

QUARTER 4, 2021

UNITING THE GLOBAL WILDLAND FIRE COMMUNITY

# WILDFIRE

*An official publication of the* INTERNATIONAL ASSOCIATION *of* WILDLAND FIRE



## CLIMATE CRISIS IAWF CALLS FOR ACTION

SACRIFICING DECISIONS

| TABLE MOUNTAIN FIRE

| WUI GUIDE

**WHEN THE  
WORLD  
DEMANDS  
MORE,**

***AIR TRACTOR  
DELIVERS.***



**AIR TRACTOR DELIVERS THE  
PERFORMANCE, EFFICIENCY, AND  
PRECISION THIS JOB DEMANDS.  
*IT'S TIME YOU DEMAND MORE.***

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## ON THE COVER

PHOTO BY SPENCER BROOKS

A member of the Kamloops Bighorn Unit surveys the Sparks Lake wildfire in British Columbia on July 17, 2021. The 20-person Bighorn crew operates out of the Kamloops Fire Zone in the Kamloops Fire Centre in B.C. In British Columbia there are 27 unit crews. The Ministry of Forests and Range employs more than 1,100 Type 1 firefighters and specialized personnel.





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# TIME FOR ACTION

In September, as I wrote this, Canada was in the throes of a federal election campaign, during which climate change and climate policy were issues, but not the main issues.

Managing the COVID-19 pandemic, affordable childcare and housing, and economic recovery trumped climate change and climate policy on the election hustings, despite one of the busiest wildfires seasons on record with 6,224 fires as of Sept. 26, compared to 3,665 last year.

While the key political parties produced climate action platforms and policies of varying substance, including the winning Liberal promise to protect 25 per cent of Canada's land and oceans by 2025 and 30 per cent by 2030, Canadians were more focussed on pandemic relief.

IAWF president Toddi Steelman writes in her President's Desk column on page 6 about a tweet posted by a worn-out British Columbia firefighter reeling after social media trolls posted negative comments that cut to the core.

British Columbia – a massive province with hundreds of thousands of hectares of wildland – experienced 1,610 wildfires this season, most started by lightning. Extreme fires in Saskatchewan, Manitoba and northern Ontario also tested the mettle of Canada's wildland firefighters.

There were dozens of evacuation orders in Canada this summer. Wildland crews from South Africa and Mexico provided relief to overwhelmed crews.

While Canada's wildfire situation is significant, it's less dire than the circumstances in some other countries. Nonetheless, with climate change a proven phenomenon, and the numbers of lightning strikes increasing, Canada must get its ducks in a row; even with the now-elected Liberal government climate promise, it will take decades to move the proverbial needle.

Therefore, in the meantime, as Steelman writes, "A more resilient approach would begin by adapting to the more uncertain realities taking place in our ecosystems, acknowledging that we cannot put out all fires, enhancing the shared responsibility for preparedness in at-risk communities, working to communicate these complexities to the public, and devoting more resources to members of the wildland firefighting community for their own professional and emotional resilience as they weather these ambiguous and extraordinary times."

The IAWF's climate paper (page 16) is a collaborative effort and a work in progress that will eventually be put to policy

makers, primarily in the United States, and will serve as a model for other countries.

Its three calls to action – to identify ecosystems most at risk to large, high-severity wildfire, to identify and enhance fire-adapted communities, and to foster safe and effective interagency wildfire response – are big undertakings that require global collaboration and commitment.

For IAWF members, it's imperative to help to refine the position paper through feedback to [info@iawfonline.org](mailto:info@iawfonline.org), and then to participate in the dissemination of the final product and its calls to action.

Coincidentally, over the last couple of years, some key players in Canada's wildland arena have put together a much-needed National Guide for Wildland-Urban Interface Fires (page 22). This newly released document fills a gap – a lack of national wildfire guidance for Canada's WUI areas.

As Allison Mills and Nouredine Benichou with the National Research Council Canada write, "... the threat posed by WUI fires is growing as urban areas expand into wildlands, rural areas increase in population, and wildfires become more frequent and severe due to climate change. The risk of WUI fires is expected to increase both in regions of Canada with a long history of wildfires and in those with no such history."

The guide is intended to help minimize the impact of WUI fires by reducing their likelihood and severity, inhibiting their spread, and improving the effectiveness of community response.

On page 34, an interview with Pau Costa Foundation general manager Jordi Vendrell delves into Spain's wildland fire crisis, and the impact of climate change: larger, more ferocious fires.

As reporter Maria Santos writes, "This dynamic of fewer fires, but more virulent and intense, is due to two fundamental factors: depopulation, and climate change."

Unintentionally, there's a climate-change theme woven throughout this issue. IAWF's recent member survey indicated that climate change is a No. 1 concern and topic of interest. Tell us your stories so we can tell others.



**LAURA KING**  
Managing editor  
*Wildfire*

**Correction:** A photo on page 40 of the Q3 2021 issue was taken by Stephen Wilkes, an air observer for New South Wales Rural Fire Service on Jan. 18, 2003.

# UNSUSTAINABLE

MANAGEMENT SYSTEM MUST ADDRESS  
ECOLOGY, FIREFIGHTER MENTAL HEALTH

**TODDI STEELMAN**  
IAWF PRESIDENT

I woke up this blistering mid-August morning where I live in North Carolina to a wrenching tweet from a wildland firefighter in British Columbia: "Help us, help your neighbors, help everyone get through the next six weeks of what has been the most challenging summer." It was accompanied by a plea: "It is time to remind yourself that when you post something out of anger, frustration, fear, or heartbreak, there are other families out there feeling all those same things and reading your words that may be hurtful." This is a reminder that we face two crises — one that is primarily ecological and one that is deeply human.

This tweet could have come from a wildland firefighter in any number of countries this summer given the conditions not only in Canada but Greenland, Turkey, Greece, Algeria, Siberia and the United States to name a few.

**The current  
wildland-fire  
management  
system evolved  
according to a  
variety of  
assumptions that  
are suspect  
under the current  
conditions we face.**

Two questions are imperative:

**What are we really witnessing?**

**What can be done about it?**

Change in our ecological conditions, primed by warming climate, is accelerating at a pace incommensurate with our current institutional responses, namely our wildfire-management systems that were put into place decades ago. This means the wildland fire community needs to take a hard look at the current conditions under which we work and realistically assess the assumptions under which we operate and can be successful.

The temptation under these conditions, especially with deeply emotional responses of anger, frustration, fear and heartbreak that come with witnessing them as noted above, is to double down and respond by thinking if we had more resources, only worked harder and longer, and exercised more control, we could vanquish the fire. This is reasonable because for many years we have had success with a management system that sought to tame a huge percentage of fires with the sheer force of funding, human power and will. Moreover, society has come to expect this from the wildland fire community and celebrated its well-earned successes. But we ignore the underlying ecological changes taking place at our own professional and emotional peril.

The current wildland-fire management system evolved according to a variety of assumptions that are suspect under the current conditions we face. These assumptions include:

- 1) wildfire behavior that is always understandable;
- 2) resources sufficient to support firefighters who face these wildfires;
- 3) a management system rooted in a belief that all fires are manageable.

We are getting very clear signals that these assumptions no longer hold.



First, the wildland fire behavior of the past is no longer always a good predictor of the future. This has implications for our mental models for managing wildland fire. It is now common for us to hear statements from front line wildland firefighters who say “we’ve never seen these conditions before” or they are “witnessing fire behavior for which we have no slides in our slide decks” or “this is something that I have never witnessed in my 30-year career.” Yet our management assumptions and socialization rests on a model of believing current fire behavior is stable and predictable and therefore understandable and controllable.

Second, we have a mismatch in the supply of and demand for resources to deal with the current problem. The demand for resources, especially at peak times during the year, outstrips the supply given the current task definition. The wildfire-management system evolved during an era when the potential for equilibrium between supply and demand was possible. Fires were smaller, climate was more stable, and fewer people lived in the wildland urban interface. The current disequilibrium means we have a mismatch given the sheer amount of wildland fire activity both at a national level and globally. This mismatch leads to negative feedback loops for wildland firefighters, who are blamed for not doing their jobs or not getting on fires fast enough. This backlash results from under-resourced conditions that set them up for failure, as the tweet from British Columbia so poignantly reminds us. Under extreme conditions, there are few things that can be done under human control to address the current challenges. In many cases, we need wait for weather to change; this is difficult for the non-firefighting community to understand and accept. We have become dependent on and expectant of a model that places the wildland firefighter as the hero of the story. The public is demanding greater intensity of response. But we are ignoring the change in the underlying system that is setting everyone up for failure.

Transitioning to a more sustainable wildfire-management system is challenging because there is so much inertia maintaining the current system — something known as path dependence. Creating a new and more resilient path will begin by acknowledging the changes in the ecological systems in which the wildland firefighting community works so we can set everyone up for greater success. We need to recognize the ecological system is changing, but we do not yet know into what it is changing. This is very challenging for a wildland fire management system founded on the need for stability to secure appropriate resources to succeed in its mission.

A more resilient approach would begin by adapting to the more uncertain realities taking place in our ecosystems, acknowledging that we cannot put out all fires, enhancing the shared responsibility for preparedness in at-risk communities, working to communicate these complexities to the public, and devoting more resources to members of the wildland firefighting community for their own professional and emotional resilience as they weather these ambiguous and extraordinary times.

Wildland firefighters are under huge pressures. The physical risks are clear and present, but so too are the emotional and mental health risks. As if the risks from fire aren’t enough, we are also dealing with a global pandemic. Please take time out to care for yourselves, your families, your work colleagues and those you love and care for. Take strength and confidence from those many people in the community who are behind you and who are supporting you. No matter where you are in the organization, you do good work. On behalf of the wildland fire community, we sincerely thank you and applaud your efforts.

This is my final column as president of the IAWF. Of course, I would have preferred to end my tenure with answers to all the issues I have just outlined. But it is not as simple as that, and, in the middle of a global pandemic, more complex for us in wildland fire than it has ever been on so many levels. Simplistic answers to complex problems are not what is needed.

Next year, the IAWF hosts the Fire and Climate 2022 conference both in Pasadena and Melbourne, two regions that are all too familiar with the impacts of both climate change and uncontrolled wildfire. This timely conference, perhaps the most important IAWF event in our 30-year history, will bring in physical and the social scientists along with the operational wildland firefighters and managers to look at the complexity of the problem and ask the most important questions: What are we really witnessing? What can be done about it? I hope to see you there.



**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.



## STUDY LINKS WILDFIRE SMOKE AND COVID

A Harvard University study has found that particulate matter from wildfires may be associated with an increase in COVID-19 cases and deaths among residents of California, Oregon and Washington. The study is the first to quantify the degree to which increases in PM 2.5 pollution during the wildfires contributed to excess COVID-19 cases and deaths in the United States. The study was published online Aug. 13 in *Science Advances*. The study found the strongest association between wildfire smoke and COVID-19 cases in California's Central Valley, near Fresno and Sacramento. On average, the study found that a daily increase of 10 µg/m<sup>3</sup> in PM<sub>2.5</sub> each day for 28 subsequent days was associated with an 11.7% increase in COVID-19 cases, and an 8.4% increase in COVID-19 deaths.



## HAZARDS RESEARCH FUNDED

On July 1, the Australian government announced the establishment of the new natural hazards and disaster research centre, with \$85 million in funding to deliver research into a range of natural hazards including wildfires, floods, cyclones, storms and earthquakes. The new centre, Natural Hazards Research Australia, continues the co-ordinated national research effort of two cooperative research centres – the Bushfire CRC and the Bushfire and Natural Hazards CRC – over the last 18 years, and will address the major challenges arising from recent natural hazards, including the 2019-20 bushfire season in eastern Australia. Natural Hazards Research Australia is now working closely with the Australian government to develop a strategic research agenda for Australia along with its partners in the emergency service agencies, universities, and industry. It is anticipated that many of the links made with international organizations and researchers through the two CRCs will continue into the new Centre.



## AUSTRALIA DEPLOYS RESOURCES

Following a request in late July by the United States National Interagency Firefighting Centre to Australia's National Resource Sharing Centre (NRSC), the New South Wales Rural Fire Service deployed its 737 large tanker to assist with several wildfires. In addition, 55 specialist personnel from New South Wales and Western Australia were deployed to Canada to support the provinces of British Columbia and Ontario; this was at the request of the Canadian Interagency Forest Fire Centre, also liaising through the NRSC. Deploying overseas during COVID-19 was challenging and while Australia was not able to meet all of Canada's resource requests, the contribution was significant. The seven-week deployment included a two-week quarantine period on return to Australia.



## GLOBAL SMOKE-RELATED FATALITIES TALLIED

Wildfire smoke causes more than 33,000 deaths a year across 43 countries, according to a global study. Research published in *Lancet Planetary Health* relates short-term exposure to fine particulate matter in the air and respiratory, and cardiovascular mortality across cities and regions around the world. The study, by an international team from the Monash University's School of Public Health and Preventive Medicine in Melbourne, found that the deaths were directly attributable to wildfire pollution, across the 749 cities in the study. Countries with the most deaths related to wildfire smoke include Japan, with more than 7,000 annual deaths in 47 cities, Mexico, more than 3,000 in 10 cities, China, more than 1,200 in 15 cities, South Africa, more than 5,200 in 52 cities, Thailand, almost 5,300 in 62 cities, and the United States, with almost 3,200 annual deaths in 210 cities relating to airborne wildfire. The study

says wildfire smoke also contributes to suicide, diabetes, renal diseases, and other conditions. To get a better sense of the most vulnerable populations, the study authors recommend that new research include mortality data by age, gender, and other factors.



