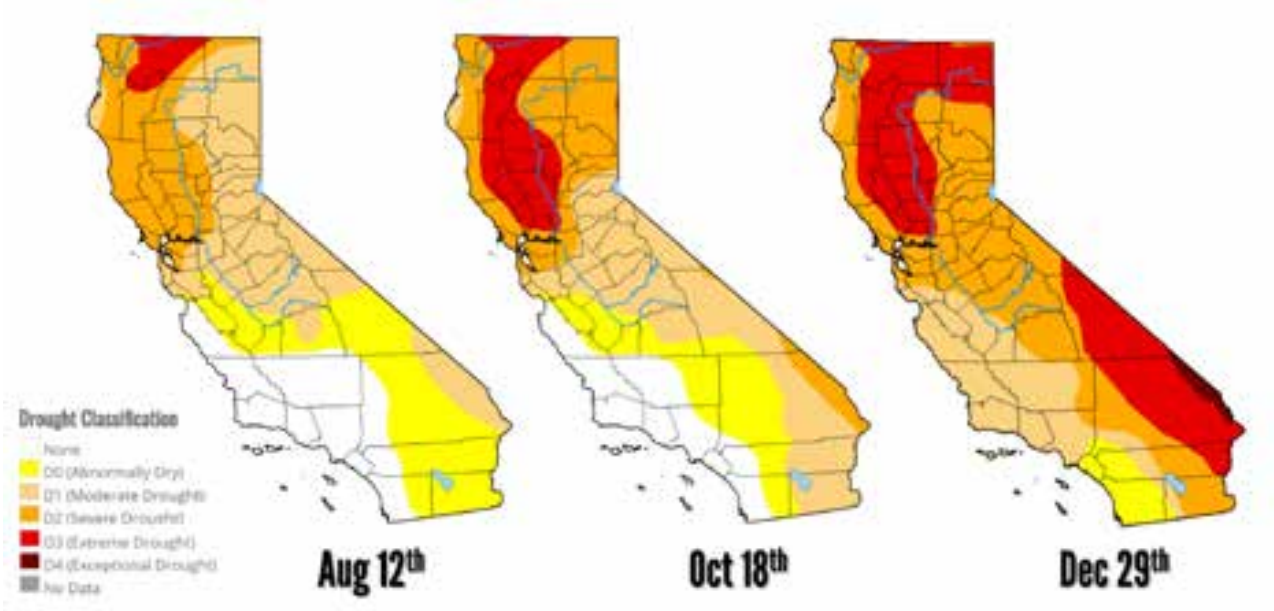

Figure 3. US Drought Monitor. 55% of California was on D1 to D4 categories during the August lighting event. Conditions kept worsening until the end of the year. Source: https://droughtmonitor.unl.edu/

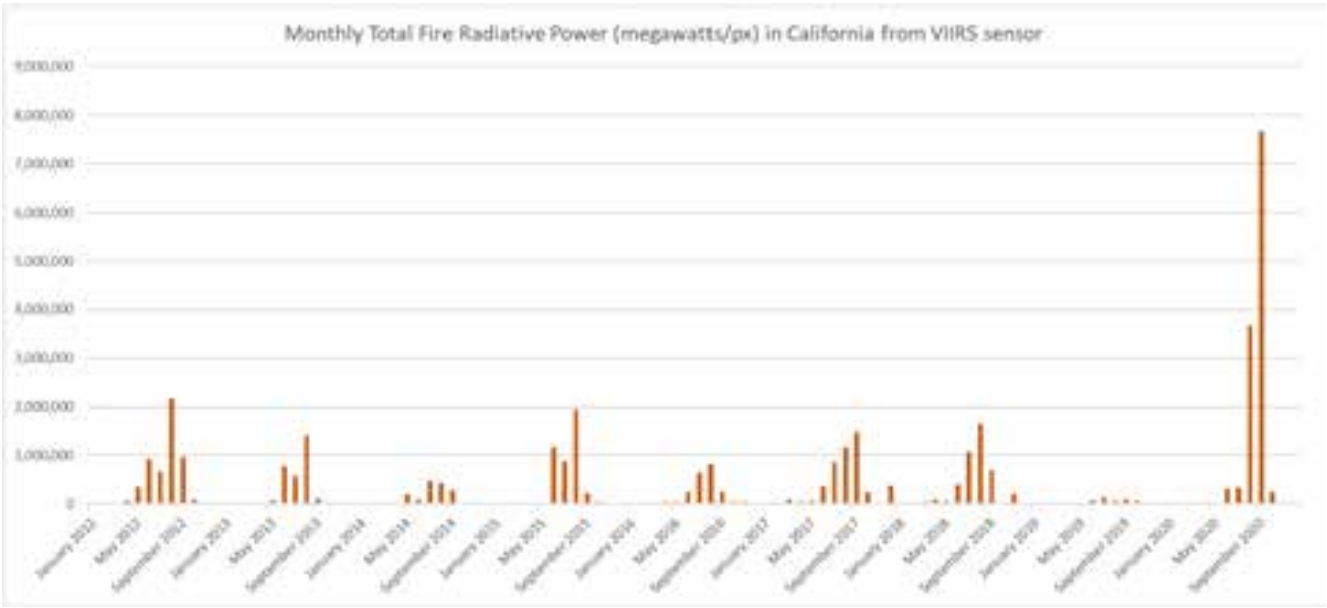

Figure 4. Monthly Total Fire Radiative Power Released by Wildfires measured from VIIRS satellite hotspots (megawatts/pixel). September 2020 stands out as the most extraordinary month since 2012.

housing demand framed in regulations that result in California being one of the most expensive places to live in the United States. And around 30% of that population live in the Wildland Urban Interface (WUI). Communities keep growing, creating the most relevant factor of the California Fire Quilt: urban encroachment into the firescapes. The following figure shows population density overlaid with 2020 fire perimeters.

This is the dynamic scenario that has been the last 20 years facing a constant mantra of "this will be the worst season in history" - every year. Well, 2020 definitively was.

THE 2020 FIRE SEASON

Conditions were set with an extremely dry January and February, followed by rain in March and April. It was just enough rain to create a fresh crop of fine fuels that quickly ignited but not enough to help dry heavier fuels recover. While not the worst drought in history, it was enough to get California ready to burn.

With this scenario, an unusual lightning event occurred. Until August 10th, around 4,500 fires had burned 51,892 acres (21,000 hectares), doubling the numbers of the previous year. Firefighters were quickly and successfully suppressing fires. Then, starting on August 13th, more than 14,000 lightning

12 LARGEST WILDFIRES IN CALIFORNIA	12 MOST DESTRUCTIVE WILDFIRES IN CALIFORNIA
1. **August Complex (2020)** 1,032,264 ac (417,898 ha)	1. **Camp (2018)** 18,804 structures lost
2. **Mendocino Complex (2018)** 459,123 ac (185,800 ha)	2. **Tubb days (2017**) 5,636 structures lost
3. **SCU Lighting Complex (2020)** 396,624 ac (160,508 ha)	3. **Tunnel (1991)** 2,900 structures lost
4. **Creek (2020)** 365,714 ac (153,738 ha)	4. **Cedar (2003)** 2,820 structures lost
5. **LNU Lighting Complex (2020)** 363,220 ac (149,990 ha)	5. **North Complex (2020)** 2,352 structures lost
6. **North Complex (2020)** 318,930 ac (129,068 ha)	6. **Valley (2015)** 1,955 structures lost
7. **Thomas (2017)** 289,893 ac (114,078 ha)	7. **Witch (2007)** 1,650 structures lost
8. **Cedar (2003)** 273,246 ac (110,579 ha)	8. **Woolsey (2018)** 1,643 structures lost
9. **Rush (2012)** 271,911 ac (110,038 ha)	9. **Carr (2018)** 1,614 structures lost
10. **Rim (2013)** 257,314 ac (104,131 ha)	10. **Glass (2020)** 1,520 structures lost
11. **Zaca (2007)** 240,207 ac (97,208 ha)	11. **SCU Lighting Complex (2020)** 1,491 structures lost
12. **Carr (2018)** 229,351 ac (92,936 ha)	12. **LNU Lighting Complex (2020)** 1,490 structures lost

Table 2. Largest and most destructive fires in California. 2020 fires highlighted in red. Source: CAL FIRE

strikes hit Northern California in an area with a historically low lightning density and little recent fire history. During an extreme heatwave, and record temperatures in the North, more than 600 individual fires ignited, and many of them exhibited very active behavior. The fire agencies faced the worst-case scenario- extreme fires, everywhere.

By September 6th, it was already the worst fire season in history, with 2.2 million acres burned. During a weekend in which numerous California places reached record high temperatures, the Creek Fire found a moment to explode in a 45,000-ac run from noon to midnight of August 5th, with hundreds of campers evacuated by helicopter in dramatic fashion.

Two days later, a record wind event occurred. Both the August Complex and Bear Fire (North Complex) exploded driven by record winds for that day. North Complex grew in 12 hours over 183,000 ac, spreading at an average of 2 mph. It was the single-day record for most activity detected by satellite hotspots from the VIIRS and MODIS sensors.

Southern California had the Apple, Lake and Valley Fires, the Bobcat Fire in Angeles NF, and the deadly El Dorado Fire, where Charles Morton, a Big Bear Interagency Hotshot Squad boss, lost his life on September 17th. In December, the Silverado, BlueJay, and Bond fires kept burning until Christmas. The fire season was still active in Southern California in mid-January 2021. A year-round fire season.

At the end of the 2020 fire season, there were 30 incidents over 3,000 acres (1,000 hectares), and only 0.3% of fire starts burned 3,716,465 acres (1,504,000 hectares), 88% of the total amount. Half of the smoke pollution in the US came from wildland fires this year. Facilitating good fire practices needs no more justification than this.

Implementing safety protocols to face this fire season was a significant challenge, but this is the land where ICS was born back in the 1970s. On May 3rd, the Wildland Fire Response Plan for COVID-19 Pandemic was implemented, and protective measures and best practices were defined for initial and extended attack incidents. The impact in the firefighters' community has been around 2%, an incredible achievement that shows professionalism in action.

The response was massive. All the CAL FIRE and Federal Incident Management Teams were active. Personnel from Texas and South Carolina to Alaska, and firefighters from Australia, Canada, Israel, and Mexico joined the effort.

The numbers of this fire season can hide the tremendous efforts of firefighters, who went from large fire to large fire, through non-stop assignments for five months straight in exhausting shifts. They definitively made a huge difference. About 8,100 fires never made the news, as they were suppressed at less than 10 ac. So, I think that the fire paradox is true: "the better we are (at fighting fires), the bigger they get (we cannot suppress on initial attack)".

We have to invest in vegetation management to create a safer environment for firefighters to engage where they can. Communities must be part of the solution and not a constant drain of resources because of poor risk planning and lack of mitigation. To achieve that, we need to use all the tools within our reach. Let's try to identify the patches of this quilt to address this challenge.

Figure 5. Daily updates of the resources assigned to the response. Source: CAL FIRE. Access to August Complex West Branch ICP.