## RESEARCHERS RECOMMEND PRESCRIBED BURNS

Prescribed burns may help researchers predict and reduce the severity of future wildfires in the western United States, according to researchers from Penn State and the U.S. Forest Service. Alan Taylor, professor of geography and ecology and interim director of the Earth and Environmental Systems Institute at Penn State, told the Penn State News that prescribed fires during favorable conditions may reduce higher severity fires in the future. "Thinking about the fire problem broadly, one of the proposed solutions is to increase the use of prescribed fire and to use wildfires burning when conditions are favorable to reduce the potential for severe canopy replacing fire over time," Taylor said. Researchers analyzed 106 fires, then used computer models to predict fire severity and identify the main drivers of the fires; they reported their findings in the journal *Ecosphere*. The researchers found that weather and fuels had the largest impact on fire severity in non-reburns. The intensity of reburns, on the other hand, largely mirrored the intensity of the previous fire. "Our research suggests that if you want to have good outcomes over the long-term, you want the first fire activity in these forests to be in moderate weather conditions — not so hot, not so dry, not so windy — because this will maintain lower-severity fire conditions in future reburns," Taylor said. "It's really pointing us to the conditions in which we would encourage prescribed fires or wildfires to burn. These practices will help us achieve and maintain less-severe fire conditions over time."





## BRITISH COLUMBIA GRATEFUL TO MEXICAN FIREFIGHTERS

A group of 100 firefighters from Mexico returned home in early September from the Okanagan Valley in British Columbia, where they had been protecting communities from wildfires. "The BC Wildfire Service wants to extend a heartfelt thank you to the 98 firefighters and three support personnel who deployed from Mexico this summer to help manage the wildfire situation in B.C.," BC Wildfire Service wrote in a Facebook post. The firefighters arrived July 24. "Their work this wildfire season has been invaluable to this organization and all British Columbians affected by wildfires," BC Wildfire said. Mexican firefighters lived and worked in operational "bubbles," the province said in the days preceding their arrival. The firefighters came to B.C. through requests for out-of-province assistance made through the Canadian Interagency Forest Fire Centre (CIFFC). There were 209 wildfires burning in B.C. in early September, but there had been 1,584 wildfires since April 1.



## MANITOBA THANKS SOUTH AFRICAN TEAM

The province of Manitoba has experienced its most severe wildfire season since the record-setting season of 1989. Almost 450 wildfires and more than 1.2 million hectares burned across the province this season. More than 4,000 Manitobans were evacuated from seven First Nations and three northern communities throughout the season, and two communities in eastern Manitoba remain evacuated while work is underway to restore power. In a press release Sept. 15, the Manitoba government thanked firefighters from other jurisdictions that came to assist the Manitoba Wildfire Service, including a large contingent from South Africa, and all the local crews who have tackled one of the

worst wildfire seasons in the province in recent years. "As Manitobans, we say thank you to everyone who answered the call for assistance as wildfires raged across our province due to the extremely dry conditions this summer," said Conservation and Climate Minister Sarah Guillemard said today. "Just as Manitoba has sent firefighting crews to help in other provinces and other countries such as Australia in 2020, this year was our time to request the support of others. South Africa will forever hold a place in the hearts of Manitobans and be remembered as an international partner that we can count on should the need arise again in the future." Organized through the Winnipeg-based Canadian Interagency Forest Fire Centre, Manitoba received significant mutual aid assistance from across Canada in the form of personnel, aircraft and equipment under the CIFFC Mutual Aid Resource Sharing Agreement. Included in the support were 120 wildfire-trained military personnel, other Canadian crews and equipment, and the special contingent from South Africa. The group of 109 men and women of the South Africa contingent arrived in Manitoba on Aug. 11 and was deployed to the large collection of fires known as the Loon Straits complex and to fires near Sherridon, Flin Flon and Snow Lake. The minister noted these firefighters were welcomed to the communities and brought professionalism and dedication to their jobs, as well as great team spirit shown through their colourful marching, chanting and singing at Richardson International Airport in Winnipeg upon their arrival, and when moving through the communities where they were deployed.



## THERAPY DOGS ARE FIREFIGHTERS' BEST FRIENDS

A growing number of therapy dogs are stationed at wildfire base camps in California, providing firefighters with a much-needed distraction from their work. "You guys are really amazing

for setting up this therapy dog thing," said a Sept. 7 Instagram post by @firstrespondertherapydogs, quoting one firefighter. "I sometimes feel the pressures of being over worked and sometimes it's hard for us out here on the lie. I think wildland fire is finally understanding the depression or sadness that sometimes comes with long hours and being away from loved ones." A story by NBC News featured several therapy dogs at the Caldor Fire. "Everybody loves the dogs. It doesn't matter what's going on. Having a dog around, you can see grown men, they turn into little kids again and get super excited," said firefighter Ricardo Tlapala. First Responder Therapy Dogs is a non for profit group that lends emotional support to first responders with the help of therapy dogs. Founder Heidi Carman said she and her dog Kerith see when they are tired and vulnerable. "This one Cal Fire firefighter, she saw Kerith, and she was probably so exhausted, she just broke down and cried," Carman said. "It was happy tears, but she was just crying and burying herself in Kerith. "When they're petting Kerith, they'll tell me how they're missing home and they're missing their families and they're missing their dogs."



## CREWS WRAP SEQUOIAS TO PREVENT DAMAGE FROM FIRE

California fire crews were getting the Giant Forest ready in mid-September before the KNP Complex Fire reached the famous grove of ancient trees. Crews applying structure wrap on some of the iconic monarch sequoias that characterize the most famous area of Sequoia National Park. The wrapping can withstand high temperatures for short periods. It has been used for years to protect sensitive areas from wildfires. Crews are also removing fuel. The complex comprised two wildfires; the Paradise Fire and the Colony Fire.



## IAWF MEETS WITH TOP U.S. OFFICIALS

On Sept. 9, president Toddi Steelman, executive director Mikel Robinson, and past president Tom Zimmerman participated in a video conference with Meryl Harrell, deputy under-secretary for Natural Resources and Environment for the US Department of Agriculture, on behalf of the association and our members. Also in attendance were Chris French, US Forest Service deputy chief, National Forest System, and Mary Snieckus, US Forest Service. Meetings such as this are conducted whenever possible to discuss important wildland fire management issues with national leaders, encourage attention, and discuss mutual support. During this call, IAWF personnel provided background information on our organization, our activities and products, how we support wildland fire management, and how we support wildland fire organizations. Wildland fire management topics of concern mentioned included diversity and inclusivity, conference attendance and continuing education, firefighter pay equity and staffing, climate change, prescribed fire and fuel treatment, and fire research budgets. Much of the discussion focused on IAWF's belief in the importance of and continued support to the National Cohesive Wildland Fire Management Strategy and implementation. Harrell has graciously agreed to be a keynote speaker for the 4th National Cohesive Strategy Workshop Oct. 4-8, and some discussion involved her presentation and areas of interest to participants. As the available time was short, written materials on all these topics were provided to the under-secretary and her staff for further review, and the IAWF participants enthusiastically agreed to any follow-up conversations as needed.



## AWARDS NOMINATIONS OPEN

The nomination period for IAWF's 2022 awards opens Sept. 23 and runs through Dec. 2. IAWF strongly encourages members to consider friends and colleagues who have excelled in research and management as potential award recipients. If you have nominated someone in the past who did not receive an award, consider nominating that person again! There are four awards: the Ember Award for Excellence in Fire Research; the Firebreak Award for Excellence in Fire Management; the Early Career Award in Fire Science; and the Early Career Award in Fire Operations. Visit [iawfonline.org/awards](http://iawfonline.org/awards) for details and nomination forms.

## NEW IAWF PRESIDENT BEGINS TERM JAN. 1



IAWF board member Joaquin Ramirez has been elected incoming president; he begins his term Jan 1. Ramirez is a wildland fire technologist who has been working for 25 years to bridge the gap between scientists and end-users. In 2013, Ramirez moved from Spain to San Diego, where he works with agencies worldwide trying to convert science into actionable tools. Ramirez is the creator of several of the most advanced fire behavior software model implementations and decision support systems, including the Wildfire Analyst and fiResponse software tools. From 2011, Ramirez coordinated the first European M.S. in Forest Fires ([www.masterfuegoforestal.es](http://www.masterfuegoforestal.es)) with colleagues at Prof. Rodriguez y Silva (University of Cordoba, Spain) and Prof. Molina (University of Lleida). Ramirez is also a founder and active member of the Pau Costa Foundation. He earned his PhD in remote sensing and GIS at the University of Leon in 2003, an MS in forestry from the University of Lleida, and his BS in forest engineering from the Polytechnical University of Madrid, Spain. IAWF board members celebrated Ramirez's election as president during their monthly meeting in August. Ramirez was both humbled and delighted by the faith his peers have in him to carry out the duties of president.

## TWO CONTINENTS, TWO CONFERENCES

Start planning now for the IAWF Fire & Climate conference in 2022. There are two segments: May 23-27 in Pasadena; and June 7-9 in Melbourne. Our conference page is up and running at <https://fireandclimateconference.com>, and the call for speakers is open. Information for exhibitors sponsors, volunteers will be available shortly. Fire and Climate 2022 will bring attention to one of the most important forces shaping wildfire, and better prepare how we can focus and respond to this formidable challenge in the new decade. Recent fires in North America, Australia and across southern Europe highlight the challenges we face as a global wildland fire community. These events are not isolated, nor are they confined to traditionally fire-prone countries. Greece, Bolivia, Chile, Israel, Greenland, Russia, Canada, Spain, and Portugal are among other countries facing similar challenges. This conference will feature insights, case studies, innovations and opinions from around the world to begin to form a collective, global approach to the wildfire challenge. California has been



at the forefront of innovation in wildland fire management and holding a conference in California to fully leverage the lessons learned and adaptive behaviors that will continue to emerge after the Camp Fire will benefit the entire international wildland fire community. The cascading impacts from fires, the cumulative effects from successive wildfires, and the ability to be resilient in the face of these challenges are a call to the wildland fire community to think smarter and faster, and entertain novel ideas to prepare for, respond to, and recover from these events. Wildfire is a wicked problem and demands that we address the complexities that contribute to the social, biophysical and design elements that contribute to present-day dilemmas. An international gathering that encompasses the entirety of the wildland fire community will help us address these complexities. This conference will merge the topics that the IAWF has established over three decades through its regular suite of conferences including the Wildland Fire Safety Summit, Human Dimensions of Wildfire, and the Fire Behavior and Fuels conference. These include the interdependent effects related to human-built infrastructure, land use and housing patterns, insurance availability and viability, air quality and smoke management, community

safety, public warnings, combined effects of climate change and fire on values such as biodiversity, carbon storage, water yields and quality, supply of timber, infestations and drought, impact on private businesses and property tax base rising cost of emergency response for federal agencies and states / provinces, as well as the looming financial threat to counties and municipalities, long-term land-management approaches, wildfire response, changing fire behavior and suppression, an firefighter workforce safety, care and well-being. Harvesting experiences, sharing lessons learned, and anticipating how to address the unforeseen challenges that await, create a pressing need for us to convene an all-hands international conference.

INTERNATIONAL ASSOCIATION OF WILDLAND FIRE  
**Fire&Climate**  
 IMPACTS, ISSUES & FUTURES  
 MAY 23-27, 2022 | PASADENA, CA, USA  
 JUNE 7-9, 2022 | MELBOURNE, AUSTRALIA

## STOPPING THE DESTRUCTION BY WILDFIRES STARTS NOW.

The relentless tally of losses makes it clear the US is facing a significant wildfire problem. Without a new approach, we are destined for more unmanageable loss of life and property.

**OUTTHINK WILDFIRE™** lays out five key policy changes that need to be made at all levels of government to dramatically reduce the devastation caused by wildfire. Through collaboration that begins with policy implementation, we can pursue a course of action that will better protect our communities.

Visit [nfpa.org/wildfirepolicy](https://nfpa.org/wildfirepolicy)  
for resources and information.



**OUTTHINK  
WILDFIRE**  
WILDFIRE ACTION POLICIES



# PARTNERSHIP

AFE, IAWF SHARE COMMON GOALS FOR  
DIVERSITY, EDUCATION, CO-OPERATION

BY CHRISTOPHER DICUS

I will soon step down as president of the Association for Fire Ecology (AFE) after serving for four wonderful years, handing the reins over to US Forest Service research landscape ecologist Paul Hessburg. As I consider the 15 years I spent on AFE's board, I am incredibly pleased that AFE and the IAWF have maintain a mutually beneficial relationship through the years. Indeed, many on the AFE board of directors are also members of IAWF and regularly attend its conferences. Both associations work tirelessly to support the wildland fire community, and because each has had unique initiatives and focuses, wildland fire professionals across the globe have been rewarded with a larger breadth of knowledge to best manage undeveloped lands than could have been provided by a single organization.

Like IAWF, AFE has long understood that we must cultivate a continuous pipeline of passionate, well-informed students because the world will continue to be confronted by increasingly complex wildland fire problems. These future fire managers and scientists must have the knowledge, skills, and abilities to change the unfortunate course that we as a society seem to be on at present. Given the large global wildfire challenges, both organizations have key contributions to make to supporting the fire community and it continues to be imperative that both associations work together toward the collective good of both memberships.





AFE, which includes membership on every continent except Antarctica, is focused on building and supporting the diverse community of wildland fire ecologists and managers. Its genesis occurred in 1997 when a group of six researchers and land managers first met at the University of California – Davis. The original intent of this group was to simply form a community that shared a common interest in fire ecology. From this initial meeting, a simple goal of founding a fire ecology working group was formed, which was called the California Association for Fire Ecology (CAFE).

As CAFE continued to meet and discuss fire issues and concerns of the day, it partnered with UC–Davis to take the message of science-based fire management to the masses. To that end, the partnership initiated a series of annual conferences held in San Diego beginning in 1997 that deliberated a diverse array of topics, including fire ecology, management, technology, policy, and others.