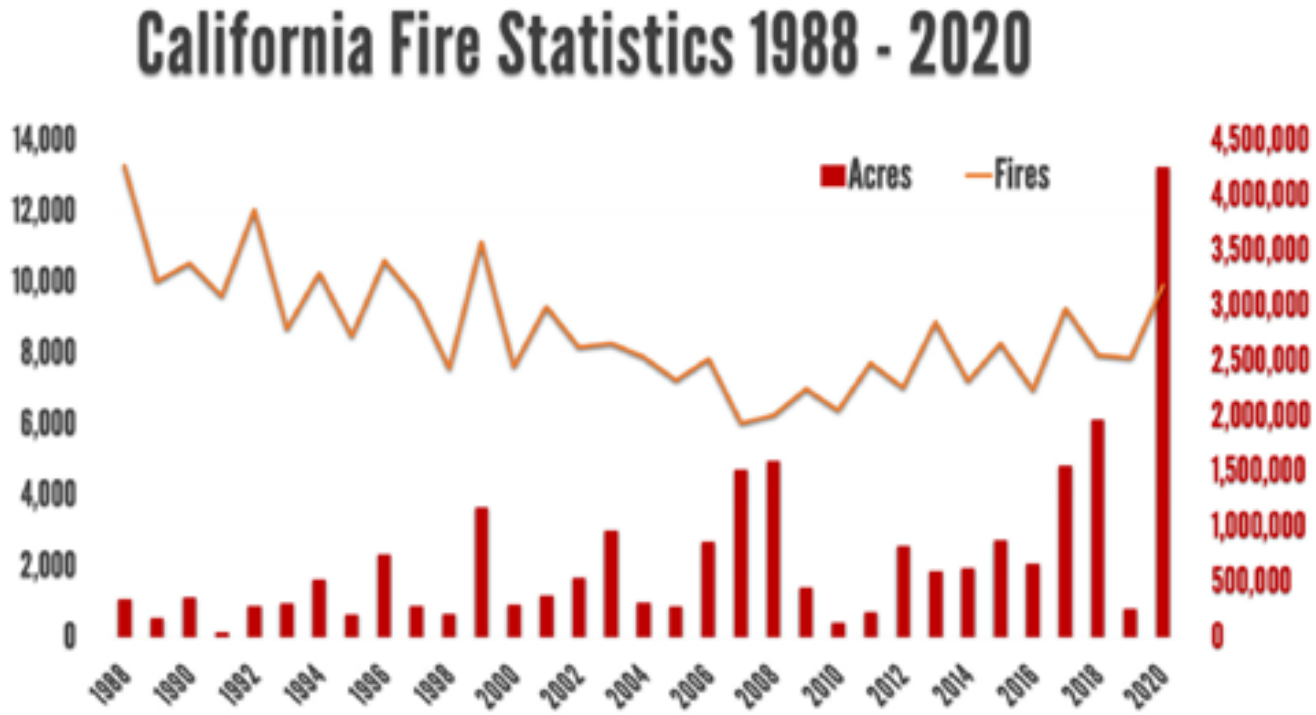

Figure 6. California Fire Statistics 1988-2020. Source: CAL FIRE

A STRATEGIC LOOK AT THE CALIFORNIA FIRE QUILT

We will look back many times to this extraordinary fire season. We have more data than ever to try to understand how and why this happened.

In my position at Technosylva, I have a daily job where I see California burn virtually every day with over 145 million fire simulations. All of it will eventually burn, because it can burn. We have to work on how it will burn. So, let's have our favorite conversation between students of fire. How can we solve this? More precisely, what do we want to solve? Fireproof California? Eliminate ignitions? The biggest problem is high-intensity fires impacting our communities. It is not only the number of acres we need to reduce but also the impacts that need to be mitigated.

During the fire season, we witnessed the many different points of view at the highest political levels. This is not an easy problem, and there are no easy solutions. The different aspects of the California fire scenario are well documented and understood by the technical and scientific community. We are lucky to have a long tradition of researchers, scholars, and practitioners that have analyzed the problem from every aspect possible. As a grateful new Californian, I felt I could include a simple exercise in this article, putting together the ideas in a way it could stimulate critical thinking. For that, I will use a powerful tool, a SWOT analysis.

A SWOT is an acronym for "Strengths, Weaknesses, Opportunities, and Threats." It is a high-level strategic planning model that helps organizations identify where they're doing well and where they can improve, both from an internal and external perspective.

This analysis' best outcome would be to create conversations that could help decision-makers define strategies to improve the actual California Quilt. To complete this SWOT analysis, I had the support of several of my California mentors. These individuals are seasoned experts, fire behavior specialists with considerable scientific and practical experience fighting fires in the West. So, we had that conversation, and the result is a personal and incomplete list of factors that can help depict all this complexity.

As a reader, you too can get involved. We present the list of items in our SWOT analysis for you to review. Which are your top factors for every category? Are we missing others? If so, what are they? Which of these factors apply to your Fire Quilt in other parts of the world?

You can participate and evaluate this SWOT analysis at **http://bit.ly/CaliforniaSWOTForm**

And hopefully, in the next IAWF conferences, we will have the chance to have that conversation in person. As CAL FIRE's Chief Thom Porter says, "the benefit of the actions we start now would be for our grandchildren."

Rate the importance of each: 1 = VERY IMPORTANT 2 = MEDIUM IMPORTANCE 3 = NOT VERY IMPORTANT

STRENGTHS Internal, positive attributes of the California Wildfire Community. These are our things that are within our control	
1. Wildland fire agencies have meaningfully evolved based on lessons learned from past fire incidents and are very advanced on many fronts: organization, resources, tactics, safety, and technology.	
2. Fire agencies have huge social support, fundamental for political support on new policies and budgets	
3. Collaboration between first responders in operations is at the highest standards. ICS was developed in California in the '70s from here expanded worldwide	
4. Robust Mutual Aid system to quickly mobilize and reinforce limited local personnel and equipment	
5. A paradigm shift within agencies to reporting accomplishments, such as homes and people saved, rather than traditional perspective focusing on impacts (houses lost, people injured), caused by leveraging new technology improvements to intel and operations.	
6. Applied research and technology implementation are world-class with CAL FIRE, improving real-time decision-making.	
7. The understanding of the wildfire phenomena problem is probably better documented than anywhere in the world. Data, science-based analysis and world-class technological solutions support decision-making.	
8. There are growing examples of community engagement, as in the FIREWISE and Community Wildfire Protection Plans and programs, reflect an increasing awareness and responsibility from homeowners	
9. A State-led training and certification program for private prescribed fire burn bosses is in the works. Together with community-based Prescribed Burn Associations (PBAs), the 'good fire" army is growing.	

WEAKNESSES Negative internal factors that detract from our strengths. These are things that we might need to improve	
1. The social attitude to the fire phenomena. that "All fire is bad" or/and "I think that fire needs to be reintroduced to the environment, but not in my backyard" are only two representative examples.	
2. Urban planning is frequently disconnected from the surrounding wildfire risk exposure	
3. Local engagement is high during incidents, but not so much in the prevention phase. Mitigation and evacuation plans could be better funded and implemented	
4. Prescribed burning annual acres are very small, far from making a substantial impact. Regulations, risk avoidance, public perception, and lack of resources limit the ability to conduct meaningful landscape-level vegetation treatments	
5. Air Pollution Control Boards and their policies for "Burn Days" weighted to reduce particulates in the air, limiting the days that prescribed burns can be done	
6. Vegetation Management Projects need to grow in strategic areas and need to be maintained or will create ladder fuels	
7. There are insufficient funds to address the VMP problem at the community buffers, at the landscape level (both need local involvement) as well as a need to work cross-boundary.	
8. Fuels accumulation is growing at a faster pace than the traditional practices to manage guilds. Ignitions in areas without recent fire history during the peak of the season can create large fires during the first hours	
9. Invasive grasses and other non-native weeds can create flammable fuels bed will need to be addressed as more burning takes place	
10. Fire behavior of convective fires is unpredictable with the science available today, and fires like Carr or Creek are more common every year	
11. More work is needed to understand fire progression within structures and work that needs to be done to have better fire-hardened houses and communities	
12. Sometimes there are different strategies in firefighting in Federal and State lands. The " modified suppression " vs "aggressive firefighting"; strategies have to be dynamic, and also consistent cross boundaries, and based on forecasted conditions	
13. Reduced number of available hand (inmates) crews (196 to 75 this year in the State) by a combination of regulations, shorter sentences, budget cuts, and the COVID impacts	

OPPORTUNITIES

External factors in our environment that are likely to contribute to our success

1. A strong economy that can support a relevant increase of investments in sustainable forest management practices	
2. Climate change initiatives are in the first line of the political agenda, and the fire situation is closely associated with climate change by most	
3. Growing understanding on the society of the difference between good fire vs bad fire	
4. General Media is moving from the news that only highlight the epic of firefighting to supporting a debate of what is needed to change the fire situation	
5. There is a growing generation of specialists that evolve from the traditional suppression mindset only approach to a more holistic one	
6. Research and technology implementation is moving full speed to support wildfire risk reduction and community needs	
7. Increased collaboration from vested stakeholders, such as electric utility, is driving forward the science and operationalization of solutions based on these scientific improvements	
8. Remote sensing is giving us new and novel ways to predict risk and monitor ongoing incidents	
9. Forest Products Industry, good management practices through policy is needed.	
10. Benefits of wildfire risk mitigation practices include increased water flow in watersheds (with increased vegetation thinking), reduce the risk of landslides, pests, and the effects of drought on healthier trees	
11. Policy shift to create more grant monies for previous VMP projects and reduce ladder fuels, and "train" the plants	
12. Healthier rangeland with the removal of Medusahead and other non-native annuals	

THREATS

External factors that we have no control over. Contingency plans might be needed for dealing with them

1. Climate change pace is putting cold and temperate forests in extreme conditions for what used to be normal years	
2. Precipitation amounts and over which areas they are occurring continues to evolve with climate change and upper-level atmospheric patterns	
3. Tree mortality due to bark beetle is transforming the Sierras. Between 2012 to 2019, over 100 million trees died due to drought that weakened the trees and left millions of acres of forestland highly susceptible to insect attacks	
4. Even with regular conditions, the topography is extreme and making it difficult and expensive for both operations and management	
5. Extreme wind events are more frequent and extend beyond traditional fire seasons	
6. These extreme wind/weather events put pressure on Utility providers to shut down power grids. People living in areas of frequent shutdowns are buying generators that may become potential ignitions	
7. Particulate Air pollution and its health effects	
8. The housing crisis is not slowing, so new developments continue to encroach into wildland areas adjacent to hazardous fire terrain	
9. There is active resistance from a part of the conservationism and research community to create appropriate-scale projects to reduce fuels putting at-risk citizens and first responders	
10. Insurance companies are not renewing policies for people that live in rural areas, instead of creating an incentive for homeowners to harden their homes.	
11. The growing Wildfire Litigation industry is doing big business by focusing the problem on ignitions, not on fire propagation that is characteristic of the California firescape	
12. Private Wildfire fighting business is growing for the selected few, but only on the suppression side, raising coordination concerns, not on mitigation needs	
13. Lack of cellular networks throughout much of the wilderness areas - wildland fire areas reduces efficiencies - the inability to utilize technologies due to coverage	

LIGHT AT THE END OF THE TUNNEL: CALIFORNIA'S WILDFIRE AND FOREST RESILIENCE ACTION PLAN

Then, some very good news went unnoticed during fire season. One day before the lighting strike event that started this series of extreme fires, on August 12th, Governor Newsom and the USFS Chief Vicky Christiansen signed the promising and ambitious Shared Stewardship Agreement of California's Forest and Rangelands. This MOU outlines six principles that will drive the collaboration between the State and the Pacific Southwest Region of the US Forest Service:

1. Prioritize public safety
2. Use science to guide forest management
3. Coordinate land management across jurisdictions
4. Increase the scale and pace of forest management projects
5. Remove barriers that slow project approvals
6. Work closely with all stakeholders, including tribal communities, environmental groups, academia, and timber companies.

The plan is that both entities commit to making these game-changing actions:

1. Treat one million acres of forest and wildland annually to reduce the risk of catastrophic wildfires (building on the State's existing 500,000-acre annual commitment).
2. Develop a shared 20-year plan for forest health and vegetation treatment that establishes and coordinates priority projects;
3. Expand use of ecologically sustainable techniques for vegetation treatments such as prescribed fire;
4. Increase pace and scale of forest management by improving ecologically sustainable timber harvest in California and grow jobs by tackling structural obstacles, such as workforce and equipment shortfalls and lack of access to capital;
5. Prioritize co-benefits of forest health such as carbon sequestration, biodiversity, healthy watersheds, and stable rural economies;
6. Recycle forest byproducts to avoid burning slash piles;
7. Improve sustainable recreation opportunities;
8. Enable resilient, fire-adapted communities; and
9. Share data and continue to invest in science.

The recently created Forest Management Task Force has published the California's Wildfire and Forest Resilience Action Plan, which will guide the actions needed to accomplish this transformational project.

It turns out that, when it was time to look for strategies resulting from our SWOT analysis, we find this initiative, with all the ingredients to set up a more balanced scenario between our landscapes and our communities. The actions proposed need to be embraced at all levels. Achieving the participation of local governments, adding the same energy to address vegetation management in their areas of responsibility, and getting citizens involvement in being part of the solution, is essential for a future more resilient California Fire Quilt. Let's communicate efficiently to get the citizen's support. This historic (again) fire season is the opportunity to break many barriers that got us here. Californians can do that, and more.

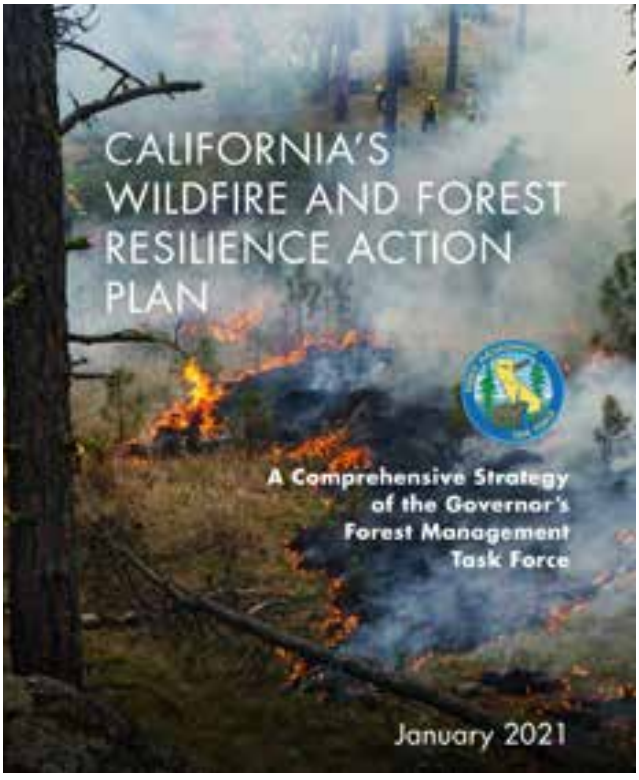

Figure 7. California's Wildfire and Forest Resilience Action Plan. Source: California Forest Management Task Force

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FIRED UP

BY DYLAN BRUCE

LIFELONG LEARNER AND DOER

A Law Degree may not sound particularly useful for a firefighter, but Mark Gunning insists it has served him well.

A Commander with the CFA in south west Victoria, Australia, Mark is a lifelong learner with an extensive history of education, but it is the Law Degree he highlights as his most useful.

"It trained me to identify critical issues, identify the rules and procedures that apply to those issues, and then apply them under challenging circumstances."

With qualifications ranging from emergency management to fire science and suppression, Mark is a life-long learner.

"I believe it sets a strong example for my children that you can put your mind to things and succeed at any time, and that you are never to old learn new things, or understand 'old things' better."

Mark has over 35 years of firefighting experience, and from a young age it was a family affair.

"My mother's family were heavily involved in the fire brigade, and I was encouraged to follow suit."

He began as a volunteer at the young age of 14, and would join as a career officer when he turned 22.

"When I started I did not know what to expect or have a picture of where the career may lead."

An ordinary day for Mark involves managing issues that arise in fire brigades in the Otways and Western Plain regions of Victoria, Australia, but his role leading Incident Management teams means he must be adaptable.

At a moment's notice, his day can be interrupted by serious accidents, such as building fires and other emergencies that he must attend to.

As well as developing an understanding of the different risks he may face, Mark says that having a capable team with the appropriate expertise with him helps a lot.

"One of the most important things I have learned is that 'None of us are as smart as all of us'.

INITIATIVE TO HONOR AND FEATURE STORIES OF SUCCESS

The "Fired Up" initiative features those who have made strides in advancing and contributing to wildfire/bushfire operations, mitigation/prevention, training and research. We invite members of the IAWF and the Wildland fire community at large to submit recommendations for individuals and groups that deserve to have their stories shared for publication.

"I used to think that this was about listening to your team, but I have adapted it to involving the communities we serve in decisions more makes the challenge easier."

Mark recalls how this mantra helped during the South West Fires of St Patrick's Day in 2018.

Of the 13 outcomes the Incident Action Plan had outlined, nine of them were about the community, with a focus on individual health and recovery from the impacts of the emergency.

"We integrated recovery operations into the Incident Management Team from day one, and achieved significant community outcomes and lifelong relationships with those communities."

Mark's passion for community engagement was called upon when assisting in the Victorian COVID-19 response.

Working with diverse and largely immigrant communities, Mark had to grapple with entrenched distrust of governments and government agencies.

"When I left I felt we had connected the community with the agencies to get the best care and support available.

"I am proud of the small role I played in adapting all the skills I learned in fire to a much greater emergency."

Although he is glad to see a greater of understanding of the impacts of smoke, gases, and particulate matter on community health and the environment in recent years, Mark is worried by the worsening scale of fires.

"The rate of escalating fire numbers and the behaviour of those fires is scary, and if it's scary to me as a trained practitioner, governments and communities should be more worried."

Hello! My name is Yuliia Khovbosha.

I am a Ukrainian artist with a Bachelor of Audiovisual Arts and a former TV director currently based in Kyiv, Ukraine. I want to draw more people's attention to the forest fire and arson issue and its devastating impact on nature around the world. I wish it could gain more visibility through such artworks. I started with creating high-realistic polymer clay plants, I continue to expand my portfolio with various nature-inspired mixed-media sculptures. I am always driven by nature's creativity as my main source of inspiration to express myself by transmitting the moment, nature's will, and beauty.

DESCRIPTIONS FOR IMAGES

"FROM THE ASHES". *(left)* The work was created under the impression of devastating fires Australia faced with in late 2019 - early 2020. The losses of bio-diversity were huge. However, I strongly believe that nature is more enduring than we can suppose. It will rise from the ashes, we just must be supportive more than ever. People have to understand that nothing is more important but nature. Just remember, if we continue killing our planet, one day our planet will kill us.

"FIREBUGS". *(right)* There are two meanings of the word "Firebugs": 1. Insects 2. Pyromaniacs. This work was inspired by the appalling acts of environmental terrorism and arson attacks on forests all over the world, especially in my fatherland Ukraine.

: wowbloomroom

SHAUN WALTON

30 YEARS OF FIGHTING WILDFIRES IN THE UK FIRE & RESCUE

In the UK today, we have more frequent, severe and widespread wildfires, and a longer wildfire season, and we need to prepare for and focus on local, national and international learning; prevention; pro-active prescribed burning; fire weather prediction systems; and joint operational response more than ever, to deal with the next generation of wildfires. The UK Joint Emergency Services Interoperability Programme (JESIP), UK FRS National Operational Learning (NOL) and UK National Operational Guidance (NOG) support and help progress multi-agency and fire sector learning and development and provide current and consistent standard operational procedures, thereby improving firefighter safety and public welfare.

Pooling knowledge from several Fire and Rescue Services (FRS) in high-risk areas of Greater Manchester, including areas that bordered Peak District National Park, we developed wildfire planning and response partnerships, working with and learning from key on-the-ground land managers who had immense local knowledge of fire behaviour and other landscape attributes that they accumulated over many years of experience managing prescribed burns and uncontrolled wildfires, which they often handled without the intervention of FRSs.

The 27th of August 1990 was a significant day for me. I was a 20-year-old with a clear mindset on what I wanted to do with my life. I had been fortunate to pass the selection process for a career in the Fire Service, and this was the day it all started, as I began my initial training as a full-time Fire Fighter with Greater Manchester County Fire & Rescue Service (FRS) in North West England.

Greater Manchester County covers 496 square miles with a current population of 2.8 million. It has many densely populated commercial, industrial and residential areas surrounded by significant environmentally protected areas of rural moorland. The Service responds to all fire and rescue incident types within the county, so in my career I gained wide experience in both structural as well as wildfire fighting, plus dealing with traffic collisions, water rescues/flooding and chemical incidents. When I began my career there were 41 stations and over 60 fire appliances covering Greater Manchester.

The first station I served at was in Bolton. It was an excellent station to begin my career as the area covered varied risks, including large towns, and miles of rural moorland areas with forests and infrastructure, including the Winter Hill telecommunications center in the heart of the moorland area.

As spring 1991 approached, experienced fire colleagues advised me to be prepared for the busy moorland fire season. Spring fires, they said, were flashy with a high rate of spread, unlike summer fires, which tended to burn in peat, i.e., underground. When battling moorland fires we often wouldn't return to the fire station for long periods of time, spending full shifts in the field. The first moorland fire I was on as a probationary firefighter was on Winter Hill, by chance the same place as my last moorland fire in 2020. This career-climax fire was without doubt the most challenging wildfire of my career.

The term wildfire or wildland fire wasn't used in the UK in the early 90s -- moorland fire or forest fire was the preferred terminology -- some referred to them as grass fires. Those latter terms suggest that the wildfires back then were less severe, frequent and destructive than many of the wildfires we have now.

Back then, there were no internet, mobile phones or social media, making it difficult to compare wildfires across the UK and the world. The world worked at a slower pace in terms of technology and communications. Professional relationships took longer to establish, both within the UK and internationally, and the lack of internet meant collecting and sharing data, things such fire severity index and weather etc, was slow and difficult. Many emergency responders operated in quasi-isolation, not able to efficiently share with and learn from others.

BACK THEN, THERE WERE NO INTERNET, MOBILE PHONES OR SOCIAL MEDIA, MAKING IT DIFFICULT TO COMPARE WILDFIRES ACROSS THE UK AND THE WORLD.

The advice I was given in my first fire season by my veteran colleagues was absolutely right--those moorland surface fires burned rapidly through expanses of tinder-dry fine fuels and were challenging to suppress.

The norm in the 90s was to attack using large numbers of firefighters and fire trucks, sometimes excluding landowners and land managers, which is quite different from the collective wildfire management we advocate and use today. Fire crews often initially responded to the place from where the caller reported the fire, not the place where the fire actually was or would soon be, the caller often being on a roadway looking at a wildfire miles away over open moorland. Our fire crews would then chase the fire on foot from the tail whilst the head of the fire was some distance away and most likely traveling faster than we were! Often other fire crews attended different locations on the fire miles away from the initial crew, and ineffective radio communications prevented coordinated responses. We had few off-road vehicles, as moorland fires were seen as an occasional, seasonal issue that could be managed with existing, albeit stretched resources. Aircraft were extremely limited because of availability and cost. If anything, one helicopter with a Bambi water bucket would help out, often arriving a day after the first response.