Further, CAFE initiated a series of short-courses open to the public in 1998 that aimed to provide a nexus between fire scientists and the land managers who could implement the very principles and best practices that their research had uncovered. Unfortunately, while a great deal of interest was generated, attendance by land management agencies was low, and it was decided to discontinue the sessions after only two years due to the enormous amount of work required, which was provided exclusively by CAFE volunteers.

From these early efforts, which exceeded expectations by most, the loosely knit CAFE working group resolved to create a formal, legal non-profit organization that included officers, bylaws, and board of directors. This result was the creation of the newly named Association for Fire Ecology in 2000.

## PROMOTING FIRE RESEARCH

Like IAWF, AFE has from its beginning promoted science-based fire management to facilitate healthy, resilient ecosystems. To that end, in 2000 the newly formalized AFE partnered with IAWF, Tall Timbers, the Joint Fire Science Program, and the Nature Conservancy to hold the First National Congress on Fire Ecology, Prevention, and Management. Purposefully intended to be of interest to a broad audience, the Congress garnered more than 1,200 attendees from 25 countries, which to date is still the largest meeting ever sponsored by AFE.

Following the success and momentum of the 2000 Congress, subsequent international congresses have been held every two to three years, alternating between sites in the western and eastern United States. At every conference, complimentary registration is now provided to a number of local fire managers to better inform their land management strategies, as well as to better inform scientists of managers' needs.

In 2005, AFE established the journal *Fire Ecology* to broaden the fire-focused scientific literature. In 2005. The new refereed journal was intended to complement IAWF's *International Journal of Wildland Fire*, which at the time seemed by some to focus more on fire management (versus fire ecology) issues. To make sometimes complex science more assessable to a broader audience, current Journal editor Bob Keane recently initiated a series of light-hearted, but informative podcasts that focus on specific manuscripts that have recently been published, which can be found on the AFE website (<https://fireecology.org>).

In addition to the Journal, AFE also published the textbook *Fire in California's Ecosystems* in 2006. Now in its second edition, the text is regularly used in numerous university courses outside of California because of its applicability to a large array of ecosystems and subdisciplines such as impacts of climate change and fire behavior.

Members of the Cal Poly Student Association for Fire Ecology (SAFE) chapter on a prescribed fire on the Los Padres National Forest. SAFE was established in 2000, at the time the AFE was being formalized, with a goal to effectively understand and manage wildland fire. AFE is now recognized at 21 universities and organizes events at all AFE conferences.

PHOTOS COURTESY OF CHRISTOPHER DICUS

## PROMOTING FIRE EDUCATION

At the time that AFE was being formalized, a diverse group of students from UC–Davis and UC–Berkeley established the Student Association for Fire Ecology (SAFE) in 2000.

While myriad academic disciplines were initially represented, all shared a common goal of effectively understanding and managing wildland fire. SAFE is now officially recognized at 21 universities across the United States and organizes events for fellow students at all AFE conferences.

To facilitate SAFE's work, AFE annually awards grants to SAFE chapters to fund equipment and travel that facilitates real-world experience with prescribed fire and other activities. Additionally, because AFE wanted to acknowledge and empower future leaders in wildland fire, SAFE now has a seat with voting privileges on AFE's board. SAFE's insight has proven invaluable to discussions about potential initiatives that further the wildland fire community. AFE has also recently initiated a new official mentoring program that matches student (and new professional) applicants with long-established fire professionals based upon common interests. The mentoring program is intended to provide young professionals with insights on how to best navigate a successful career focused on wildland fire.

With increasing focus (and subsequent jobs) becoming available in the wildland fire realm, AFE recognized a need for fire ecologists and managers to be acknowledged for their distinctive skill sets. To that end, AFE formalized a Wildland Fire Certification program in 2011, which includes various types of certifications for both managers and scientists who focus on wildland fire and fuel management, the level of which is based on previous education and professional experience. It has been interesting to witness some recent job postings that have specifically listed AFE certification as evidence of an applicant's qualifications.

The AFE has a burning desire to better the wildland fire community, in partnership with IAWF and other like-minded organizations.



The initial AFE board retreat held in 2000 at Yosemite National Park, which included four current and future presidents.

In addition to individual certification, AFE also recognizes nine universities in the United States that meet educational standards in various subject matter areas germane to wildland fire. Graduates from these programs are automatically entitled to obtain individual certification at the entry level.

Because of the historic lack of university programs focused on wildland fire (which is happily increasing), the certification program now recognizes certain agency-sponsored courses as meeting educational requirements for individual certification. Further, because certification has historically focused on the educational system in the United

States, discussions are underway to formalize pathways for certification in other areas of the world.

## FUTURE ASPIRATIONS

As I step down from AFE's presidency, I look forward to observing the continued good will and partnerships between AFE and IAWF. To that end, both associations have designated official liaisons who attend board meetings of the other association. These positions have been extremely beneficial to both organizations because the liaisons share lessons learned for similar types of initiatives and best practices for certain types of events. Further, the liaisons notify the other association of upcoming plans so as not to step on the toes of the other in terms of scheduling.

A primary goal during my presidency was to increase international participation in AFE. To that end, the AFE board elected 50 per cent of our executive board from



outside the United States (Spain and Mexico). Further, we continue to plan (in partnership with the Pau Costa Foundation) for a conference to be held in Florence, Italy, in fall 2022 to meet the needs of our European colleagues. While COVID-19 has frustratingly delayed the meeting for two full years, we are fully committed to having our first conference in Europe and hope to do similar meetings on other continents.

We also aspire to have a greater presence with fire managers who are doing the good work on the front lines, for whom much of the science is geared. While we hope to guide management with sound science, it is imperative that management guides scientific efforts to be relevant in an increasing complex world.

Finally, I hope both associations continue to diversify their memberships, in terms of not only gender, ethnicity, and nationality, but also personal philosophies. In a world that is increasingly divided (and regrettably hostile to opposing views), both associations should aspire for their membership to enjoy a feeling of belonging regardless of their personal worldview and not just fit in, the latter of which necessitates people to modify their identities to feel accepted by their peers. Indeed, members in both associations (and society in general) would benefit from an increasing sense of mutual respect, even when our personal views differ on a given subject.

## ABOUT THE AUTHOR

Chris Dicus is a professor and co-ordinator of the Wildland Fire and Fuels Management Program at California Polytechnic State University. Dr. Dicus is the current president of the Association for Fire Ecology (having served on the board since 2006) and is also co-ordinator of the Wildland Urban Interface Module of the California Fire Science Consortium. His research focuses on the wildland urban interface and how fuel treatments impact potential fire behavior and ecosystem services. Dicus obtained his B.S. in forestry-wildlife from Louisiana Tech University, an M.S. focusing on fire ecology from Utah State University, and a PhD focusing on silviculture from Louisiana State University. He is a certified senior wildland fire ecologist and a California-registered professional forester.



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# CLIMATE CRISIS

## IAWF CALLS FOR ACTION

*In May 2022, IAWF will host a global conference on climate and wildfire, in the United States and Australia. In anticipation of this important event, IAWF, under the leadership of past president Alen Slijepcevic, has created a position paper on climate change. We invite our membership to comment on the paper by submitting feedback to [info@iawfonline.org](mailto:info@iawfonline.org) as we continue to refine it and produce a clear statement on IAWF's position in advance of convening next year. Our goal with the paper and the conference is to create conditions for discussion, reflection, sharing and networking as we consider the impact climate change is having on wildfire preparedness, response and recovery worldwide. NOTE: This version of the climate paper has been condensed slightly and the citations removed, for magazine publication only. To see the full version, visit [www.iawfonline.org](http://www.iawfonline.org)*

Climate models predict drying and warming trends in many parts of the world; this is likely to exacerbate wildfire risk, the likelihood of fire, and extreme fire consequences. In many cases, fire seasons will lengthen, become more extreme and extend into landscapes previously unaffected by wildland fires. This will increase the risk to the health and safety of firefighters, the community, the environment, industries and the economy.

This IAWF position statement articulates the impact of climate change on the wildland fire community and the challenges IAWF must address.

### Human-induced climate change and the risk

Evidence of the warming of the climate system is unequivocal and the human contribution to the climate system is clear. Rising global average temperatures are altering global weather patterns, resulting in more frequent and intense extreme weather events such as heatwaves, droughts, and large storms. These changes will impact health, economies, livelihoods, infrastructure, and societies.

For instance, smoke from wildland fire is an unhealthy pollutant that statistically increases hospital visits for respiratory and cardiovascular symptoms, heart failure, pulmonary embolism, ischemic stroke, and death.

### Climate, weather and fire

Climate change is increasing the frequency and severity of fire weather. Fire seasons around the globe are starting earlier, resulting in longer fire seasons. In addition to longer fire seasons, fire weather is becoming more extreme, with many regions experiencing a significant increase in the number of high fire risk days. The conditions behind the Australian fire season of 2019-2020 (Black Summer) were at least 30 per cent more likely to occur than a century ago due to climate change, and the risks of a similar event would rise four-fold if the increase in global temperatures exceeds 2 C.

Warmer conditions have also been shown to result in more lightning-caused fire ignitions due to the combination of more ignitable fuels and more thunderstorms. Along with an increased risk of ignitions, a study focusing on the United States found that for every degree of warming, a 12 per cent increase in lightning occurrence is expected.

These trends in fire weather are likely to continue with an increase in severity driven by hotter, drier conditions. In some areas, the occurrence of extreme fire weather days is expected to triple. There are also likely to be more dangerous fire conditions for communities and firefighters, with studies indicating climate change could amplify the conditions associated with pyrocumuliform (PyroCu) and pyrocumulonimbus (PyroCb) development which can result in fires generating their own lightning, wind and rain, and feeding back to longer-term climate systems.



## Fire regimes, ecosystem change and fuel management

Fire is a natural and necessary component of ecosystem processes that stimulates regeneration, inhibits fuel accumulation, and helps to maintain the mosaic complexity and ecosystem diversity on landscapes.

Climate change is shifting fire regimes through its influence on weather, ignitions and fuels. Altered temperatures and rainfall patterns are changing the composition and distribution of vegetation, resulting in different fuel patterns and greater vulnerability of ecologically sensitive communities.

Additionally, changes in climate will make it more difficult, operationally unfeasible, or impossible to implement controlled burns that are vital for ecological, economic, cultural and public safety purposes. In certain regions of the world, prescribed fires must be frequent. Losing the ability to use controlled burns looms in the face of the great strides made in preserving and restoring the culture of prescribed burning and in embracing the many benefits of fire.

The absence of fire in parts of the world has led to an increased accumulation of fuels, and weather and climate exacerbates this situation. Further, maintaining biodiversity is challenging when tolerable fire intervals for species and ecosystems are compromised, and particularly when flora and fauna are further threatened by climate changes that exceed their natural environmental constraints. Climate-driven changes in fire regimes, compounded by other socioecological and spatiotemporal dynamics, appear likely to accelerate species extinctions and could cause collapse of ecosystems. Gradual changes in climate over geologic time scales allows organisms time and space to shift in latitude and elevation and to evolve, and gives certain species, including humans, time to adapt. Even if current climate change were slow, fragmentation of landscapes by human activities now blocks corridors that some species could use to shift their ranges. Rapid changes in climate limit the range and the time-frame of options that may be taken by society to avoid further impacts.

It is now widely accepted that vegetation management, including prescribed burning and the use of wildland fire to meet land management objectives, can mitigate the risk of negative impacts to human communities, economies, critical infrastructure, watersheds, and valuable natural and cultural resources. An increase in the application of prescribed burning in some regions will necessitate multiple agency interactions (for example, wildland fire and air-quality agencies), to balance the risk of poor air quality, with the risk to air quality and health, under conditions in which prescribed fire is inhibited. Social science can help advance the understanding of the barriers and opportunities to prescribed fire, including those for landowners and the public.

Prescribed burning and wildland fire used under prescriptive conditions can reduce future potential fire behavior, increase the potential success of containment efforts, and maintain and improve the health and resiliency of ecosystems. These treatments can be completed at scales ranging from small site-specific projects of less than 50 hectares to large landscape treatments totaling more than 50,000 hectares, with a treatment range from single to combinations of treatments, and single to multiple applications over several years. Treatments must be carried out over multiple jurisdictional boundaries and must possess significant political and social demand for the expanded use of wildland fire to adapt to climate change's immediate presence.

## Wildfire management

Globally, wildfire managers strive to and are expected to reduce risk to communities, protect assets and critical infrastructure, and ensure the safety of firefighters. Managers are expected to accomplish these goals even while fire seasons are lengthening, there are more lightning-caused fires, more flammable environments, and fire weather conditions are becoming more extreme; all these variables are expected to worsen under climate change. Furthermore, there is a more complex wildland urban interface, including differences in flammability and fire transmission in urban areas compared with areas that are mainly rural. Fire incident management in turn becomes more complex as more jurisdictions are affected and costs rise. Globally, those with the fire expertise face intense public scrutiny for their decisions, as well as uncertainty from changes in responsibilities and exhaustion from constant fires.

Parks Canada ops section chief Reade Terek keeps an eye on the Nk'mip fire in Oliver, British Columbia, at 2200 hours. Crews struggled with the fire behavior, as it was very volatile at night as well as during the day, which, in Canada, is generally not the case but was seen all over B.C. in the summer of 2021.

PHOTO BY JANE PARK



In summary, some of the likely impacts and implications of climate change for wildfire and land management services, and the communities they protect, include:

**WEATHER** – changes in the frequency, severity and complexity of extreme weather that directly lead to cascading wildland fire extremes, extended fire seasons, and related events (e.g., post-fire debris flows, flooding).

**CLIMATE** – changes in the seasonality and latitudinal position of previously typical climate, and the arrival of new and different extremes, which affect both ecosystems and fire regimes.