Those spring 1990 wildfires were mainly surface fires due to colder winters that reduced the availability of sub-surface fuels (i.e. peat) to become involved in the fires while encouraging aboveground vegetation to grow strong, long roots to collect water. Recent milder, wetter winters have discouraged vegetation from developing strong, deep roots to gather water. In drought conditions, although this vegetation is green to the eye, it lacks moisture and is more susceptible to carrying fire. I see this as a significant change and one that increases the window of opportunity for wildfires in late spring-early summer, creating a longer fire season. Other climate-change dynamics, along with changes in land use and management, and restrictions on prescribed burning, are creating a perfect storm for increasingly challenging wildfires in the UK.

Like most UK FRSs in the 90s, we had very few, if any, specialized wildfire teams and equipment. Fire crews on moorland or grass fires used exactly the same Personal Protective Equipment (PPE) they used on structural fires. This included rubber boots and heavy structural fire kit that were punishing to wear whilst making one's way on-foot across miles of moorland to attack fires and prevented us from effectively managing the fires. Body heat could not escape the heavy gear, leaving one quickly exhausted. The heavy, cumbersome and no-breathable boots led to sore, blistered feet. For many reasons, including perception of wildfire threat and financial constraints, some FRSs in the UK still utilise structural fire kit to fight wildfires, but some FRSs have invested in proper PPE and other equipment, as well as training.

The mindset in the early 90s was invariably to simply chase the red stuff (fire) and put the wet stuff (water) on it and/or beat it out with decommissioned fire hose on sticks (beaters). Often 20 fire trucks would be parked, unattended, at the roadside, whilst over 120 firefighters were deployed on foot on the moors. Today, the UK has National Operational Guidance with detailed standard operational procedures for dealing with wildfires, and integrated core incident command and environmental protection techniques. During my career I was able to play a role in developing these procedures with the UK FRS.

Back in the 90s, the high rate of spread of the wildfires almost always meant the fires would come to a stop on their own at a roadway before the running fire fighters could catch up to the head. We would position fire engines to try to stop fire that threatened buildings and other infrastructure. This chasing of wildfires while protecting numerous infrastructure and buildings required considerable resources and was finally realized to be unsustainable. Managing the land more effectively by lessening restrictions, working on prevention/education and building partnerships across all stake holders is now widely accepted as the way forward.

In my early career, during June most of the moorland landowners and managers took their holidays. Back then at that time of the year the UK countryside greened over with lush new growth, a product of the cold winters and wet springs, and it was rare to have wildfires in June in the UK. As July ended so, too, did the shift from spring wildfires to more intense summer wildfires. These later seasonal wildfires were a completely different ball game and really tested FRSs, as they burned longer, more severely and deeper into the peat. They also produced challenging surface fires that spread rapidly over large areas, fanned by warm, southernly winds.

During the next 16 years I developed my firefighting skills, both structural as well as in wildland fire. I progressed through the ranks and was promoted to managing a cluster of fire stations, at that point meeting an influential colleague who was passionate about wildfire and was focused on developing wildfire planning and response partnerships, working in high-risk areas of Greater Manchester, including areas that bordered the Peak District National Park. This Park bordered several FRSs, allowing us to pool knowledge and skills. We were fortunate to work with and learn from key land managers who had immense local knowledge of fire behaviour and other landscape attributes due to many years of experience managing prescribed burns and uncontrolled wildfires, often without the intervention of FRSs.

This significant step led to a Wildfire Officer cohort

THE MINDSET IN THE EARLY 90S WAS INVARIABLY TO SIMPLY CHASE THE RED STUFF (FIRE) AND PUT THE WET STUFF (WATER) ON IT AND/OR BEAT IT OUT WITH DECOMMISSIONED FIRE HOSE ON STICKS (BEATERS).

in Greater Manchester having detailed knowledge of fire behaviour with the support of experienced, local land managers. We also worked with universities to determine the economic cost of fire and to model changing socioecological conditions that were leading to increasingly frequent and severe wildfires.

Over the next few years great trust was developed between stakeholders and firefighters, most importantly with land managers who helped develop a cohesive approach for preventing, planning for, and managing wildfires. This established a precedent in which stakeholders regularly worked together closely, sharing knowledge, tactics and equipment. Conflicting priorities in UK law and land use policy sometimes prevented viable active land management such as prescribed burning to create fuel breaks. Sadly, these conflicting priorities still exist, meaning larger areas of land will be unnecessarily affected by wildfires.

As the years went on, it became clear to me that wildfire was not primarily a FRS problem, that the causes and impacts were much wider and more complex, and that what wildland fire management in the UK required was a fully integrated approach involving multiple stakeholders, in particular the UK Government. What was needed was a national policy with support mechanisms for managing wildfire prevention, preparedness and response.

In 2009 I transferred on promotion from Greater Manchester FRS to the geographically adjacent Lancashire FRS. Like Manchester, Lancashire has a mix of cities and rural areas and shares similar wildfire risks. However, Lancashire is larger with significant moorland challenges both within Lancashire as well as in adjoining Manchester, Cumbria, Yorkshire and Merseyside.

My passion for wildfire fit well in my new position. Within my first few months there, Lancashire experienced a significant wildfire at Belmont, an area adjoining Manchester. This incident generated many opportunities for learning and for sharing good practices, leading myself and a colleague to attend Advanced Wildfire Courses with Wales and Northumberland FRSs. We consolidated our knowledge and delivered updated mandatory wildfire management training to all Lancashire FRS personnel, including the Chief Fire Officer, to assist in providing strategic direction and buy-in from all colleagues to raise the level of understanding of and preparedness for the growing threat of wildfire. This allowed us to benchmark knowledge, while ensuring that new recruits received wildfire awareness training with clear procedures. These significant developments showed that some FRSs accepted the fact that a new generation of wildfires was threatening the UK, and that it was imperative to firefighter and public safety to adapt to this new situation.

Chief Fire Officer (CFO) Paul Hedley from Northumberland FRS is the UK Wildfire Lead Officer and also chair of the National Fire Chiefs Council (NFCC) Wildfire Group. Chief Hedley invited me to represent Lancashire FRS at the NFCC. I later became Deputy Chair and Interim Chair of the group. During this time I had the privilege of working with some fantastic and knowledgeable people and organisations, both within the UK and internationally, and working together we improved wildfire related matters with the UK.

One of the most significant moments of the group for me was developing the NFCC Wildfire Tactical Advisors (WTA). This group consisted of a small cohort of appropriately trained and knowledgeable fire officers from UK FRSs who volunteered with the support of their CFOs to be deployed at short notice anywhere in the UK, utilising a standardized UK Fire National Resilience mobilising mechanism. The aim of the WTA was to provide advice and support to Fire Incident Commanders and their teams on operational wildfire-related matters. It

was my pleasure to be Lead Wildfire Tactical Advisor for the UK. I was part of the first team to be deployed to the North West England Saddleworth Moor and Winter Hill fires of 2018. The feedback we received from CFOs about the wildfires we attended over 2018/19 was extremely positive and with UK Government, UK FRS and NFCC support, the NFCC Wildfire Group increasingly improved.

My work with NFCC led to invitations to attend national and international wildfire conferences. This helped me to be a part of increasing both UK FRSs' and UK stakeholders' awareness of and commitment to wildfire preparedness. I attended The UK Home Office in London with the Wildfire Lead Officer to provide updates on progress and threats and to discuss opportunities for improvement.

A turning point for me was attending an international conference with Pau Costa in Catalonia. There I met many colleagues whom I now call friends. Pau Costa is a true supporter of sharing best practices, and has been great in helping UK Wildfire to improve prevention and response. During a further fact-finding visit to Catalonia, I was exposed to the Catalonia Wildfire Burn Teams, which utilise fire behaviour knowledge to manage wildfires that are generations in advance of UK wildfires.

Working closely with Pau Costa since about 2010, and with the support of a forward-thinking UK FRS Senior Management Team at Lancashire FRS, we trained and delivered a 16-person Wildfire Burn Team based in Lancashire. This exceptional training, delivered with the support of colleagues from Mafra, Portugal, aimed at exposing the Lancashire FRS team to extreme fire behaviour that could not be replicated in the UK (we have in the short time since this training already experienced frequent, severe fires that had potential to endanger life in the UK) thereby preparing them for the UK's increasingly challenging wildfires. The Lancashire FRS team also attended wildfire training delivered by South Wales FRS to learn skills common to many UK FRS environments. This complemented the international training while forging relationships between UK Wildfire Burn Teams.

Since we brought this new wildfire management capacity back to Lancashire it has been used to great benefit, reducing the impact of wildfire on the environment, structures and the public. It has improved community safety by requiring fewer fire engines being committed to wildfires due to utilisation of burn teams, reducing the time taken to bring wildfires under control, and limiting air pollution and improving health to those in the community with underlying respiratory conditions, due to less duration and intensity of wildfire smoke. It has also reduced the impact on firefighters by reducing the time spent working incidents (due to more effective tactical management of wildfires), and improved firefighter safety through having a better managed and safer process available to incident commanders.

The Wildfire Burn Team's value was recognized by UK FRSs, with the team being repeatedly requested via NFCC and National Resilience to support Fire Incident Commanders across the UK in dealing with wildfires. When it was practical, the team also travelled to assist in other FRSs.

The UK is now experiencing wildfires more akin to Mediterranean regions than those that historically burned in the UK. During my early career the late spring-early summer wildfire season usually ended during June. Severe wildfires were usually regionally based across the UK, but very rarely simultaneously in Northern Scotland, Ireland, Wales and all parts of England, as we are seeing now. The fires burned on a 5-7 year cycle.

We now see wildfires occurring more frequently, starting earlier in the year, burning between spring and summer without a break and burning later into winter. The UK wildfire season has extended significantly in the last 30

years, following trends in other parts of the world, most notably the Mediterranean and USA. Wildfires in the UK have increased in severity, with fire burning deeper into the peat and forest vegetation increasingly involved. Larger geographic areas are burned in areas previously not susceptible to wildfire. All this has led to FRSs in the UK being stretched more than ever. We have FRSs that once did not have wildfires now experiencing them in their own areas and/or travelling to other parts of the UK to support other FRSs. Timescales to manage fires often stretch into weeks, and crews are also responsible for responding to non-fire emergencies. This new era of UK wildfire means that FRSs must reassess their capabilities for these worsening incidents in their own geographic areas, while providing support to other FRSs.

The long-term recovery phase of wildfires and the financial impact to society is becoming unsustainable. As environmental lands are developed, we need rigorous wildfire management plans, plans that are adaptive and use lessons learned, to be a part of the development. Areas of conservation work and young forest plantations are being impacted by wildfire. Individual agency's priorities need to be agreed upon locally, to ensure all agencies work under one plan, with clear multi-agency priorities and achievable outcomes. It is important that we now start planning and training for worse-case UK Wildfire scenarios.

The USA's National Fire Protection Association (NFPA) is a highly regarded partner of the NFCC, and its Wildfire Division is helping partners around the globe recognize and prepare for increasing wildfire risks. In the USA, states such as California have a wildfire season that in varying areas can be year-round. In the UK we are experiencing the type of wildfires that Catalonia had a decade ago. This trend is widespread, with each country experiencing worse wildfires. We need to be looking forward to the risks that seem sure to face us in decades to come, using lessons learned from other countries so we don't make the same mistake twice. We are not going to lessen the impact of increasingly frequent and severe fires if we don't change our approach. We must take strategic intent based on an integrated approach to tactical delivery at the local level. We need to re-evaluate our ways of working to protect our communities, our firefighters and responders, and the environment.

We need to concentrate on working with all stakeholders to develop a national strategy, delivered by the UK Government, to manage wildfire across all UK Government Departments, one that can be incorporated into National Risk/Local Community Risk Registers, Integrated Risk Management Plans, and Local Resilience Forums.