**HEALTH** – increasing exposure and vulnerabilities of communities, including the impact of smoke on firefighter and public health, and an increase in health care costs associated with large and long duration wildfires.

**ORGANIZATIONAL COMPLEXITY** – growing number of jurisdictions impacted which challenges the ability to co-ordinate among multiple local, state, provincial, federal and national responders.

**ECONOMIC COSTS** – increasing suppression costs of wildfires including the primary, secondary and tertiary impacts on private and public property, infrastructure, businesses, and air quality and health.

**RESOURCES** – increasing pressure on land and fire management agency resourcing due to longer fire seasons, and more frequent and severe events.

**RISKS** – increasing health and safety risks for staff and volunteers, including heat stress, fatigue and mental health due to less time for recovery between severe seasons.

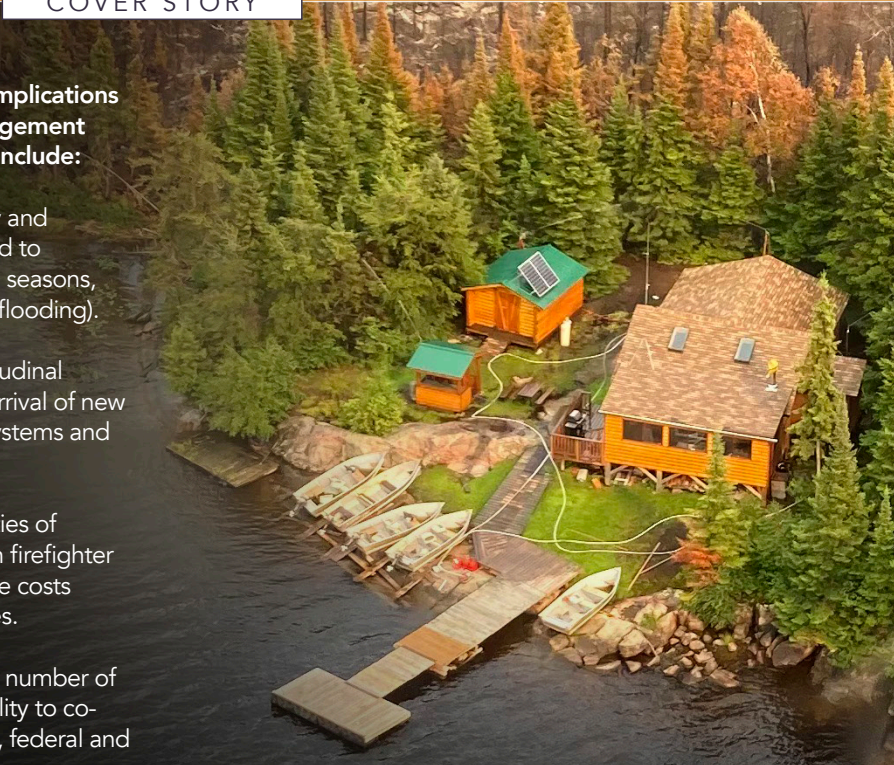
**LEGAL** – Greater risk of litigation due to increased complexity of jurisdictional involvement and land ownership.

**SAFETY** – Increased stress on community preparedness (including mitigation) and controls, such as building codes (local and regional influences) and land-use planning to respond to what is needed to keep the community safe.

**SUPPORT SYSTEMS** – supply chain vulnerabilities creating shortages of equipment and logistical support to land and fire managers.

**ECOSYSTEM DAMAGE** – adverse outcomes to ecosystem flora, fauna, and services, due to climate-change driven variations in fire regimes, temperature, and rainfall.

**WATER** – threats to water supplies (both for domestic use and firefighting) and post-fire effects (e.g., impact on water yield and quality, debris flows).



The planet faces more extreme, more frequent and longer fire seasons, which will affect service delivery unless clear adaptation plans are created and implemented. Fire and land management organizations, government departments, and jurisdictions have an obligation to reduce their contribution to greenhouse gas emissions, therefore mitigation plans also need to be developed by all levels of government and businesses.

### Calls to action

The vision: IAWF seeks to safely and effectively extinguish wildfires, when necessary; to use prescribed and wildland fire when possible, to meet protection and land and resource management objectives; to manage natural resources through progressive fuel reduction to increase landscape resilience; and to create fire adapted communities that can accept shared responsibility for addressing how to co-exist with smoke and wildland fire.

**To achieve this vision, the IAWF proposes three actions:**

- Identify ecosystems most at risk to large, high-severity wildfire
  - Prioritize landscapes that are at the greatest risk for treatments and mitigation measures to withstand future change in fire regimes in accordance with climate, land and resource management objectives.
- Identify and enhance fire-adapted communities
  - Develop public understanding of the overarching long-term benefits of fire on the landscape to mitigate potential risks, and the necessity for prescribed, controlled and Indigenous burning, as well as wildfire, based on both qualitative and quantitative cost-benefit analyses.





Fire #96 at Eardley Lake on the east side of Lake Winnipeg in Manitoba, in mid-July. There were more than 440 wildland fires in Manitoba over the summer. The Manitoba government said in its Aug. 27 briefing that the 2021 wildfire season was unprecedented. PHOTO BY ZEKE MCLEOD

- **Foster safe and effective interagency wildfire response**
  - Formulate and implement safe, effective, efficient risk-based wildland fire management decisions, in co-ordination with multiple agencies across all jurisdictions.

The IAWF proposes these three calls to actions in the context of the following broader global influences.

### **Increase prescribed burning**

IAWF will advocate for increased support, training for, and application of prescribed fire globally by public, private and non-profit partnerships. To accelerate understanding of the role of climate change on fire regime change and the essential role of prescribed burning, the IAWF continues to support the need for extensive research and modelling to forecast the changes in vegetation as a result of reduced or increased rainfall, increased temperatures, prolonged droughts, and changes in fire regimes, especially those that result in increased fire severity and frequency.

The IAWF adopts an ecosystem approach to create greater effectiveness and efficiency in treatments over larger landscapes, regardless of jurisdiction. The IAWF acknowledges and supports the role that Indigenous peoples have in undertaking cultural and traditional

burning for a range of purposes associated with caring for land, including promoting revegetation, producing food and game, and maintaining spiritual connection to the land. IAWF encourages land and fire managers and Indigenous Peoples to be better engaged and learn from each other about the application of fire.

### **Promote shared responsibility for safer community preparedness, response, and recovery**

IAWF recognizes and accepts wildland fire as a natural process necessary for the maintenance of many natural ecosystems, and endeavors to inform, educate and work in partnership with communities living in and next to fire-prone landscapes to reduce risk. By accepting the natural role of wildland fire in the landscape, and the ability of communities to plan for and adapt to living with wildland fire and smoke, mitigate the risk of large damaging fires, and the need to be prepared to respond to fire when it occurs, the IAWF will promote an all-inclusive approach to the future of wildland fire management with an emphasis on a shared responsibility by all stakeholder organizations, provinces, states, localities and the public, rather than create reliance on services provided by all levels of government.



A large wildfire at night, with bright orange flames and thick black smoke rising into the dark sky. In the foreground, two firefighters in full protective gear are visible, one standing and one crouching, managing the fire. The background shows silhouettes of trees and a large, fallen log. The overall scene is dramatic and intense, with the fire's glow illuminating the surrounding area.

**With an increase of wildfire activity into the future, all local, state, provincial and national agencies will need to accelerate development of their future workforces to build capacity for wildland fire management.**

In its broadest sense, shared responsibility is about negotiating a new social contract for wildfire preparedness, management and recovery through which governments and communities agree on how rights and responsibilities are allocated. Land-use and critical infrastructure planning begins at the local level and will need to be improved to make communities more resilient to wildfire impacts under climate change. Educating the public about the necessity for more resilient landscapes and infrastructure is a necessary first step. Building practices, codes and standards will need to be improved to make structures withstand higher levels of fire intensity; this process will need to be motivated at the local level.

An effective shared responsibility between agencies and communities will result in reduced need for extensive suppression activity in and near communities while leading communities to safely co-exist with wildfire. Knowledgeable, engaged communities in partnership with local and regional agencies would act to mitigate threats from wildfire to housing, infrastructure, cultural resources, valued landscapes, watersheds, timberlands, pastures, and the surrounding ecosystem.

### **Reimagine and invest in the wildland fire management workforce and systems**

With an increase of wildfire activity into the future, all local, state, provincial and national agencies will need to accelerate development of their future workforces to build capacity for wildland fire management. IAWF will work to promote a new model for workforce development that replaces the traditional model of slowly, deliberately building skills and experience over several decades, which is now obsolete.

IAWF will continue to advocate for more frequent support within and among countries and continents for wildfire response. The opportunities should include prescribed fire for mitigation, which is likely to require a workforce with a different set of skills. For the past several decades, wildland fire suppression has relied heavily on the use of a force that overwhelms the fire. The magnitude of the overwhelming force for wildfire suppression – planes, helicopters, tankers, trucks and more – may have grown to the point where it is unsustainable, and the fire management community needs a more nuanced approach that does a better job of working with fire and ecosystems rather than working against them.

As wildfire and smoke impacts grow in their complexity, so does their management. IAWF will advocate for adaptation of the current wildland fire governance and management systems to adapt to the changing conditions under climate change. As wildfires grow in size, they cover more jurisdictions, necessitating the co-operation and collaboration of local, state, provincial, and national responders from the public, private and non-profit

PHOTO BY KATHLEEN CAHOON

Members of the Bighorn Unit crew during night operations on the Sparks Lake wildfire on July 17, 2021. As of Sept. 9, there had been 1,578 blazes recorded in the province. More than half – 891 of them – were believed to have started by lightning.



sectors. Safe and more effective fire management means creating fire management structures that can take into consideration this growing response network of personnel and adapt to accommodate these integrated responses.

### **Invest in and promote research, science, technology, and policy**

IAWF promotes the position that fire management strategies, plans and activities need to be based upon the best available science and made publicly available to communities and elected officials. Further investments in technology could also help advance progress to mitigate, adapt and recover from wildland fire. The purpose of technology is to enable the effective sharing of data and support personnel and organizations to be more innovative, safe, and efficient. The role of technology is to make fire fighting better, improve communication, situational awareness, safety, and mitigation. A key role for IAWF is to ensure that this knowledge, research, science, and experience is widely shared among our wildland fire community.

IAWF advocates for an active fire research program combined with international and interagency collaboration to share information with fire managers, communities, and governments to stimulate sound science policy that drives fire management. Research is an enabler for all of the previously listed action areas and should be continuously supported so that decisions are driven by the best available science and expertise is available when needed. Governmental agencies need to co-invest with the private sector and research providers to accelerate development of better technologies and tools from modelling, artificial intelligence, robotics, respiratory protection, safety equipment and clothing, building materials and designs, and virtual reality. IAWF commits to creating venues for sharing research, knowledge and technology.

### **Create opportunities for continuous improvement and adaptive management**

IAWF supports the need for more nimble adaptation among our community to the rapidly changing conditions we face. IAWF will provide opportunities for our community to gather the diverse stakeholders invested in creating a

more sustainable wildland fire paradigm so that we can reflect on, reconsider, challenge and adapt our current policies, processes, and procedures to the evolving realities under climate change.

We must get smarter, faster to address the considerable challenges climate change poses to the wildland fire community. Land and fire management agencies, business, and communities must learn together, so that they can respond to changes faster and achieve better outcomes. Adaptation takes effort and time. Achieving adaptive behaviors will depend on deliberate investment in improvement, adaptation and learning across the community and agency workforce. Making changes through learning must become routine, not just something that happens after disasters.

### **Our commitment**

IAWF will continue to provide opportunities for research, knowledge and experience sharing through its conferences, webinars, workshops, Wildfire magazine, newsletters and the International Journal of Wildland Fire (IJWF), with a focus on science, knowledge and best practices in relation to how wildland fire and those who work in fire and smoke research, or wildland fire management can adapt to and mitigate the impacts of climate change.

IAWF will continue to take a position on contemporary wildland fire issues and advocate with national and international policy makers for improvements in wildland fire management policies in relation to climate change.

IAWF and Indigenous Peoples will work together to facilitate the exchange of knowledge and practices with other Indigenous Peoples as well as with all land and fire managers.

IAWF will continue to advocate for improved diversity in global fire management. A diverse workforce, including a variety of gender, identity, age, cultural and religious backgrounds provides superior ideas and work outputs at a time when the challenges and complexity of problems brought about by climate change require deeper thinking and progressive and deliberate actions.





# CANADA CREATES GUIDE FOR WUI FIRES

DOCUMENT PROVIDES SUPPORT, RECOMMENDATIONS

BY ALLISON MILLS AND NOUREDDINE BÉNICHOU

A need for comprehensive guidance for planners, builders, decision makers and emergency responders working in Canada's wildland urban interface (WUI) has driven the development of a national guide to enhance community protection from and resilience to WUI fires.

In the last decade, WUI fires in Canada have resulted in the loss of more than 2,400 structures, with an insured loss of C \$4.5 billion. The 2016 Horse River fire in Fort

McMurray, Alberta, was the most expensive disaster in Canadian history. When the fire spread into Fort McMurray and neighbouring communities, it destroyed almost 1,600 structures, resulting in an insured loss of C \$3.8 billion, and forced the evacuation of more than 80,000 people.

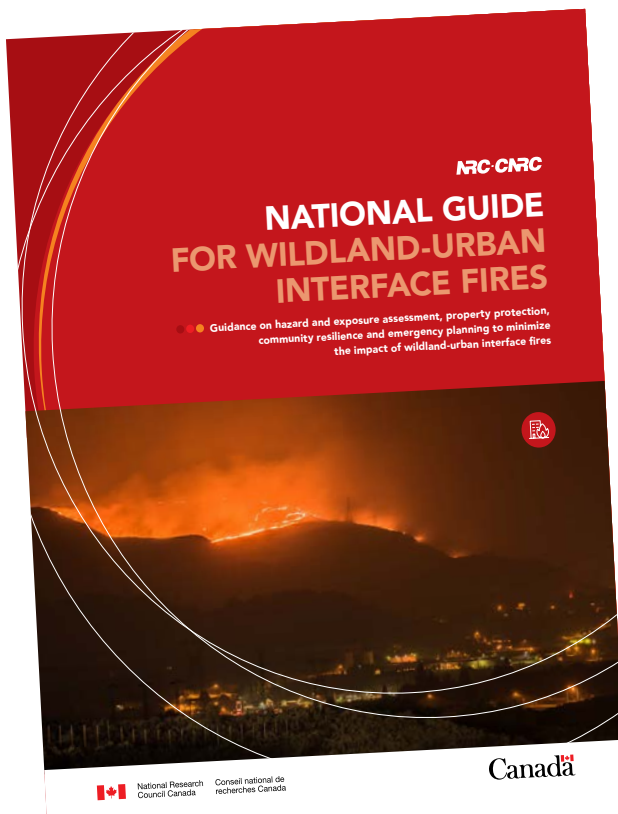
In Canada and elsewhere, the threat posed by WUI fires is growing as urban areas expand into wildlands, rural areas increase in population, and wildfires become more frequent and severe due to climate change (see Canada's Changing Climate Report at [www.changingclimate.ca](http://www.changingclimate.ca)). The risk of WUI fires is expected to increase both in regions of Canada with a long history of wildfires and in those with no such history.

## Building wildfire resilience

In 2016, the National Research Council of Canada (NRC) and Infrastructure Canada launched a five-year Climate-Resilient Buildings and Core Public Infrastructure initiative to integrate the consideration of climate resilience into building and infrastructure design, guides and codes.

Given the increasing threat of WUI fires in Canada, improving the wildfire resilience of buildings and communities has been one of the initiative's primary goals. At the outset, an NRC project team was formed to examine current practices and existing Canadian and international reference documents; the team discovered a lack of national wildfire guidance for Canada's WUI areas.

Seeing the opportunity to fill this gap, the team assembled an international technical committee of experts from government, academia, industry and consultancy to drive the development of a national guide, and established task groups to develop content. Once a draft guide was completed, the team invited stakeholders from different sectors to review and comment on its content. The team



anticipated that this inclusive development process would lead to broad acceptance of the resulting guide.

The National Guide for Wildland-Urban Interface Fires is now available for free download from [nrc-publications.canada.ca](https://nrc-publications.canada.ca) (<https://doi.org/10.4224/40002647>).

Drawing on recent wildfire research, existing codes, standards and guidelines, and new insights from international experts, the Guide provides comprehensive support for WUI areas across Canada, including recommendations on:

- hazard and exposure assessment,
- vegetation management and construction measures,
- community planning and resources, and
- emergency planning and outreach.

#### Hazard and exposure assessment

The first step in applying the Guide is to carry out a hazard and exposure assessment, which allows users to identify the recommendations that will be most beneficial.

In the Guide's assessment method, the hazard level of a location is determined from a hazard map provided by the Canadian Forest Service of Natural Resources Canada.

The hazard level, which ranges from Nil-Very Low (Level 1) to High (Level 4), takes into account regional topography, potential fuel and weather conditions, wildfire ignitions, and the possibility of extreme fire behaviour. The Guide's recommendations are intended for locations with a hazard level greater than Nil-Very Low (Level 1).

To identify recommended building-scale measures, the local exposure level also needs to be determined. The Guide provides both simplified and detailed assessment methods, which are partially based on FireSmart™ Canada's Wildfire Exposure Assessment (<https://www.firesmartcanada.ca/firesmart-resources/>). The simplified method considers local fuel conditions and the potential for ember transport, radiant heat or direct flame contact. The detailed method further considers local topographic conditions, fuel percent cover, and hazard level.

The exposure level, which ranges from Nil to High, indicates the potential for exposure to ignition sources if a high-intensity fire occurs nearby. The Guide's building-scale measures are intended for buildings with an exposure level greater than Nil.



**"Given the increasing threat of WUI fires in Canada, improving the wildfire resilience of buildings and communities was one of the initiative's primary goals."**

## Vegetation management and construction measures

The exposure level is used to determine which of the vegetation management and construction measures outlined in the Guide are recommended for the WUI fire protection of a particular building.

The vegetation management measures include recommendations for landscaping, fuel removal or reduction, firebreaks and setbacks. The construction measures include recommendations for exterior walls and cladding, roofs, foundation walls, supporting elements for raised or elevated buildings, doors and windows, and decks, balconies and porches.

To determine which construction measures are recommended, the building is assigned a construction class (CC), ranging from CC1(FR) to CC3, on the basis of its exposure level and the extent to which vegetation management is applied up to 100 metres (approximately 300 feet) from the building.

If vegetation management extends further from the building, the construction class will be higher and the recommended construction measures will be less stringent. For example, without vegetation management, a building with a high exposure level would be assigned to construction class CC1(FR), and non-combustible external wall cladding would be recommended. With vegetation management extending 100 metres (approximately 300 feet) from the building, the same building would be assigned to construction class CC3, and exterior wall cladding with limited ignition resistance would be recommended.

This means that, in many cases, the construction costs associated with WUI fire protection measures can be reduced by managing the vegetation surrounding the building.

## Community-scale guidance

In addition to building-scale measures, the Guide provides community-scale recommendations on community planning and resources, as well as on emergency planning and outreach.

To support community and resource planning in the WUI, the Guide sets out considerations and recommendations for demographic analysis, land use and development, access and egress routes, utilities, public transportation, and firefighting resources. The Guide also sets out considerations and recommendations for evacuation planning, emergency communications, public education, and outreach communications to support emergency

planning and outreach in the WUI.

This extensive guidance will enhance community protection from and resilience to WUI fire.

## Impact

On the whole, the measures recommended in the Guide will help to minimize the impact of WUI fires by reducing their likelihood and severity, inhibiting their spread, and improving the effectiveness of community response.

Users can currently choose to implement the Guide's measures on a voluntary basis. The NRC project team will be working to convert the Guide into a standardized document that could be adopted by communities, provinces or territories.

The implementation of the Guide's recommendations is expected to save lives, protect homes, businesses and communities, and reduce the long-term cost associated with human developments in the WUI. An impact analysis report prepared for the NRC by the Institute for Catastrophic Loss Reduction (ICLR) indicates that, by adopting the Guide across Canada, approximately \$4 would be saved for every \$1 spent on mitigation. The potential cost savings are predicted to increase with climate change. (See the report at <https://doi.org/10.4224/40002649>.)

According to the ICLR report, "Satisfying the National WUI Guide's recommendations appears to offer benefits that greatly exceed its costs. The benefits come from avoiding future property and life-safety losses."

The Guide is a valuable resource for anyone wanting to improve the wildfire resilience of buildings or communities in the WUI, including local governments and authorities, planners, emergency managers, developers, insurers, and property owners. With this resource, the WUI areas of Canada will be better able to adapt to the increasing frequency and severity of wildfires in the changing climate.

## ABOUT THE AUTHORS

**Allison Mills** is a technical outreach officer with the Construction Research Centre at the National Research Council of Canada.

**Noureddine Bénichou** is a principal research officer in the Fire Safety Group of the Construction Research Centre at the National Research Council of Canada. His research includes fire resistance modeling and experimentation, fire safety in buildings, fire risk analysis, and impact of wildfires on the WUI. He led the development of the National Guide for Wildland-Urban Interface Fires.



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# SUCCESS, AND SACRIFICING-DECISIONS IN THE FIELD

## BREAKING THE RULES FOR A POSITIVE OUTCOME

**Keynote speaker Dr. Sidney Dekker** explored sacrificing decisions during the virtual 16th Wildland Fire Safety Summit / 6th Human Dimensions of Wildland Fire Conference in May. Dekker is professor and director of the Safety Science Innovation Lab at Griffith University in Brisbane, Australia. He introduced participants to sacrificing decisions and how, in hindsight, we might avoid second-guessing firefighters' sacrificing decisions in the field. The transcript has been edited for length and clarity.



I want to share with you some stories and experiences. All of these ideas about human performance have direct and immediate consequences to the ways we respond to human performance – is it going well, is it not going well? – and how we deal with each other as colleagues and fellow human beings in the pursuit of success.

The reason we want to talk about this is that we're finding the progress on making human performance in safety even better has slowed over the past 20 years. There are go-to recipes that we have: 1) we make more rules, and 2) we try to stop things from going wrong.

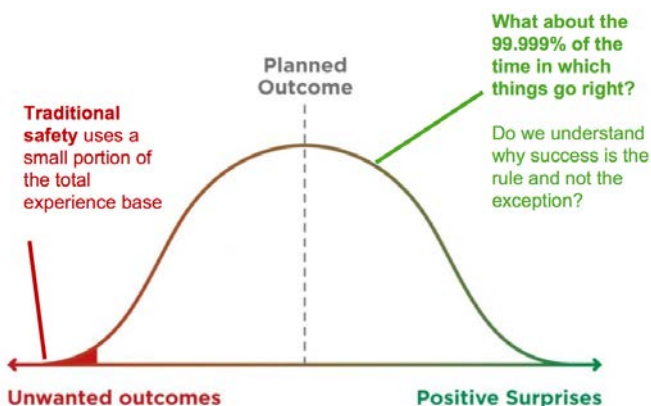
One of the consequences of this, obviously, is that if you make more rules, if you try to stop things from going wrong, you gradually begin to clutter your system and shrink the bandwidth of human performance at the front line, squeezing it between what is allowable, and

squeezing the native resilience from the front-line people.

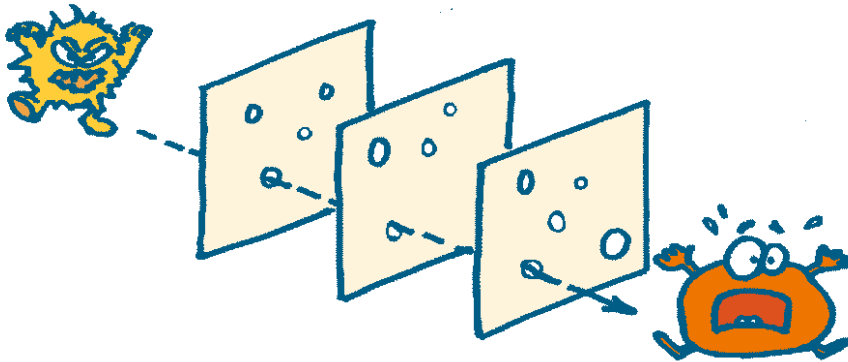
Back in 2012, a colleague made this essential point: we try to understand safety by looking at non-safety. We focus on the tail end of distribution of normal work (Figure 1), and sometimes, things go wildly good on the tail end of distribution of normal work, [for example,] the Hudson River landing. It turns out, actually, that you can learn very little from these heroic recoveries because the circumstances that led to them are so incredibly unique that it's difficult to tease out lessons from them.

We were talking to an obstetrician, and she said when it comes to performance and safety, it is as if you are trying to understand how to have a happy and healthy marriage for the rest of your days by studying a few cases of divorce and domestic violence. You study those and then you assume you know everything there is to know about how to have a happy, healthy marriage for the rest of your life. Nonsense; that's an absolute absurd, bizarre presumption.

For the last 10 years, the safety community has said the way to look at this is to stop this obsession with squeezing the last little red bit (Figure 1) out of our human performance distribution.



**Figure 1:** The way to make the red part (unwanted outcomes) on the left smaller is not by making it impossible for things to go wrong (as we've done almost everything in that regard already). We make the red part smaller by making the white part bigger: focusing on why things go right and enhancing the capacities that make it so. Graphic by Kelvin Genn.



**Figure 2:** The Swiss cheese model of accident causation, originally proposed by James Reason in his book *Managing the Risks of Organizational Accidents*, likens human system defences to a series of slices of randomly holed Swiss cheese arranged vertically and parallel to each other with gaps in-between each slice. The layers of cheese represent a process safety system. If several slices of cheese are stacked on top of each other, the hypothesis is that the holes would not align, which would shield the beam of light, preventing a hazard from passing through the layers (and resulting in catastrophe).

In a complex world, things are not going to go well. But much more goes well than goes wrong.

I'm not saying it's impossible to try to stop things from going wrong. It is ethically incumbent on us to try to stop things from going wrong. But if we only focus our entire discussion on human performance and safety on that, we get in trouble. This idea is infused by this iconic image of the Swiss cheese model (Figure 2) – that you want to protect a person or the thing from harm by putting all kinds of things in between. But this type of thinking is porous like Swiss cheese, and is known as the Swiss cheese model of accident causation.

Here's an example. A hospital decided it wanted to prevent a recurring problem – a nurse dispensing medication who was constantly interrupted, therefore creating risk of dispensing the wrong medication. This hospital decided – like much of health care, which seems wedded to this 30-year model of problem solving – to put a high-visibility vest on the nurse. Now, on the vest it says **DRUG ROUNDS IN PROGRESS – DO NOT DISTURB**, in other words, bugger off, leave me alone, solve your own problems.

My student comes back to the lab with results and says [he is] very confused. (Well, PhD students are always confused. That's nothing new!) The nurse who wears the vest gets interrupted more. Intuitively, it makes sense – you put a high-visibility vest on the nurse and the nurse is more visible. Nurses are always in low supply and high demand. This example is just to show that unleashing this linear model of stopping things from going wrong in a complex environment actually generates results that are counter to the whole intention to begin with. And that goes for you guys. The kind of work you do takes place in incredibly complex, highly emergent situations, where it's very difficult to predict what's going to happen, where you have novelty and surprise, and those worlds are not made for Swiss-cheese thinking, for barrier thinking, they are made for "Oh we've got to stop

bad things from happening," because you don't know what's going to happen. So instead of stopping the bad things from happening, how do we increase the capacity for people to make good things happen?