The strategy must center on effective land management (including prescribed burning and other proactive techniques), wildfire prevention and an effective response capability, and it must address conflicting priorities of government departments. Working together to change our cultural approach by providing consistent and timely messages and education to prevent actions that contribute accidentally or deliberately to wildfire ignition is essential. Wildfire Tactical Advisors of the NFCC should be used to improve firefighter safety and provide consistency to wildfire response. Funding is needed for national capability recognition and representation in National Capability Advisory Teams, thereby ensuring initial training, and uniform PPE and other equipment.

The UK has very limited aircraft suppression capability compared to some other countries. We need a frank assessment of aircraft support to assess wildfires, transport firefighters and equipment, and help suppress wildfires.

The UKs' FRSs lack uniform response capabilities. All FRSs should be utilising UK FRS NOG to develop policies and procedures, and provide PPE fit for wildfire use rather than utilising structural PPE. The isolated changes in making proper PPE available made over the last 5 years is heartening, but must become widespread and systematic.

I urge all FRSs to develop Wildfire Burn Teams, which can provide more effective, efficient and safe wildfire management. Whilst wildfire is still seen as a seasonal risk

in the UK, it can restrict FRS investment as there are other competing priorities year-round. FRSs might consider utilising wildfire teams during non-wildfire season to provide flooding and water rescue, as it is unlikely that the two incident types will be in high demand simultaneously. Understanding how ground erosion caused by wildfire in spring/summer months may lead to more flooding in other seasons by responders dealing with both phenomena could help mitigate each problem.

Developing a clearly defined UK Strategy, bespoke Wildfire Burn Teams, centrally funded and managed NFCC Wildfire Tac Ads and improved National Capability might be seen as a difficult aim, a bit like turning a super tanker, but we must start somewhere. Nature's global clock is ticking, and we need to act now to break the inertia and accept wildfire as a clear, present and increasing threat in the UK. There are some fantastic UK and international wildfire organisations with dedicated people actively and openly trying to reach out. We need to embrace the change required to prepare the international wildland fire family for the next generation of fires.

SHAUN WALTON retired from the Fire and Rescue Service in August 2020 as a Group Manager having completed 30 years service and making lifelong friends both in the UK and internationally. He looks forward to these friendships continuing and new ones developing. He remains passionate about wildfire and continues to share experiences and develop teams. Shaun is currently working with a UK training provider to develop and deliver wildfire simulation training utilising the latest technology to improve firefighter safety and wildfire incident command. He is also keen to help the NFCC and NFPA deliver a Firewise Community in parts of Lancashire and Greater Manchester in the North of England.

A STORY ABOUT A BIRD AND FIRE

UNLIKE OTHER BIRDS, IT DOESN'T LIKE THE DENSE NEW GROWTH POST FIRE.

BY DIANA KUCHINKE

The swing-seat has a gun-metal grey, mild-steel A-frame, with polyester cushions. We didn't plan for its home to be where it stands, it just ended up there because under the roof-line of the house, it is out of the weather. During the years I worked on my PhD data analysis and write-up, I often ended up on this seat. It was where I reflected, immersed in the thoughts that filled my head, trying to apply reasoned logic to reams of pages covered with data and graphs, and notes that sometimes made absolutely no sense whatsoever.

On this one particular day, I was drained of life. That was often the case by late afternoon. It was dusk. I was holding a vodka martini. That was also often the case. And I was trying to apply some biological reasoning to my thought patterns. The laughing kookaburra (*Dacelo novaeguineae*) was the only bird out of 56 species I had observed over two

years from a total of 10,296 individuals that responded so unquestionably to fire. Not in the way you might expect. It didn't disappear from patches of vegetation with ash-grey ground and dense epicormic growth sprouting from blackened tree-trunks. My data and models showed that its numbers dropped when flush new growth covered the ground, as is the case in heathy-dry forests from about 3-10 years post fire. And, it preferred vegetation unburnt since the extensive 1939 conflagrations that burnt across this region. The fact that it cannot see its prey in dense ground cover was obvious to me.

But, I wondered if there wasn't something else pushing this bird out of the dense post-fire patches that most birds love. It was on the swing-seat, at that time of day when the birds are all feeding before the sun sets, that I spotted two carnivorous birds only metres apart - a laughing kookaburra and a grey currawong *(Strepera versicolor)*. I sat still, watching.

What everyone knows about a laughing kookaburra is its distinctive call; a vocal pattern that starts as a low-tone, rolling chuckle. With no break in its music, the call rises up the scale, hitting a top note. It pierces the air. Chortles. A high-pitched laughing 'koo koo koo koo kaa kaa kaa kaa'. For a non-Australian, they might think after that first chorus, the kookaburra has finished. But it starts again, rolling the notes, one after the other. Peals of laughter. The laughing kookaburra changes the tone of its music by opening and closing its beak – wide for the top notes, closing its beak slightly for the low. The bushman's alarm clock. It is one of the most distinctive sounds of Australia – to fauna what the didgeridoo is to human music.

But if you watch, as well as listen, what you will notice about the laughing kookaburra is its pounce. From motionless to wings extended, as it descends to earth at about 30km/hr, it snatches its prey. As I watched, a southern grass skink writhed in the kookaburra's beak. The kookaburra bashed its meal against the ground. A 46cm-long bird with just a ten-centimetre beak and claws subdued the skink; killing it was necessary. The kookaburra flew back to its perch, ten metres above ground and gulped the skink. The first swallow and a skink tail was left hanging from its mouth. A second swallow, and the tail disappeared. The kookaburra sat motionless.

It was the second bird that I watched on that day that completed the tableau. The grey currawong is the kookaburra's competitor for the same food source. Related to the Australian magpie, it is comparable in size to the kookaburra. In heathy-dry forests, both the laughing kookaburra and the grey currawong will co-inhabit a space. Assuming ample prey, the currawong spends seventy percent of its forage time at ground level and the remaining thirty percent high in the canopy, while the kookaburra pounces from height. I watched these two. The kookaburra sat high while the grey currawong walked across the dry ground directly below. No shrubs, little grass, the older heathy-dry forest has little ground cover.

Our property, in the middle of heathy-dry forest, had burnt in 2006, eleven years prior. But this habitat changes, especially from fire. Assuming a family of kookaburras flees fire in a heathy-dry forest and survives, they must be able to persist for six months in the territory of other laughing kookaburras, before they return. In a heathy-dry forest, vegetation regrowth post fire begins around six months; and most common birds have at that point, returned. But the kookaburra must again leave, perhaps in two years, as the new ground growth creates dense cover; unsuitable for a broad range of reptiles that they feed on, which require open-canopy environments for basking. Not only is the food source reduced, but the kookaburra must compete against the grey currawong for it. Burning more than once a decade in a heathy-dry forest can result in perpetual ground-cover vegetation. It's all in the timing.

I checked my data. In heathy-dry forests, there is a 5-fold decrease in the occurrence of these two birds together in the dense new-growth vegetation, compared with vegetation that has had at least ten years to recover post-fire. For the kookaburras, it becomes a law of diminishing returns against them. The more the new growth develops and the denser it becomes, the less food is available for the bird that pounces from height. Meanwhile, land clearing continues unabated across the Australian landscape, removing the tree hollows essential for kookaburras to persist.

As I sat on the swing-seat, watching and thinking, my thoughts regressed, like a movie in rewind, spinning back through history and the phylogenetic tree of the ancestors of the kookaburra. One hundred and fifty years ago, a kookaburra sat, same location, different tree. A winter fog dropping dew on its feathers, as it ruffled them before making an early morning call. Back further to five hundred years ago, same location, different tree, this one a female, sitting next to her life-mate, out of the hollow for a sunrise feed before heading back into the nest to feed her chicks. Back and back, past the one-thousand year mark, past the five-thousand year mark, back past the 65,000 year mark, when man first walked across the Australian landscape, back to the laughing kookaburra's most recent divergence from other *Dacelo* species, about two million years ago in the Pleistocene. The climate then ran through warm-wet to cold-dry phases, and in this area the stretches of sclerophyllous vegetation had expanded; trees with hard leaves and not much distance between leaves on a stem. Back even further, the film whirrs through a divergence of the kookaburra from relatives at the 3.5 million year mark in the Pliocence, when Australia first drifted north and the continent dried out, with a gap in time when pollen wasn't preserved. But it was cooler, and drier, and sclerophyll vegetation had started to take hold. And we go back further still to the 9 million year mark, then the 13.8 million year mark, and still further back, to the first divergence representing colonisation of Halcyoninae in Australia from the kingfisher's Alcedinidae family, about 16.3 million years ago, in the Miocene, where this location in space was at a higher latitude with a more polar-light environment. The kookaburra's ancestor stood on the bough of a rainforest tree, wings still, eyes alert, cloaked by cloud and gentle rain; watching and waiting. A sentinal in an ancient landscape. Today, it is waiting still.. Today, it is waiting still.

Ironbark tree *(Eucalyptus tricarpa),* Brisbane Ranges National Park in central Victoria, Australia.

Some months after my epiphany on the swing-seat, I took a walk down the road that extends from our property, north-south through the National Park. I stopped at an ironbark tree, standing majestically thirty metres tall in the sparse heathy-dry forest.

A heathy-dry forest is not a dense forest with numerous species at various heights filling the void from ground to canopy. It has a simpler structure: ground cover, tree trunks and canopy, a product of poor-quality soils. Surrounded by eleven-year-old stringy-bark and black wattle post-fire regrowth, this ironbark's coat was vertically lined grey and black, trunk and boughs furrowed four to five centimetres deep, an accumulation of dead bark that over the years had created fissures and protected its core from fire. I could see that the coat faded to grey on the western side of the tree. Around the rest of its trunk, this tree bore the scars of the wildfires of 1939 and 2006 and the controlled burn of 1994, the tops of the furrows still black. I couldn't tell which black scars related to which fire but anecdotally, I had heard that this tree was alive before the 1939 fires. At five metres above ground level, the trunk extended into its lowest level, half-metre thick, furrowed bough with gnarly branches; more than a dozen dead extensions winding outwards through the air, each not much more than a metre long. The last held light branches, new growth since 2006. It was winter and the thin branches hung heavy with one of the largest flowers in the eucalypt species.

I watched from a distance, standing quietly. On the bough sat a laughing kookaburra. Was it the same one that was near my house months earlier? It was likely.

The laughing kookaburra is highly territorial. They have clearly defined territorial boundaries, from about sixteen to 240 hectares, a size determined by resource availability – hollows and food – and by the flock size and their ability to defend space. But that territorial range is shrinking. A set of "synergistic wicked problems" - set in motion by the hands of humans/numerous, complex and including climate change - is impacting Australia's iconic bird with dramatic effect. "The New Atlas of Australian Birds" published in 2003 listed the laughing kookaburra as being in abundance. "The State of the Birds Report" created by Birdlife Australia in 2015 lists it in major decline down the whole east coast of Australia.

The kookaburra is in trouble. It is easy to see why. Urban development down the entire east coast of Australia removes trees with hollows. Permits to control that are issued by State Government officers remove birds from their territories. Two Australian states consider the laughing kookaburra to be an exotic species and so offer no protection. And in recent years, fire frequency in the landscape has increased such that dense new growth, loved by most birds, proves a problem for the kookaburras that then can't pounce to feed. They are competing for a food source, already limited, because basking prey reduces in dense cover. And there are fewer places for them to regroup. The land clearing strips away not only their traditional range but potential sanctuaries where they might recover and from which they might return. The laughing kookaburra sat, watching; an icon of the ages woven into the Australian landscape. But today, it is ruled by a sovereign hand that is determining its fate. Death by a thousand cuts.

I stood motionless. It must have seen me; it can see an earthworm from fifty metres. It sat quietly, no doubt scanning the open ground for basking lizards. I began to walk away. With the first crack of ground cover under my feet, the kookaburra flew off.

DR DIANA KUCHINKE

Dr Diana Kuchinke is a fire ecologist. Her PhD in 2018 'Investigating bird responses to fire in the heathy dry forests of Victoria, Australia' reviewed bird responses to wildfire and controlled burns in terms of time-since-fire, fire frequency and burn severity for individual species, foraging guilds and communities. She works as a sessional lecturer at Federation University in Ballarat. Diana lives with her family on a property enclosed within the Brisbane Ranges National Park, a heathy-dry temperate forest in Victoria. Her property burnt in a bushfire in 2005.

This article is the product of the IAWF mentoring program in 2020; Diana was mentored by Stephen Pyne.

Image of the 2016 Rognac Fire on the southern coast of France as taken from the International Space Station by Oleg Skripochka at 17:45 local time on August 10. Ignited at around 15:09 with winds averaging 55 km/h (34 mi/h), its initial run propagated mainly through shrubland fuels at a rate of 5.3 km/h (3.3 mi/h) over the first hour and 20 minutes or so. After this time, as the fire reached industrial and urban areas, the main head broke into smaller separated fronts, slowing it down and eventually limiting its forward spread. The fire advanced nearly 15 km (9.3 mi) from its point of origin, burning an area of 2655 hectares (6560 acres) and impacting 181 houses within the wildland-urban interface over an eight-hour period. No lives were lost.

EVALUATING THE 10% WIND SPEED RULE OF THUMB FOR ESTIMATING A WILDFIRE'S FORWARD SPREAD RATE

BY MIGUEL G. CRUZ and MARTIN E. ALEXANDER

INTRODUCTION

In the October-December 2019 issue of WILDFIRE, we described a recently developed rule of thumb for estimating a wildfire's forward spread rate when burning conditions are severe, namely when wind speeds are high and fuels are critically dry, and the time available to prepare a more exacting prediction is limited (Alexander and Cruz 2019). Based on the analysis of three distinct datasets comprising 118 high-intensity wildfire runs from around the world in forests (conifer- and eucalypt-dominated) and shrublands, rate of spread was considered to be roughly 10% of the prevailing 10-m (33-ft) open wind speed, independent of the unit system used (Cruz and Alexander 2019). For example, given an open wind speed of 25 km/h (16 mi/h), the estimated wildfire spread rate during severe burning conditions would be approximately 2.5 km/h (1.6 mi/h).

Here we present a summary of an evaluation study that analyzed the predictive accuracy of the 10% rule of thumb against two large, independent wildfire datasets. For further details on the study, see Cruz et al. (2020).

THE INDEPENDENT DATA SOURCES

Documented observations of wildfire rate of spread were extracted from two different databases totalling 350 wildfire runs. The analysis focused on the wildfires

spreading under the influence of strong wind speeds (i.e. >30 km/h or 19 mi/h) and low fine dead fuel moisture contents (i.e. <7%). The application of this filter reduced the data used in the analysis to 88 fire runs. Thirty of these runs came from a database of fires in native eucalypt forests of southern Australia compiled by researchers from the Monash University in collaboration with the Country Fire Authority (CFA) and the Department of Sustainability and Environment of Victoria (Harris et al. 2011; Kilinc et al. 2012). The rates of fire spread and corresponding wind speeds ranged from 0.8-8.0 km/h (0.5-5.0 mi/h) and 30-100 km/h (19-62 mi/h), respectively.

The second dataset consisted of 58 fire runs in shrublands, eucalypt forests and conifer forests garnered from the BONFIRE global fire behaviour database project led by the Universidade de Trás-os-Montes e Alto Douro (UTAD) in Vila Real, Portugal, starting in 2015 (Fernandes et al. 2020). The rates of fire spread and corresponding wind speeds ranged from 0.55-12.5 km/h (0.3-7.8 mi/h) and 30-80 km/h (19-50 mi/h), respectively.

MAIN OUTCOMES OF THE ANALYSIS

The analysis of the performance of the 10% rule of thumb against wildfires spreading during severe burning conditions revealed the following:

- ✓ Its predictive accuracy is comparable to other evaluation studies of empirical fire spread models using wildfire data.
- ✓ No significant differences were observed in error trends between the three fuel types considered (i.e. shrublands, conifer forests and eucalypt forests).
- ✓ An over-prediction bias was detected for fires that spread at rates of less than 2.0 km/h (1.2 mi/h). This was also observed in the original analysis related to the development of the rule of thumb.
- ✓ It works best for wildfires spreading at rates greater than 2.0 km/h (1.2 mi/h) with most fires predicted within ±35% error prediction band. Prediction error, expressed as a percent of the observed rate of fire spread, was found to decrease in absolute terms with increasing rates of fire spread (Figure 1; see Box 1 for an interpretation of percent error).

THE DOMINANT CONTROL OF WIND SPEED DURING SEVERE BURNING CONDITIONS

The results of the Cruz et al. (2020) study have substantiated the strong control that wind speed exerts on the forward spread rate of wildfires when fuels are critically dry (i.e. both fine dead fuel moisture and overall long-term landscape dryness) and winds are strong. These burning conditions produce the type of fires that typically surprise emergency response agencies and communities as a result of their fast spread rates and corresponding high fireline intensities. Despite the high energy release rates associated with wildfires burning during these conditions, the convective plume tilt associated with the strong winds leads to a decoupling between the advancing flame front at the surface and the plume downwind that seems to reduce fire-plume interactions and the associated uncertainty with respect to weather conditions at the surface.

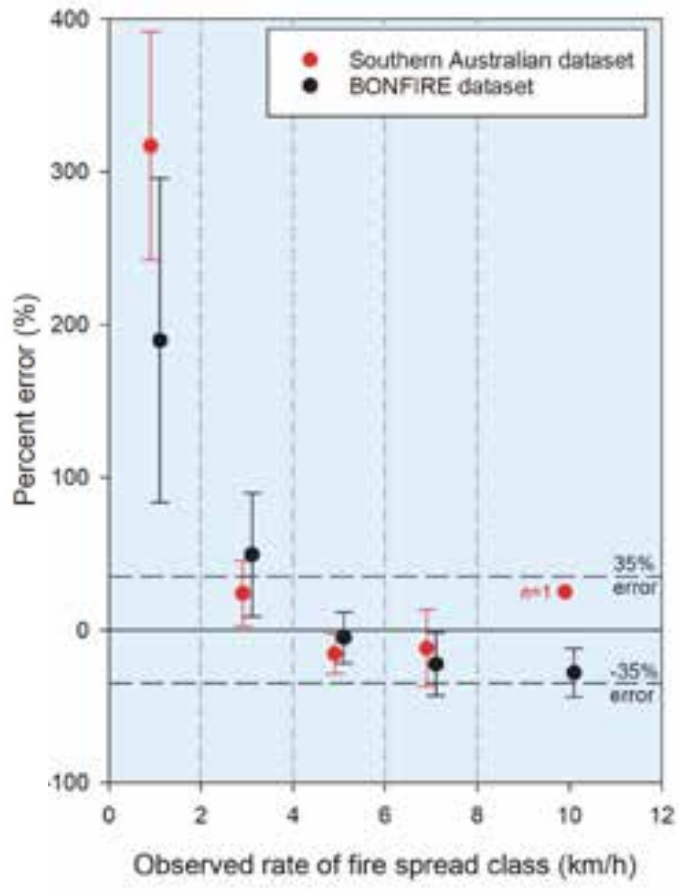

Figure 1. Variation in the percent error obtained with the 10% rule of thumb in relation to observed rate of fire spread as determined in the evaluation study. The ±35% error band was considered an acceptable percent error for wildfire propagation based on an analysis of 49 published model evaluation studies as described by Cruz and Alexander (2013). The solid dots denote the mean values of each class and the error bars are ± one standard deviation (a measure of the variability around the mean).

CLOSING REMARKS

The 10% rule of thumb was developed to provide first approximations of wildfire propagation rates for situations when there is little or no time to apply more comprehensive and accepted fire behavior prediction methods. As shown in the evaluation study, its application works well for the dry and windy conditions associated with fast-spreading wildfires, but will result in large over-predictions when applied in low to moderate wind speeds (i.e. <20 km/h or 12 mi/h) and fine dead fuel moisture conditions >7%.

ACKNOWLEDGEMENTS

Thanks to Paulo Fernandes (UTAD), Musa Kilinc (CFA) and Ângelo Sil (UTAD) for their contributions to the 10% rule of thumb evaluation study and to Matt Plucinski and Andrew Sullivan (CSIRO) for their comments on a draft of this article. Vincent Pastor with the Service Départemental d'Incendie et de Secours – 13, Bouches-du-Rhône, France, kindly provided details on the 2016 Rognac Fire.

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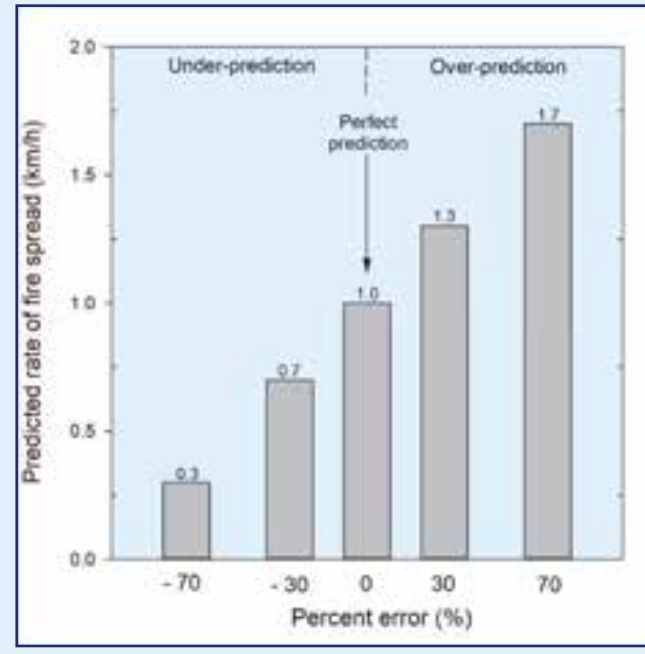
Marty Alexander is a semi-retired Canadian wildland fire behavior researcher (mea2@telus.net).

The two of them have been cooperating on various projects for the the past 24 years.

Box 1. Interpreting Percent Error Associated With Predictions of Wildfire Rate of Spread



The spread rate of wildfires can vary over a wide spectrum. The error produced by predictive models is best interpreted on a percent basis relative to an observed rate of spread. This can be calculated as the difference between the predicted and observed fire spread rates, divided by the observed fire spread rate, multiplied by a 100:

$$\text{Percent Error} = \frac{\text{Predicted Value} - \text{Observed Value}}{\text{Observed Value}} \times 100$$

The above formula will result in negative errors if the fire spread rate is under-predicted and positive errors if the prediction is higher than the observed value. For example, if the observed rate of fire spread is 1.0 km/h (0.6 mi/h), a prediction of 1.3 km/h (0.8 mi/h) equates to an over-prediction error of 30%, whereas a prediction of 0.7 km/h (0.4 mi/h) would constitute an under-prediction error of -30%.

This article is the first in what will become a regular contribution from our colleagues in the Association for Fire Ecology.

THE NEW FIRE PROFESSIONAL

confident, capable and prepared?

Wildland fire management across the US is under intense scrutiny as it faces challenges of extreme wildfire seasons, a warming climate and increasing pressures on natural resources. As he ends his term as President of the Student Association for Fire Ecology Lars Filson offers his view on whether the current cohort of graduates is up to the task.