Here is an example of a sacrificing decision [imagine a photo of a road crew member running across a busy highway with cars going 60 mph or more!]. This gentleman in the Netherlands is running across the road to peel off the masking from a speed sign because they are done with roadwork. Normally, that is supposed to happen within a whole system that guides traffic around, and cleaning up the site. The problem was that within the planning, it fell between cracks and the people who were supposed to do the traffic management were two hours and 15 minutes late. So this crew said, well we are out of time, we have to go to the next site, so they called their boss and said we're out of time, is it OK if we just run across and pull off the tape? And he said yeah, yeah. Sacrificing decision, right? You sacrifice one goal in order to achieve another. The guys are thinking, there is daylight, the cars are still 100 yards away (even though they're going quite fast!), so what's the problem?

Sacrificing decisions are quite common. Where do they come from? Goal conflict, multiple goals at the same time to be achieved by all people in the field, and yet they cannot all be achieved without something giving. So there is a constant negotiation that has to go on. That's where sacrificing decisions come from. When we face these things, it is so easy to stand back and say, "Look, how could you be so stupid? You should have waited. Two hours and 15 minutes? It's clearly unsafe. You should've waited for the troops to come." If you want to have any understanding of human performance, you need to put yourself in the other person's shoes . . .

I was chatting to [someone] recently and the question



came up, is it that people make poor choices or that they have poor choices? If they have poor choices, then we really need to look for the responsibility for that, deeper in the organization, which is of course consistent with the idea of understanding human error. It's not that they make poor choices, it's that they only have poor choices . . .

If you are a Boy Scout and follow the rules to the letter, you won't get any work done. Things have to give. Some sacrifices matter. Some sacrifices don't . . .

[Safety researcher] Jens Rasmussen said the sacrificing decisions come from this interplay between having to be faster, better and cheaper all at the same time. Now, these might not be the three goals that bound this space of human performance . . . but the idea behind this is the operating point at which human performance gets pushed around by having to be faster and better and cheaper, and you can't be cheap and fast and better all at the same time. If you're faster and cheaper you won't be better or safer, for example. So, something has to give in the real world, because we live under resource constraint and goal conflict, in a complex universe. If you're making sacrificing decisions, you're making them in a situation that's dynamic.

Now you might say hang on, are our rules not relevant? The scientific answer is, it depends. On what? On a lot of things. [Rene] Amalberti, [who wrote the book *Navigating Safety, Necessary Compromises and Trade-Offs – Theory and Practice*] did great work on this in relation to rules and safety. If you are engaged in a [very dangerous] activity where you kill or intentionally maim a member of that activity, then more rules actually do make a difference. For example, if you think about the line to the summit of Mount Everest, one of every 50 [climbers] will die. If you

make more rules, you can prevent some of those deaths . . .

It's not that rules are bad, but it depends on the context of the safety level of the activity. In wildland fire fighting, the safety exposure waxes and wanes. It's important to think about how to shrink the bandwidth of human performance by rulemaking. One of the key phrases in thinking differently about safety is freedom in a frame. Yes, we need rules. But we have done this before. We know how you die, so let's not do that. That's the frame. But within that, there needs to be some freedom. The context determines the applicability of the rule.

It's important to understand work as imagined versus work as done. Work as imagined happens in a universe that is linear, predictable, closed, no surprises, in a world that is not rapidly developing, or unfolding, or emerging. Work as imagined is linear, foreseeable, it's what we think should happen. Of course, in the real world, nothing is by the book at all. Even your actions in the world change the world in ways that may not be entirely predictable, particularly in the sort of work that you guys do . . .

In the early 20th century there was hardly any difference between work as imagined versus work as done, because the work as planned was the work that was done. It's simple. The world is closed. There are no surprises. It's a factory. In that sort of world that is linear, predictable, ordered, it is also utterly joyless.

Here a scenario from a research project. Two workers are putting a pipe in a sewer to stent it. My student takes a photo [while everything is being done by the book] and the project director says OK, I will wander off and go to the next team because all of this looks good. The guys go

Sacrificing decisions are made when there are conflicting goals, for example, following safety protocols, and getting something done quickly. Sidney Dekker says when firefighters make sacrificing decisions, managers should think twice about challenging their actions and instead determine what circumstances led to the actions.





**The most courageous question to ask anybody of authority is “What is the stupidest thing I am asking you to comply with?” I think if you are honest about wanting to listen to the answer, you will learn a lot about work as imagined versus work as done.**

way that’s much more efficient]. Do you know that [the pipe] goes in two and a half times quicker this way? Two and half times quicker! That is work that is actually done. Who benefits from that? The boss! So we were working on this and thinking, what guidance do we want to give? The thing you don’t want to do is shout, “Why are you violating this rule. Who is responsible for this? What should the consequences be?” These questions are predicated on judgments and you knowing better and your infatuation with work as imagined: “This is how the world is supposed to look. Why doesn’t the world adhere to my plans?” Because it’s the real world! So, what do you ask? You ask, “Help me understand why this makes sense?” And, “What is responsible for putting you in this position? What is the constraint? What are the goals? What is not working? What is responsible? What are the factors responsible for putting you in this position? What’s not working in my plan?”

I think the most courageous question to ask anybody of supervisory authority is “What is the stupidest thing I am asking you to comply with?” I think if you are honest about wanting to listen to the answer, you will learn a lot about work as imagined versus work as done.

I saw this on the wheel well of an airplane: “To avoid serious injury don’t tell me how to do my job.” It was in the wheel well, not very visible to the rest of the world, which to me, says something about the culture of the company.

Final little story. This was in a hospital in Canada in the mid 2000s. In a hospital, one in 13 events goes wrong. One in 13 patients gets hurt or dies because of the care they get. Which for a hospital is pretty safe. But that means you get big data. We asked, have you investigated these things? Yes, they had investigated every one that goes wrong. What did you find, we asked. These are the causes: workarounds; shortcuts; violations; errors; miscalculations; people can’t find their tools; unreliable instruments. These

OK, the boss is gone, let’s get some stuff done – and the rules go out the window. Work as imagined versus work as done. When the boss is gone, you put the pipe in [not necessarily following the rules, but in a

are the sorts of things we keep finding, we were told. Well now that you know that, what are you doing about it? They put up posters, had campaigns. [In these situations,] you tell others to care more, try a little harder. But they were still stuck at one in 13.

So then we asked what would become the miracle question: “What about the other 12? Why did they go well?”

Well, we don’t know. Well, let’s find that out. How do we find out? We don’t have dead bodies. How do we investigate a non-incident? You investigate the way normal work, work as actually done. What we found after weeks of researching how work as done in the hospital, for the 12 that went well, all the same things that happened in the bad outcomes also happened in the good outcomes. All the things that went well happened because of guidelines – 600 policies every day. Tell me about some of these policies, we asked. But they were done after two or three and then they don’t know anymore; so are there are 597 other policies are hidden in the fog somewhere? They have no idea. How can you follow them if you don’t even know them?

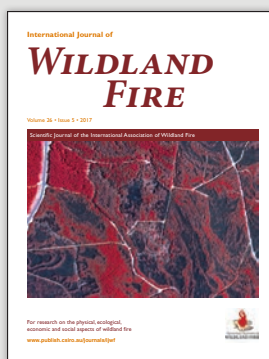
So it’s not surprising. We owed the people in this hospital an explanation for the difference between the 12 that went well and the one that went wrong. When we started looking deeper at the data, we found in the 12 that go well, more diversity in the team, and even the possibility of dissent. They keep a discussion of risk alive. Past success is not taken as a guarantee of success now.

In the dynamic world, past results are no guarantee. We find the ability to say “stop” well distributed throughout the team, and independent of hierarchy and rank, and deference to expertise. Don’t ask the boss. Ask the person who knows. In a professional organization, sometimes the boss and the person who knows are different people. Don’t wait for inspections and audits to improve things, improve them yourself. Break down department barriers. And we found pride of workmanship . . . It is these capacities that account for successful outcomes. If we can think about human performance and sacrificing decisions, in these capacities of making things go well, then there is progress.

Progress doesn’t sit in squashing the bandwidth of human performance even more. Progress doesn’t rest in being judgmental about things that have gone wrong. Progress about human performance and safety sits in our understanding and capabilities to enhance these positive capacities.

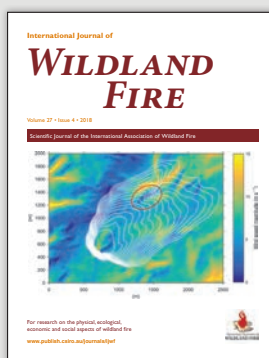
# THIRTY YEARS OF IJWF

JOURNAL CELEBRATES THREE DECADES, PUBLICATION OF 1,800 PAPERS



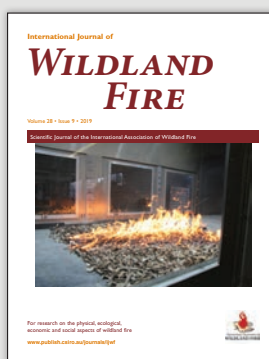
The International Journal of Wildland Fire (IJWF), the official journal of the International Association of Wildland Fire, was started in 1991 to provide the international wildland fire science and fire management community with a much-needed peer-reviewed outlet for the latest research on all aspects of wildland fire. Its purpose is to disseminate high quality fire research information within the international science community as well as to practitioners and policymakers who need access to the latest science-based information to guide fire management policy and practice.

Since its inception 30 years ago, IJWF has published more than 1,800 papers on topics ranging from social and human health aspects of wildland fire to fire economics, effects of fire on ecosystems, fire behaviour and physics, fire suppression, smoke transport, and interactions among fire, weather, and climate.



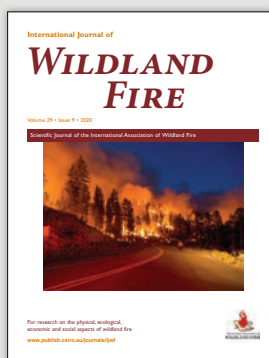
The IJWF was initially a quarterly journal and the first nine volumes (1991 to 1999) were self-published by the IAWF. CSIRO Publishing took over management and publication of IJWF under contract with IAWF in 2000. Through to 2006, the Journal was quarterly. Since 2007, the number of issues per year has gradually increased to accommodate rapid expansion in fire research globally. The Journal has been monthly since 2016 and now publishes about 90 papers per year.

IJWF is a top quartile journal, consistently ranking in the top 10 of more than 60 journals in the forestry category of Clarivate Analytics. Its content is managed by two editors in chief and team of about 45 associate editors who have high-level expertise in traditional and emerging disciplines of wildland fire science. Our dedicated associate editors and peer reviewers ensure that IJWF publishes high-quality and internationally relevant wildland fire science produced in this increasingly complex and interdisciplinary field. While most papers published originate from North America, Europe, and Australia, the Journal is truly international, with contributions also from Asia, South America, Africa, and the Middle East.



We are committed to the long-proven approach of anonymous peer review and thorough evaluation of manuscripts by the editorial team. We are also known for our commitment to helping submitting authors improve their manuscripts if we believe the underlying science is sound. This inevitably takes time and often involves more than one revision, but it supports scientists and ensures that the quality of the research published in IJWF is of the highest standard.

We would like to take this opportunity to express our gratitude to our associate editors, past editors, and reviewers for their invaluable contributions in this process, and all authors for choosing IJWF as the journal to disseminate their work. We also thank our sponsoring organization (IAWF) and the members of the editorial advisory committee for supporting the Journal as it continues to grow and evolve. Currently the Journal has a hybrid publishing model, which includes fee-based open access and subscription components. In line with international trends, an increasing proportion of papers are published open access.



In celebration of the 30th anniversary, we have put together a virtual issue that includes a series of review papers published in IJWF over the past 12 years. The virtual issue covers a wide spectrum of topics including economics, firefighter health and safety, fire behavior and emissions, fire management, remote sensing of fire and fuels, effects of fire on vegetation,



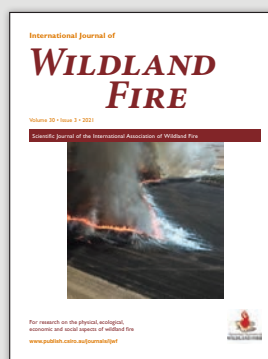
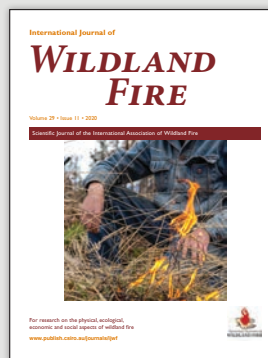
mammals and postfire erosion and runoff, effects of fire on human health, Indigenous fire management, and interactions between fire and climate change.

There are few areas of fundamental and applied science that are as diverse as wildland fire research, and we feel this is the best way to acknowledge this wide range of disciplines and to provide readers with critical overviews on key topics in wildland fire science.

In line with our commitment to diversity, authors and co-authors come from at least seven countries, and the corresponding authors on six of the 15 papers are female. These papers provide examples of the impactful research disseminated through IJWF. We invite you to look at the full breadth of topics in the virtual issue, which is available on the IJWF website at <https://www.publish.csiro.au/wf/virtualissue/3062>.

In the past several years, we have seen increasingly severe fire seasons in many regions of the world. Major fires are regularly in the news, communities are destroyed, human health impaired and ecosystems impacted. Disseminating the outcomes of high-quality and internationally relevant wildland fire research will only increase in importance as our climate and approaches to land management change. We look forward to IJWF continuing to serve the global community by publishing high quality research on the most relevant topics in wildland fire.