BY LARS FILSON

Come May I will graduate from the University of Idaho's Department of Forest, Rangeland and Fire Sciences with my bachelor's degree in fire ecology and management. My graduation will mark the culmination of a five-year journey as a full-time student and seasonal firefighter. As I reflect on the time I've invested in academics, I feel fortunate to have received so much support from peers, mentors, and family alike, as well as for the unique opportunities I've had both on and off campus. Many of the connections I've built during my time at the University of Idaho are a product of the time I've invested with the Student Association for Fire Ecology (SAFE). Founded in 2000 by graduate students at the University of California at both the Berkley and Davis campuses, SAFE is the student branch of the Association for Fire Ecology (AFE). In an effort to support students of wildland fire, SAFE was founded to provide student members with a forum to share research, form networks and access funding and other resources. Since 2000, SAFE has grown to include 20 local chapters distributed

across every geographic region of the United States. Today we continue to meet our objectives by connecting students with professional mentors, providing yearly chapter grants for the acquisition of equipment or to cover travel expenses to conferences and prescribed burn exchanges, providing student scholarships, and providing students with access to AFE's scientific journal, Fire Ecology.

Shortly after arriving at the University of Idaho in the spring of 2019 Heather Heward, my major professor, approached me to see if I had any interest in pursuing a position as the National President of the Student Association for Fire Ecology. Eager for any opportunity to become further involved in the wildland fire profession, I jumped at the opportunity. I had very little idea of what I was getting myself into at the time. I was fortunate to be elected by my cohorts. As my involvement at the national level increased, so did the time I invested with the local chapter at the University of Idaho which gave me the chance to travel to Florida with my fellow students over spring break. Our chapter sent ten students, an alumnus, and a professor to the Disney Wilderness Preserve where we were able to conduct prescribed burns on nearly 1500 acres in a week. The hands-on learning experiences provided by the College of Natural Resources at the University of Idaho are excellent, thanks in part to the university's access to a 12,000-acre experimental forest. But nothing in my college experience was as special, memorable, or valuable as the opportunity to stand shoulder-to-shoulder with my fellow SAFE members and my prof and an alumnus Michael McManus in a new fuel type, in new ecosystems and in a whole new landscape. Since that experience I have served two 1-year terms as SAFE's National President. As I prepare to move from academics into my career, the time has come for me to pass the torch to the next group of officers who will shape the future of SAFE.

I've been fortunate to be able to take advantage of the opportunities provided to me, made possible by the support of my peers, mentors, and family, both on and off campus. My seasonal work during the summers, supplemented by a minimal part time position on campus and the occasional scholarship, has provided me the flexibility to take advantage of volunteer positions, dedicate my weekends to hazardous fuels reduction work with my local

I'VE BEEN FORTUNATE TO BE ABLE TO TAKE ADVANTAGE OF THE OPPORTUNITIES PROVIDED TO ME, MADE POSSIBLE BY THE SUPPORT OF MY PEERS, MENTORS, AND FAMILY, BOTH ON AND OFF CAMPUS.

College of Natural Resources prescribed burn in the University of Idaho Experimental Forest

SAFE chapter, and spend university breaks traveling to prescribed burn exchanges. This can't be said for every student pursing a degree in fire ecology and management or similar study. Many of my peers work part-time or full-time jobs during the school year to make ends meet, which restricts their ability to undertake training outside of their school schedule or travel to prescribed burn exchanges that take place during the school year. Many are non-traditional students seeking degrees to further their current careers with various land management agencies in between fire assignments and daily life. Some are even working to balance a full course load, work, and a family.

Despite the advances the academic community has made in producing wildland fire professionals, including increases in the number of institutions offering degrees or concentrations in fire ecology and related subjects, research into both the ecological and social aspects of wildfire, and university coordinated prescribed fire exchanges, many of the same challenges identified by Kobziar et. al. (2008) in their paper Challenges to Educating the Next Generation of Wildland Fire Professionals in the United States remain. In many instances the National Wildfire Coordinating Group (NWCG), which was established in 1970 to standardize agency-provided wildfire training, refuses to recognize any university-provided training that students complete during the duration of their time on campus. Similarly, because of the restrictions placed on who can participate in prescribed burns completed by federal and state agencies during the shoulder seasons, many students employed by the same agencies during the fire season miss out on opportunities to observe fire behavior and gain experience during the shoulder seasons. Many universities are dependent on their own experimental forests, partnerships with non-governmental organizations, or other private landowners to provide students with the opportunity to gain 'boots on the ground' fire experience during the school year. The opportunities I've had to operate in the field with my peers have been an invaluable part of my college experience, and a frequent frustration shared by my peers is the lack of similar opportunities. With increased conversations about the future of state and federal fire management, the potential of a unified wildland fire force in the United States, special interest groups pushing for increased recognition of wildland fire personnel, and even a future federal job track specifically for wildland fire management personnel, it's high time that we double down on our commitment to the next generation of WFP and offer the next generation the training, hands-on learning opportunities, and career prospects they need to further their careers and meet society's needs..

There are moments when the future of fire management seems bleak. In 2020, a year when the cumulative acres burned during western wildfire season in the US exceeded the number burned in the infamous year of 1910, the challenges fire managers face are obvious The US's failure to manage climate change, manifest in extreme droughts and other events, has resulted in longer and more extreme wildfire seasons. As we experienced this past summer, longer fire seasons result in a national drawdown of available resources, increasing the mental and physical fatigue the country's wildland fire personnel experience. A legacy of aggressive fire suppression has resulted in un-naturally heavy fuel loads, species

shifts and other ecosystem changes, which have drastically altered fire regimes. Population increases across the Western U.S. have resulted in ecosystem fragmentation and increased wildland-urban interface and exposed the challenges of evacuating nearly entire cities in the face of fires. These challenges demand an a well-educated and highly trained group of WFPs to ensure public safety while restoring and maintaining the ecological and economic health.

One thing I can definitively say as I wrap up my time at the University of Idaho and with SAFE, is that the future of wildland fire management is bright. During my time serving as the national president for SAFE, I've been fortunate to represent an exceptional group of students. Universities with SAFE chapters are producing a high caliber of WFPs. They've taken motivated, passionate, and excited students and given them the tools they will need to succeed. These students determined for themselves how to implement the tools, a testament to their individual desires to see their careers and their profession succeed. They have put in a tremendous amount of work to better themselves and prepare to enter career fields in a way that will allow them to maximize the impact of their careers. The United States is a critical period in the history of wildland fire management. Without a new generation of confident and capable fire professionals, the country may surpass a threshold from which we will not be able to return. Despite this threat and the severe consequences, it carries, I have complete confidence this group of emerging WFPs will rise to the occasion. It has been an honor to work with and represent these students and I look forward to seeing what we can collectively accomplish throughout our careers.

Photo: Katie Mosman Wilson

LARS FILSON began his academic career at Central Oregon Community College in Bend Oregon before transferring to the University of Idaho where he is a senior fire ecology and management major. Outside of the school year Lars works as a helicopter crewmember on a helitack crew based in the Northern Rockies.

LIGHTING FIRE TO FIGHT FIRE:

US NATIONAL GOVERNORS ASSOCIATION AND WILDLAND FIRE LEADERSHIP COUNCIL PROMOTE PRESCRIBED BURNING TO ENHANCE AIR QUALITY

Johnny Stowe

INCREASING USE OF PRESCRIBED FIRE AS A FIRE MANAGEMENT TOOL CAN BE CRITICAL TO REDUCING FUEL LOADS, MODIFYING FIRE BEHAVIOR AND ULTIMATELY REDUCING SMOKE PRODUCED BY CATASTROPHIC WILDFIRES.

-- NATIONAL GOVERNORS ASSOCIATION

In an effort to increase the use of prescribed fire as a land management tool to lessen the impacts of smoke from wildfires, the National Governors Association (NGA) issued a letter this past November providing guidance and resources to each of the US Governors' offices. The NGA represents the US's fifty states and five territories, identifying and prioritizing issues and dealing with governance and policy at the state, local and global levels.

The Wildland Fire Leadership Council (WFLC) comprises all levels of government in the US, from the federal firefighting agency heads down to the local level, and is dedicated to promoting and coordinating consistent wildland fire policies, goals and management activities across the nation. Mike Zupko, Executive Director of the WFLC, said "This letter, which recognizes and encourages the use of prescribed fire through the highest levels of federal and state government, in close partnership with local wildland fire professionals, aims at dealing with the increasingly challenging wildfires and the associated air quality and other issues we are facing, through the judicious use of a time-tested land management tool."

Prescribed fire (aka "controlled burning") is by far human's oldest ecosystem management tool, but about a century ago in the US, this "good-fire culture"--both the practice as well as the people whom it defined--was attacked as part of a nationwide, categorically anti-fire program that is now seen to have been a hegemonic failure. But the wise, multicultural heritage of carefully using fires lit under prescription for ecological, economic and public safety benefits was never quite destroyed (Stowe 2020: Figure 1). In certain areas, most notably the Southeastern US, firelighting traditions persisted. Over the last two decades, the remnant flames of these traditional rural lifeways (TRL) have been fanned and are spreading, being increasingly used, shared and valued (Miller and Stowe 2020). By lighting controlled burns,

land managers actively facilitate a natural and inevitable ecological process, becoming a part of, rather than apart from, ecosystem integrity.

It may seem a paradox to some, but in certain areas where it is not a matter of *if,* but rather of *when,* wildland fire burns, objective-driven prescribed fires--those safely lit under specific socioecological conditions, when fire intensity and the type, direction and dispersal of smoke can be chosen--are uniquely able to remove fuels that could drive wildfires that would severely impact air quality while also destroying property, harming natural resources and imperiling public safety. Prescribed fire allows controlled burners to "choose the when" of wildland fires.

The burgeoning recognition of prescribed burning in the US is evident in the spate of state prescribed fire councils (37 and growing), and the overarching national Coalition of Prescribed Fire Councils (prescribedfire.net), chaired by prescribed fire master Mark Melvin of the Jones Center at Ichauway, in Georgia.

In September 2020, Secretary of the US Department of Agriculture (USDA) Sonny Perdue (former Governor of Georgia, who grew up in a prescribed fire culture) emphasized the importance of prescribed fire in his keynote address to the annual meeting of the Georgia Prescribed Fire Council youtube.com/watch?v=AdKOoYA5bLg&feature=youtu.be. The US Forest Service, one of the nation's leading fire management agencies, is a branch of the USDA. Georgia Governor Brian Kemp also spoke at this meeting youtube.com/watch?v=foSQLS5Jnv0&feature=youtu.be. Georgia, which has a population of 10.6 million, prescribed burns 1.4 million acres per year.

RESOURCES

Miller, S.R and J. Stowe. 2020. Passing the Torch to Tomorrow's Wildland Fire Professionals: Through Mentoring, Training and Pyrotourism. Wildfire. IAWF. 29:4. 34-39.

Stowe, J. 2020. Fire Ties that Bind: The Natural and Cultural Heritage of Controlled Burning in the Southland. Southern Fire Exchange. youtube.com/watch?v=HvVcIMFgu-s

OUR PRESCRIBED FIRE WORK IS CRITICALLY IMPORTANT, BECAUSE IT REINTRODUCES THE BENEFICIAL EFFECTS OF FIRE INTO AN ECOSYSTEM, PRODUCING THE KINDS OF VEGETATION AND LANDSCAPES THAT WE WANT, AND REDUCING THE HAZARD OF CATASTROPHIC WILDFIRE CAUSED BY EXCESSIVE FUEL BUILD-UP.

-- US SECRETARY OF AGRICULTURE SONNY PERDUE

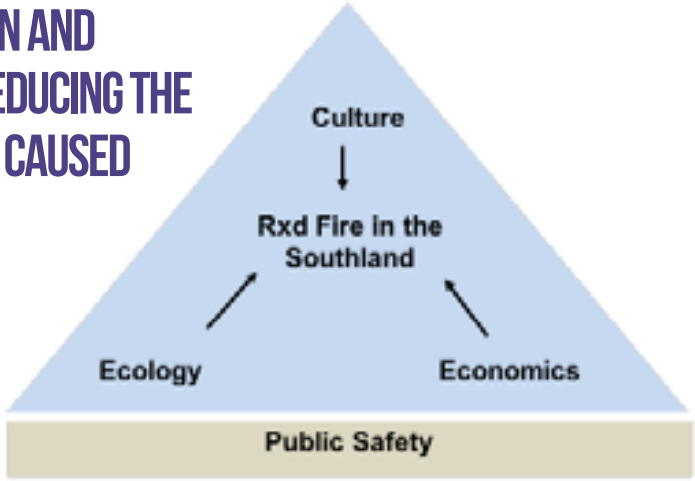


Fig. 1. Johnny's *Why We Set the Woods on Fire Pyramid*

NATIONAL GOVERNORS ASSOCIATION

M E M O R A N D U M

To: Governors' Offices
Re: Opportunities for Reducing Wildfire and Smoke Impacts: Prescribed Fire Considerations in Regional Haze Rule and State Implementation Plans
From: National Governors Association, Wildland Fire Leadership Council
Date: November 9, 2020

The National Governors Association (NGA) is partnering with the Wildland Fire Leadership Council (WFLC) to provide the below information to Governors' offices, including state air offices, and state forestry/fire departments, that highlights several resources and opportunities that are available to address the short-, medium- and long-term implications of wildfire smoke. NGA and WFLC are also encouraging strong communication between your air quality and forestry agencies as states grapple with air quality challenges that have resulted from the current fire season, especially in advance of the need to renew State Implementation Plans (SIPs) for regional haze and air quality in the summer of 2021.

Resources and Opportunities
The following resources are available to help minimize the impact of smoke to your communities in the short and medium term:

- Interagency Wildland Fire Air Quality Response Program – Managed by the USDA Forest Service, this program offers a suite of resources during a wildfire event to work with the Incident Management Teams and the affected communities to directly assess, communicate and address risks to the public and fire personnel posed by smoke. The program is organized with four primary components: specially trained personnel called Air Resource Advisors, air quality monitoring, smoke concentration and dispersion modeling, and coordination and cooperation with agency partners.

- Smoke Ready Communities – This is a program used by several Western states to help a community prepare for smoke from wildfires or prescribed fires before they occur. The intent is to provide communities with information and knowledge about what they can do to lessen the impact of smoke.

- Exceptional Events Rule – "Exceptional Events" are those events that impact air quality but are not reasonably controllable and not likely to reoccur. The Exceptional Events Rules (EER) gives states a method for removing air quality data impacted by wildfires or prescribed fires when National Ambient Air Quality Standards (NAAQS) are exceeded, provided that the Environmental Protection Agency (EPA) concurs with the supporting documentation, the event contributing to the data meets certain criteria and the exceedance can be deemed regulatorily significant. As forest agencies strive to utilize more prescribed fire, preparation for use of the EER could streamline efforts and allow for clearly defining roles and expectations between agencies using prescribed fire and those who regulate air quality. However, planning and coordination between land managers, state forestry officials and air

regulators on what happens if and when a prescribed fire causes an exceedance is required in order to successfully utilize EER.

Use of Prescribed Fire and Air Quality Considerations:

Increasing use of prescribed fire as a fire management tool can be critical to reducing fuel loads, modifying fire behavior, and ultimately reducing smoke produced by catastrophic wildfires. It is also one of the most cost-effective fuels treatments. If done in a responsible manner, prescribed fire can be carefully planned, timed and managed to reduce wildfire risk and lower environmental, economic and public health impacts as compared with the unplanned nature of wildfires. Due to the past several years of increasing catastrophic wildfire, land management tools such as prescribed fire are being identified as one of the key ways to reduce overall risk of wildfire and ultimately mitigate the impact of smoke on public health. This is based partially on the ability to use prescribed fire on days when the impact from smoke is minimized by favorable weather conditions.

NGA strongly encourages close coordination between air quality agencies and state foresters before beginning utilized prescribed fire plans to ensure compliance with NAAQS, to maintain public health and safety and to ensure air quality. State Implementation Plans (SIPs) for regional haze and air quality will be renewed in the summer of 2021. States are given the flexibility within their SIPS to address the key issues as required by EPA, and to confront additional issues that may be specific to each state or geographic region. Each geographical region has varying considerations, and a variety of approaches have been developed throughout the state by air quality agencies. Prescribed fire factors into the development of these plans.

One such approach has been the Western Regional Air Partnership, which Western states have used as a model to consider the use of prescribed fire as a land management and wildfire reduction tool in the upcoming decade. Due to limited past use of prescribed fire in many states across the West, the model is showing only a modest increase reflecting input from the federal agencies. There had been little consideration of the need for increased prescribed fire on state and private land, which is another opportunity for collaboration among environmental and regulatory agencies and state foresters. Despite the modest increase of prescribed fire use in the model, it demonstrates a benchmark for future dialogue and needed further increase of the tool, especially as it may factor heavily into SIP renewals. Prescribed fires are also already used extensively across multiple states in the Southeast, but there is an opportunity to evaluate future use as states develop their SIPs. The Northeast is also looking to prescribed fire as a management tool, and states there may rely upon it more heavily in the coming years.

Given that prescribed fire may play an increasingly important role in land management strategies, it is recommended that states begin facilitating conversations between state air quality agencies and their counterparts in state forestry and fire management. Specifically, states should begin to consider plans to address prescribed fire in their SIP submissions for 2021 to allow flexibility in using it as a tool to help reduce risk from wildfire and increase environmental health benefits in the future. This conversation can include discussing the opportunity to expand the use of prescribed fire in the near future, and it may be helpful to use state level data to better capture the intended increase of the use of prescribed fire in the coming years.

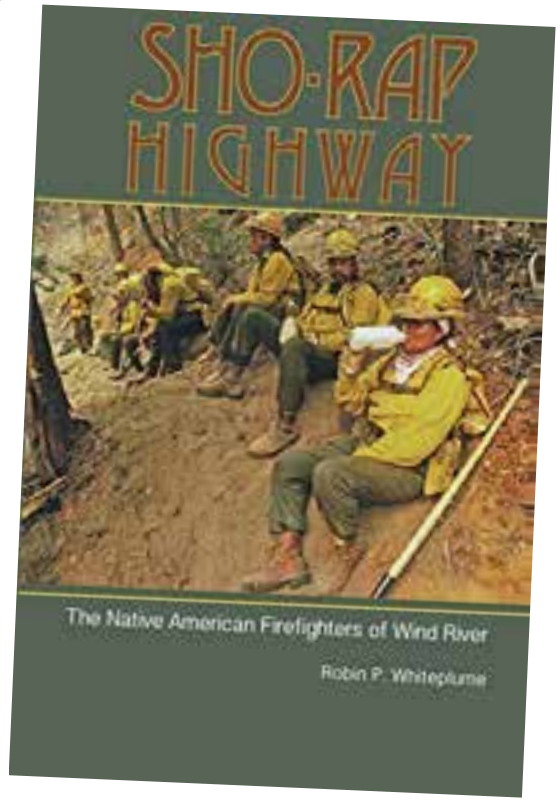
We are happy to provide further information or connect your state with key experts at the national level that can help facilitate the conversation in your state. For more information, please contact: Mike Zupko, executive director, Wildland Fire Leadership Council at mike@zup-co-inc.com or (770)267-9630 or Alex Whitaker, legislative director, National Governors Association at awhitaker@nga.org or (202) 624-3623.

SHO-RAP HIGHWAY:
THE NATIVE AMERICAN FIREFIGHTERS OF WIND RIVER (2017)

Robin P. Whiteplume.

By Richard McCrea

Native American wildland firefighters have a rich history of battling forest fires in the United States. Their experiences have never been well documented and personal narratives rarely recorded. Whiteplume has written an interesting memoir of working as a proud firefighter with the Shoshone/Arapaho Native American fire crews, known as Sho-Raps. Whiteplume has thoroughly scouted the archives and government records and his own memories and come back with a full report. Whiteplume is a member of the Northern Arapaho Tribe and grew up in the shadows of the rugged 13,000-foot peaks of the Wind River Range of Wyoming, about 125 miles south of Yellowstone National Park.



This book is much more than a personal story; it is an important historical account of indigenous firefighters in the western United States and discusses the early formation in the 1940's of Indian fire crews from the Red Hats of the Mescalero Apache Tribe in New Mexico to the Montana Indian Firefighters. Sho-Rap Highway provides us with a detailed account of the founding of the Sho-Rap fire crews and an unvarnished chronicle of what it is like to be a firefighter.

The author gives a realistic account of firefighting and the incredibly hard, tiresome, dirty, and dangerous work. Firefighting is not glamorous, and many things can go wrong such as conflicts between crew members, and potential injuries from a variety of hazards like bees, raging flames, falling snags, and gripping rides in the open back of 2 ½ ton trucks on narrow roads.

The book describes the cultural and social aspects of being a native firefighter and how their outlook is often different from other crews. As Whiteplume observes, there is a long history of Native American struggles to survive which has made them stronger and less prone to carelessness when it came time to battle historic enemies or nature. Perhaps that is why Indian crews return from fire assignments without large-scale casualties or fatalities. There is a great deal of pride that native crews have in their work and what it means to come home safe to their families and have a nice paycheck for all the hard work they have done.

The book shows sparks of humor and many interesting stories. Whiteplume relates an account of Sho-Rap crew bosses discussing a deployment on the fireline, and overhearing one of them say to the others, "You go down there, if you got the nerve," a line famously (to the Sho-Raps) spoken to General Custer by Jack Crabb in the 1970 movie, Little Big Man. History records how General Custer did indeed

www.amazon.com/Robin-Whiteplume/e/B073V9ZV16/ref=ntt_dp_epwbk_0
https://booklife.com/project/9780692889121-24286

decide to go down that hillside, and met with his demise, along with 268 of his troopers. How many times have firefighters deployed on a mountain, only to observe flames below, and have had to decide, whether to "go down there."

The book describes the cultural use of fire by Indian tribes, in an historical context, and up until present day. The author observes that, "Fire was also used to drive enemies from concealment in wooded and brushy areas. Fire was used for signaling at night, along with smoke plumes by day, for directional travel, partly because it was quicker than using runners to relay information between people at distant points from one another. Fire was used by Indians and against them."

The author gives credit to individuals and organizations that have helped support and organize the Sho-Raps, including the Bureau of Indian Affairs (BIA), federal, state, and county agencies. A Preface in Sho-Rap Highway by Roy Montgomery, retired BIA forester, introduces the book. Karl Brauneis, forester with the US Forest Service, also provides a colorful chapter featuring his interactions with the Sho-Rap program.

From descriptions of fighting fire in Yellowstone National Park to the Salmon River Breaks in Idaho, Sho-Rap Highway is an important historic record and memoir, which readers will find an interesting and fine book. There are few if any histories of Native American fire crews — though this BIA web page offers some background: https://www.bia.gov/bia/ots/dfwfm/bwfm/proud-history — and this book helps fill that gap. Whiteplume paints a vivid account of indigenous American firefighters and their battles across the western landscape. This book will find its place in my fire library, like a well sharpened shovel or Pulaski sitting in the fire cache.

Richard McCrea *(LarchFire LLC) is based in Boise, Idaho and worked three decades as a BIA fire management officer.*

There are so many reasons to become a member of the International Association of Wildland Fire!

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