Susan G. Conard, editor in chief;  
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# PRESCRIPTION FOR REGENERATION

RESTORATION SPECIALIST COMMITTED TO BRINGING BACK QUEBEC'S PINE FORESTS

BY DYLAN BRUCE

Eastern white pines once dominated the forests of what is now La Mauricie National Park in Quebec, but colonial logging devastated this species. Once making up nearly half of the area's forests, eastern white pines now account for only 12 per cent.

Michel Thériault is hoping to change that; he is a restoration specialist with the national fire management division in Canada, part of a team supporting Parks Canada and co-ordinating its fire management program.

"More specifically, I'm co-ordinating the review and renewal of our prescribed fire program at a strategic level," says Thériault. It is this prescribed fire program that is helping to regenerate the eastern white pine populations by utilizing wildfires to develop ideal conditions for their growth.

Thériault lives in St-Mathieu-du-Parc in Québec, a small community on the north shore of the St. Lawrence River. A landscape of rolling hills dotted with lakes and rivers once famous for its hunting and fishing clubs, the community is now home to provincial and national parks. Just to the north of St-Mathieu is La Mauricie National Park, where Thériault began his career as a park warden.

Thériault started with Parks Canada in 1991, just as it was introducing the prescribed fire program, and worked to bring it to maturity, which was a first for Eastern Canada at the time.

"At this time, park wardens were still generalists providing services in natural resources conversation, national park law enforcement, and public safety," Thériault says. "For a freshly graduated biology student, it was a dream job."

Thériault graduated with a biology degree from Université du Québec à Rimouski in 1986 and completed graduate studies in forest fire ecology and forest landscape dynamics at Université du Québec à Chicoutimi. After 15 years as a park warden, Thériault shifted to operations co-ordination before returning to fire management with Parks Canada; he eventually transitioned into the national fire management division.

As climate change worsens the Canadian fire season, and human expansion heightens the consequences, Thériault believes that international collaboration is more important than ever.

**"Working on such long-term goals helps give some perspective on our place and duration in this world."**

"I was deployed to Australia last year, which was an amazing experience from a professional and human point of view," says Thériault. "I learned many interesting things.

The importance of a common structure like the incident command system for the integration of various agencies, and the level of integration they have, is very applicable to Canada."

Thériault admires the proactive post-fire and recovery planning that takes place in Australia, as well as the inclusion of Aboriginal Australian specialists to mitigate the impact of fire management activities on Aboriginal culture and sacred sites.

Working on the prescribed burning program over the last 30 years has given Thériault a unique perspective about how such a program evolves. The first prescribed burns took place on old spruce plantations, which were burnt slash with the goal of restoring them to natural forests. "Science has demonstrated that fire has real, important, and positive

# FIRED UP

**Fired Up** features those who have advanced and contributed to wildfire and bushfire operations, mitigation and prevention, and training and research. The IAWF invites members and the greater wildland fire community to submit recommendations for profiles of individuals or groups to [info@iawfonline.org](mailto:info@iawfonline.org).



impacts for most North American ecosystems," Thériault says. "This is why we try to manage wildfires using strategies that minimize our influence on the effects of fire when possible."

The eastern white pine, as well as the red pine, are fire-adapted species, meaning they can survive intense fires on the surface such as during a prescribed fire. These fires open the canopy up by clearing out the saplings of other trees such as balsam firs, establishing favourable conditions for pine seeds to establish themselves and grow. These burns are supplemented with planting operations when needed, with the goal of increasing the density of pines in areas they were once more common.

Results from burns in the 1990s are only now beginning to show results, but the long wait was always expected. With the program now well established and accepted by the public, Thériault plans one last tour of the burn units before he retires.

"I won't live long enough to see those young pines reaching maturity," Thériault says. "These trees live easily up to 300 years and grow slowly, so all this is just a small contribution to a long process. Working on such long-term goals helps give some perspective on our place and duration in this world."

Michel Thériault co-ordinates the review and renewal of Parks Canada's prescribed fire program to regenerate pine forests.

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# MEET THE MOST INNOVATIVE TOOLS FOR **DIRECT ATTACK** IN WILDLAND FIREFIGHTING

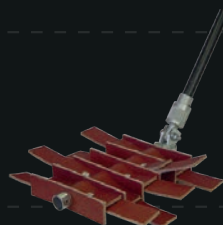
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# TAKE BACK THE LAND

AN ACTIVE, RURAL SPAIN IS A CRITICAL TO THE PREVENTION OF WILDFIRES

BY MARÍA SANTOS

*EDITOR'S NOTE: The Spanish newspaper el Agora recently published an interview with Jordi Vendrell, firefighter by profession and general manager of the Pau Costa Foundation. Vendrell puts the increased fire risk in Spain in a global context, and analyzes the role of an active rural society in fire prevention. Reprinted with permission; translated and edited for clarity. This article is a follow up to the transcript in the Q3 issue of Wildfire of former Spanish prime minister Felipe Gonzalez's presentation to the 16th Wildland Fire Safety Summit / Human Dimensions of Wildland Fire conference in May. The Pau Costa foundation is a supporting partner of IAWF.*

**T**he Pau Costa Foundation this year celebrates its 10th anniversary as a platform for exchanging knowledge about wildfires. More than 60 top-level multidisciplinary professionals founded this institution in 2011 with the aim of connecting a network of experts worldwide to improve the suppression and manage wildfire emergencies, to create awareness in society, in general, and to influence wildfire prevention through fire ecology.

This year has been a turning point due to the global increased risk of fires due to the abandonment of the landscape in rural environments and the impact of climate change.

Fire in itself is not bad, but fire is one functional element of the ecosystem that Spain has learned to manage over the years due to the intense exposure of the peninsula to these

catastrophes. This experience has made Spain an international benchmark, not only in the fight of fires, but also in research and innovation in the field.

In fact, Spain, through the Pau Costa Foundation, will lead a European project that has been provided with 60 million euros in funding to identify strategic lines of research and determine where to invest in prevention, research, and territorial management.

"From the Spanish experience we are going to identify and decide the key lines of the European Commission (EC) in the next 10 years in terms of wildfires," said Jordi Vendrell, general manager of the Pau Costa Foundation.

The project will help to establish a collaborative and



The migration of people to the city from rural areas has resulted in a build up of fuels, and fires that burn longer and are more virulently. The Pau Costa Foundation recommends restoring traditional activities such as animal grazing, along with forest harvesting and prescribed burning, to combat the increasingly intense wildfire situation. Photo courtesy Pau Costa Foundation.



multidisciplinary strategy for forest management and the prevention and extinction of wildfires adapted to climate change, starting in Europe but with progress also in Argentina, Chile, Ecuador, and South Africa.

Vendrell said the wildfires in Turkey and Greece share structural causes that extend to the whole of the Mediterranean arc. For example, the vacating of rural areas for urban centers has favored the abandonment of traditional practices such as extensive cattle ranching and the use of forest masses, increasing the accumulation of fuel in the landscape. Additionally, the scarcity of rain and high temperatures increase the periods of risk and the intensity of the fires.

Vendrell points out that although the number of fires and the average area burned has decreased since the late 1990s, there have been more large wildfires that have burned more than 500 hectares and have done so with more intensity and virulence.

Fires spread at high speed and have much more impact on the ecosystem and biodiversity. "It is not the same to have a 10,000 hectares fire as it is to have a fire of 200 or 50 hectares," Vendrell said. "Small ones go out and cause less damage in the short and medium term in the ecosystem."

This dynamic of fewer fires, but more virulent and intense, is due to two fundamental factors: depopulation, and climate change. Rural depopulation since the end of the 1960s led to many hectares ceasing to be cultivated and cared for, generating more forest fuel load, and climate change is visible in higher average temperatures and a changing rain regime.

"The distribution of rainfall during the year has changed," Vendrell said. "It does not rain the same now as 30 years ago, and it is not the same if 10 litres fall during 10 days as 100 liters in one day . . . Water evaporates more easily and our forests have less water to survive, they are more vulnerable, they suffer from water stress.

"In short," Vendrell said, "we have much longer periods of fire risk that are no longer concentrated only in the summer season."

To combat all this situation, the Pau Costa Foundation points to the need to work to keep the landscape alive and more prepared for this fire scenario through sustainable forest management in which traditional activities such as grazing or extensive livestock are brought back, together with forest harvesting, in addition to prescribed burning.

"The ecosystem role of fire must be valued and applied with strategies developed by experts and professionals who identify strategic areas to reduce the fuel load in the mountains," Vendrell said.

It is necessary, Vendrell said, to place the value of ecosystem and environmental services of rural socio-economic activity in forest areas; these are activities that not only produce tangibles such as meat, milk, wool, crafts, but also preserve and keep alive a landscape that is more prepared for fire.

For this, Vendrell insists, it is necessary for consumers to know these intangible values and when purchasing products, incorporate rural production into buying habits, opting for local products that reward people who live in rural areas.

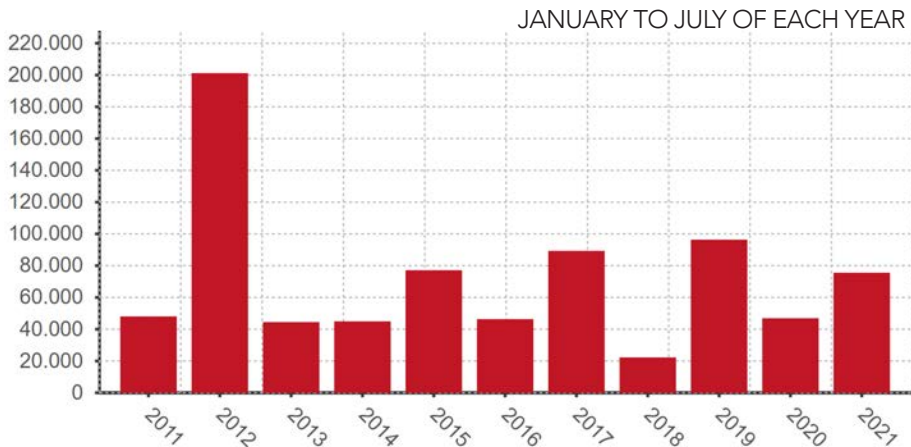
"Because only if [people] can live with dignity in rural areas will the landscapes be kept alive, as a society, we can decide which landscape is the one we want."

Vendrell calls for a sustainable management strategy of the territory that revalues rural assets and local commerce, "repopulating emptied Spain and promoting a healthy rural economy would preserve and enrich biodiversity, reduce the risk of mega-fires and facilitate fire control."



Prescribed burning is necessary to help reduce the numbers of firefighters and the effect on the landscape, says Spain's Pau Costa Foundation. Bottom photo by Carla Vilarasau.

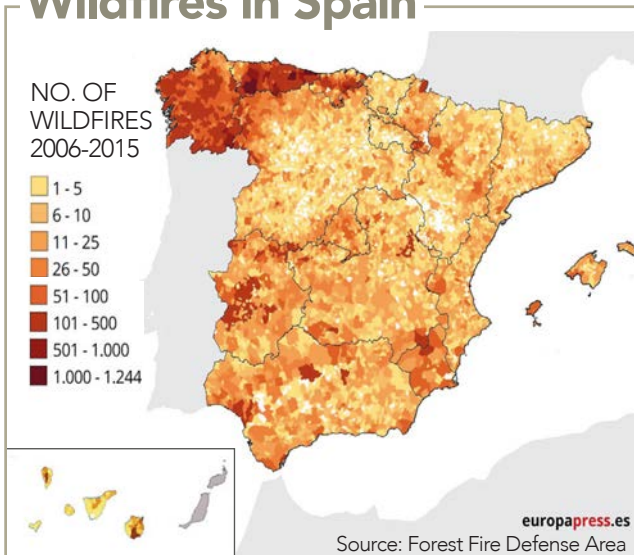
## Hectares burned by wildland fires



Source: Ministry of Agriculture, Fisheries and Food

**"In fact, Spain, through the Pau Costa Foundation, will lead a European project that has been provided with 60 million euros in funding to identify strategic lines of research and determine where to invest in prevention, research, and territorial management."**

## Wildfires in Spain



According to data from Copernicus, the Earth observation program managed by the European Commission, from Jan. 1 to July 25 there were 12 large forest fires in Spain that devastated more than 26,000 hectares in total.

## ABOUT PAU COSTA FOUNDATION

Pau Costa Foundation, through the Network of Drivers of Change (RIC/ Red de Impulsores del Cambio) of the Aquae Foundation, will promote not only the generation of self-protection plans for municipalities but will also influence the dissemination through citizen awareness actions on prevention and ecology from fire and wildfire.

Jordi Vendrell is general manager of the Pau Costa Foundation. He has a Bachelor of Geography from the University of Barcelona (2010) has focused his studies in meteorology and the evolution of



forest fires by convection. In 2006 he started working on forest fires in the Fire Department of Catalonia, where in 2008 he began working as a GRAF technical specialist. From there, he specialized in the study of the meteorological element, as a key, to predict the behavior of forest fires. In 2012 he began working at the Pau Costa Foundation, where he directs the R&D area, focusing his activity on fostering the exchange of knowledge among fire services. He had worked in the fire services of Portugal and France, implementing fire analysis. He is a professor at the Public Security Institute of Catalonia (ISPC) on forest fires and has given several lectures on the close relationship between meteorology, landscape and forest fires.

## FOREST FIRES IN 2021

In Spain, between 2010 and 2019, the number of wildfires fell by 36 per cent compared to the previous decade and the average area affected decreased by 27 per cent. However, the proportion of large fires grows year after year.

Wildfire burned a total of 37,535.90 hectares of forest area between January and July 2 this year, compared to 21,132.94 in the same period of 2020, and 58,209.46 in 2019, according to government data..

A total of 5,613 fires were recorded in that period.

Of these, 3,654 were smaller than one hectare; 1,959 were larger than one hectare and 11 exceeded 500 burned hectares.

By type of vegetation, most of the burned area reached 23,104.67 hectares of scrub and open forest, 10,693.33 hectares of wooded area, and 3,737.9 hectares of pastures and meadows.





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# PRESCRIBED FIRE?

PLANNED BURNS, PLUS FUEL MANAGEMENT,  
MAY BE RX FOR WESTERN CAPE

BY JENNIFER FILL AND BRIAN VAN WILGEN

**T**he all too familiar hue-and-cry was raised in Cape Town, South Africa, when wildfires erupted on the slopes of Table Mountain on April 18. The fires burned more than 600 hectares, tragically damaging numerous University of Cape Town buildings, including irreplaceable libraries and historical sites. Neighborhoods and university students evacuated, and more than 250 government and volunteer firefighters and resources were deployed to the scene. Stunned citizens and those watching around the world were asking: How did this happen?

Large wildfires are a familiar anxiety not only for people living in South Africa, but also in places such as the western United States, Australia, Canada, Greece, and Spain. It seems that all it takes is one spark and thousands of hectares are burning. Although this observation might suggest that the way to control fire is to control the source of the spark, it takes more than just an ignition source to set the mountainside alight. All wildland fires depend on the right mix of three key ingredients: weather, fuel, and ignition.

Hot, dry, and windy weather is ideal for fire ignition and spread. Regions such as the Western Cape of South Africa and the west coast of California have weather patterns that are very conducive to wildfires. Cool, wet winters alternate with hot, dry, and often windy summers. High temperatures and low humidity in summer allow vegetation to dry out, and once the fire has begun, high winds fan the flames. Temperatures on the day the Table

Mountain fires started rose to more than 36 C with wind speeds of 45 km/hr, and relative humidity below 10 per cent.

The 2015 Cape fires burned more than 6,900 hectares around Cape Town alone, when wind gusts were more than 100 km/hr. To put this in perspective, weather for lighting safe prescribed fires is roughly considered to be relative humidity above 25 per cent and wind speeds of five km/hr or less. Such gusty winds made the Table Mountain fire that much harder to contain and likely sent sparks flying dozens of meters to kilometers ahead of the flaming front.

Not only did the weather set the stage, but the vegetation on Table Mountain was like a tinderbox under those conditions. The fynbos vegetation on the slopes of Table Mountain is a shrubby, biodiverse ecosystem unique to the Western Cape. It is structurally very similar to shrublands in other Mediterranean regions, like chaparral in California.

Many fynbos species, including endemics (species unique to this ecosystem), are dependent on fires for reproduction, so fire is not always harmful from an ecological perspective. These shrublands are well known to be highly flammable and to recover rapidly after fire (witness the post-fire recovery of vegetation after the 2015 fires in the Western Cape).

A much greater concern, however, is the alien pine trees that burn more intensely and result in greater fire severity





Widespread alien pine stands in native fynbos tend to burn with greater intensity than in uninvaded fynbos. Photo by Jennifer Fill.

than does natural fynbos vegetation. (More than 50 pine species native to the northern hemisphere were planted in the country after European colonization.) Indeed, the intensity of the 2017 Knysna fires in coastal southern South Africa, which burned 15,000 hectares over four days, was largely increased by non-native pines and was one of the worst fires in the region's history.

Although South African National Parks has been clearing pine trees since Table Mountain National Park was established in 1998, people still place value on these trees for shade, stalling their removal. Many buildings that burned in the Table Mountain fire might well have been started by embers that spotted long distances from the burning tops of tall trees.

Additionally, in this area of high human population density there is no scarcity of ignition sources. With a population of more than four million, Cape Town is just one of many places around the world where high population density in close proximity to highly flammable vegetation increases the likelihood of wildfires. Routine activities such as outdoor cooking and smoking, and even deliberate and malicious ignitions, further contribute to the hazard of accidental or deliberate fire

ignition. In fact, the latest report of the Table Mountain fire investigations suggests that the fire might have been started intentionally.

## What can be done?

Conducive weather conditions and flammable fuels set the stage for a fire to take off that day in April. Indeed, there have been record-setting wildfires in Australia, California, and southern coastal South Africa within the last five years, and the occurrence of weather conditions that promote these events is expected to increase with climate change. What can be done to reduce these large wildfires? Although it is impossible to control the weather and difficult to regulate ignition sources, people can manage fuels and purposefully burn them under safe and ecologically appropriate conditions. So why not prescribed fire?

Around the world, there has been growing recognition of the effectiveness prescribed fire to prevent wildfires from burning out of control and threatening human safety and property. Prescribed fire can reduce the fuel loads and fire hazard posed by vegetation. Generally speaking, even if a wildland fire occurs within a few years of a





A fire burns with moderate intensity in the uninvasive Western Cape fynbos. Photo by Jennifer Fill.

prescribed fire, recently burned vegetation burns with much less intensity and fire is more easily contained than in vegetation that has not burned for a long time.

Increasing the frequency of prescribed fire, however, might be inappropriate in fynbos, which requires about a decade between fires for plants to mature and produce seed. However, the presence of non-native trees over much of the landscape is an even greater risk

**“A much greater concern, however, is the alien pine trees that burn more intensely and result in greater fire severity than does natural fynbos vegetation.”**

factor than unburnt native fynbos. So, one approach would be to integrate prescribed fire with active fuel management (removing alien plant fuels) to reduce fuel loads and increase human safety.

In South Africa, numerous calls have been made over the last three decades to use prescribed fire to help control non-native trees, many of which are invasive. Prescribed fire was widely used in the 1970s and 1980s, although tree plantations were still protected. By the 1990s, however, both reduced budgets and increasing concerns about safety and liability greatly decreased organizational capacity for conducting prescribed fires, such that conservation agencies were unable to implement them. The focus shifted primarily to fire suppression. In the meantime, the government's Working for Water program began actively clearing alien plants throughout the country, but risk-averse behavior under new fire legislation hampered integration of this activity with prescribed burning to encourage native fynbos recovery. Moreover, on the private side, landowners are not legally required to conduct burns on their properties, and those who do wish to burn are often deterred by lack of expertise or legal risks. Private landowners can also rarely afford the money and resources required to clear alien plants



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Native fynbos in the Western Cape is rich in plant diversity and endemism. Photo by Jennifer Fill.

## ABOUT THE AUTHORS

from their land and maintain it, or to undertake prescribed burning of large areas of natural vegetation.

In the future, our ability to prevent unwanted large and damaging wildfires will depend on addressing more than just ignitions; it would be more appropriate to focus on managing what burns. At the very least, those living in fire-prone areas can take appropriate measures to make their communities safer, using FireWise™ or FireSmart™ principles.

In South Africa and in other regions highly prone to severe wildfires, removing non-native vegetation and landscaping with certain native plants, reducing flammable material around homes, and using fire-resistant building materials will help reduce the likelihood that important structures will burn.

In South Africa in particular, increasing legal support and organizational capacity for clearing invasive plants and for using prescribed fire safely, including providing resources for training opportunities and supplies, could provide a much longer term and more sustainable solution for managing wildfire risk.




**Jennifer Fill** received her PhD from the University of South Carolina Columbia where she studied pine savanna fire ecology and restoration. As a postdoc at Stellenbosch University in South Africa, Fill gained several years of experience working in fynbos as a researcher and volunteering as a wildland firefighter. She currently researches plant and fire ecology as a postdoc at the University of Florida, with field studies in both the United States and Belize.



**Brian van Wilgen** is professor at Stellenbosch University, South Africa; he has four decades of experience as an applied ecologist in southern Africa and beyond. His research has focused on two fields – fire ecology, and invasion ecology. He has conducted work in southern and eastern Africa, and collaborated with others in Australia, Europe, North and South America, and island ecosystems. Van Wilgen has served on numerous editorial boards, the most recent including the journals *Conservation Biology*, *Fire Ecology*, *International Journal of Wildland Fire*, and

*South African Journal of Science*. He has received numerous awards, most recently the South African Academy of Science Gold Medal for excellence in the application of outstanding scientific thinking in the service of society. He is author of more than 200 publications, including four books and 150 peer-reviewed scientific papers.





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# A TEST OF CHARACTER

BY MICHAEL DEGROSKY

I've been thinking a lot lately about character, particularly the character of leaders. It's been an eventful time since I retired in June. I've wished fond farewells to retiring old friends, seen off associates moving on to new opportunities, talked with close colleagues who I will miss as I open my next chapter, and have been doing a little coaching and mentoring. All have me thinking about the character of the people I most respect and admire, the values and beliefs that guide their decisions and actions, their North Star.

People who know me best know that the highest compliment I pay is to call someone a person of character or one of the good ones. Those are people whom I find most credible and in whom I have unquestioned trust and confidence. On reflection, I've come to realize that I value in potential leaders a collection of character traits including authenticity, benevolence and compassion, competence, drive and sense of purpose, honesty, humility, integrity, openness, perseverance, and trustworthiness. People who inspire me, people to whose leadership I would commit, possess some combination of these character traits.

However, character is a subjective construct and I wanted to know how my thoughts on character and leadership compare to the research and the reasoning of some great leadership thinkers. That took me back to the books as well as to recent research literature. As expected, I didn't discover some universal list of desirable character traits for leaders. After all, we're talking about the personal, intangible and ethical aspects of personality that define who people are. I was just happy that my list of traits

making you "one of the good ones" looked pretty good, and is well supported in the literature.

Other elements of character captured either in the research literature or the thinking of leadership philosophers included resilience, competence, confidence, universalism, transformation, and forward looking or vision. I can't argue with any of these. Honestly, they're all things that contribute to fine leaders and great leadership. However, when it comes to what makes people admire their leaders, two universal aspects of character stood out for me: trustworthiness and integrity.

We know that trust is essential to leadership and trust flows from trustworthiness.

Bottom line: people willingly follow only those people they believe are worthy of their trust. Honesty is a part of trustworthiness. In fact, from their extensive research, James Kouzes and Barry Posner, of The Leadership Challenge Model fame, have concluded that the characteristic most admired in leaders is honesty, that the leader is both truthful and ethical. But trustworthiness transcends honesty and ethics. Trustworthy leaders, in addition to being honest and ethical, possess a combination of wisdom, judgement, and competence. I know some people think "Competence, part of trustworthiness?" "Really?" But let's be honest, people trust people who get stuff done. We follow people who are clear about their values and beliefs, but only if they have the competence to execute on those values and beliefs.

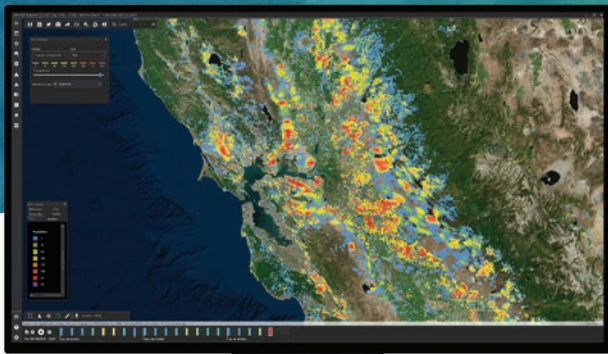




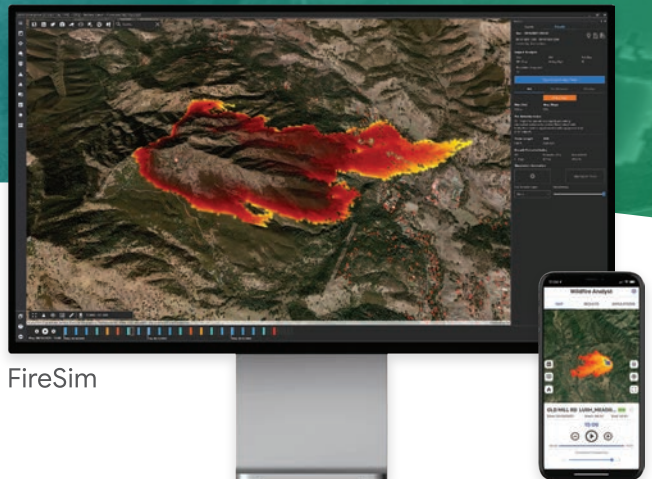
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It is said that integrity is a foundational moral virtue and the footing on which character is built. The author and lay theologian C.S. Lewis is credited with saying "Integrity is doing the right thing, even when no one is looking." Lewis's statement reflects the perspective that sees acting with integrity as being honest and truthful, and I've seen his perspective offered as a practical shorthand for acting ethically. However, just as trustworthiness transcends honesty, for me, so does integrity. Honesty is being truthful, sincere, and free of deceit. Integrity has a broader meaning encompassing honesty, ethics, and the practice of aligning one's conduct with one's values, choosing to live in accordance with certain principles and to act on those principles; it's consistency between word and deed and the connection between ethics and action, between saying and doing, between talking and acting.

For me, people with integrity are not only clear about their values and beliefs but they have the skills to enact their beliefs and confidence in their ability to execute effectively. To frame this around a hot topic in the fire world, nearly every organization has messaging around diversity, equity and inclusion. However, at the personal level, people act with integrity when not only do they publicly message a commitment to DEI but, out of the public eye, their recruitment, hiring, and retention moves are transcending

the status quo and advancing those values in their organization. Integrity is doing the right thing (versus just saying the right thing) whether it is to one's advantage or disadvantage.

I am inspired by people who are compassionate, competent, driven by a sense of purpose, open, and who persevere against challenges. I can't argue that resilience, confidence, and transformative vision aren't also essential to effective leadership as well. However, without trustworthiness and integrity, none of these other traits is possible. A final thought: every moment of every day, people continuously assess your character, both consciously and sub-consciously, deciding whether or not to commit to your leadership. May you be a person of integrity. May you be one of the good ones.



## ABOUT THE AUTHOR

**Mike DeGrosky** recently retired as 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.

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