

WILDFIRE

QUARTER 4, 2022
UNITING THE GLOBAL WILDLAND FIRE COMMUNITY

An official publication of the INTERNATIONAL ASSOCIATION OF WILDLAND FIRE



PRESCRIBED BURNING
IAWF ADVOCATES LONG-TERM
USE OF APPLIED FIRE

CHINA | SPAIN | PORTUGAL | GREECE | AUSTRALIA | UNITED STATES | CANADA

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CONSENSUS ON A BURNING ISSUE

The IAWF position on prescribed burning is clearly articulated in this edition of *Wildfire* magazine, starting on page 8.

- Identify and enhance community co-existence with fire and increase public understanding of the benefits of prescribed burning.
- Identify ecosystems most at risk to large, high-severity wildfire and prioritize those areas for treatment.

Months ago, once the association's position paper on climate was complete (see Q4 2021), the IAWF board got to work developing a consensus document on applied fire.

Ensuring all voices involved in the paper's development were heard, all regions' issues were included, and all the language in the paper was consistent and suitable (bushfires in Australia, wildland fire elsewhere), was quite a feat – one that will serve IAWF members and stakeholders well.

During the development of the position paper, it became clear that the countries in which IAWF members live and work have vastly different policies about prescribed burning, and that some countries' politics about applied fire are more complex than others.

While there is agreement among IAWF stakeholders about what needs to be done to reduce injuries, death and loss caused by wildfire, achieving the desired outcomes will be challenging regardless of location.

The stories on pages 16 through 38 that explain applied fire policies, programs and challenges in China, Spain, Portugal, Greece, Australia, the United States, and Canada, written by IAWF board members and their research colleagues, describe the political climates, background, and context around prescribed burning – or lack thereof. In some cases, prescribed burns that escaped and resulted in devastation have shaped government policy, and advocates have been unable to change opinions or regulations.

In China (page 16), in 2004 a prescribed fire in the Greater Khinganling Forest went out of control near the city of Heihe due to a sudden weather change. Since then, the central government has been shy about prescribed burning and local governments have set more policies to standardize the control of applied fire.

During the development of the position paper, it became clear that the countries in which IAWF members live and work have vastly different policies about prescribed burning . . .

Yet there are active prescribed burning practices in China's fire-prone habitat and forest ecosystem, and regulations are detailed, constantly updated, and varied in different wildland regions.

While many countries permit some prescribed burns, or are entering pilot projects, most lack national programs.

Parks Canada, for example, has a clear policy on prescribed burning (page 38), but Canadian provinces and territories differ in their approaches to applied fire on other land.

In Spain, advocates of prescribed burning have almost overcome the decades old "All Against Fire" mantra, but bureaucratic red tape has slowed progress.

Similarly, in Portugal (page 22), prescribed burning has been happening on some level for almost five decades, yet adoption has been slow because of the no-fire culture inherited from Central European forestry.

A pilot project in Chios is expected to be the starting point for prescribed burning in Greece, while in Australia, high-frequency burning is strongly opposed by environmentalists, and programs vary across the country.

In the United States (page 34), where the National Fire Protection Association's Outthink Wildfire program is gaining traction and President Joe Biden spoke in October at the Summit on Fire Prevention and Control in support of applied fire, interest groups with loud voices and deep pockets challenge prescribed burning and often have the ear of elected representatives.

But there's momentum, with the US Fire Service proposing a 10-year plan to treat 20 million acres, and the Bipartisan Infrastructure Act setting out funding for prescribed burning. Still, as writers Ron Steffens and Kelly Martins note, "Landscape prescribed burning will take years to build up dedicated, trained and experienced teams . . ."

The IAWF clearly states its commitment to prescribed burning: to provide opportunities for research, knowledge, and experience sharing; to take a position on contemporary issues and advocate for prescribed burning policies; to work with Indigenous Peoples to support cultural burning; and to advocate for diversity in global fire management.

As long-time *Wildfire* columnist Mike DeGrosky so nicely articulates on page 46, the IAWF "has taken an informed position on a contemporary, important and at times controversial issue confronting wildland fire communities around the world, and communicated it globally."



A SUMMER OF FIRES

I spent this past summer in Spain watching wildfires spread across borders and challenge the various prevention and suppression efforts that fire and forestry agencies made to reduce loss. As our association shares its new position paper on prescribed burning, global lessons from the past few months will enrich our discussions as we bring the wildfire community together at conferences over the rest of 2022, and guide us as a community into the new year with new tools for success.

The Mediterranean region experienced yet another destructive season of wildfires in Algeria. The same hot and dry winds plaguing Southern Europe fanned fires during mid-August across 14 separate regions of Northeastern Algeria. The fires claimed numerous vacationers in the coastal El Tarf province, where 34 of the 37 fire-related deaths occurred. All this comes following fires in 2021 that claimed 90 lives and burned more than 10.1 million acres of forest lands in the country. At the time of the 2022 fires, the regional media-outlet Al-Jazeera reported that "the situation underscored the perennial criticism that [the country's capital] Algiers has not invested enough in firefighting technology, including specialized planes, forcing it to seek help from the international community." Again, the misleading messages that some media share during a wildfire crisis. It is not more planes that are needed to face the fires, but a more complex combination of professional forest and fire management measures adapted to every country's realities.

Over the same period, a wildfire reignited in the southwest of France around Bordeaux, spreading over 52,000 acres before being controlled and displacing 40,000 people from their homes. Reflecting on the extreme drought conditions of this summer, EFFIS (European Forest Fire Information System) reports 160,000 acres had gone up in flames in France by mid-

September, nearly six times the full-year average for 2006-2021.

And, that same week in mid-August, Madrid was blanketed in smoke from a Portuguese wildfire almost 250 miles away. Fire authorities had to inform area residents that there was no fire nearby. That fire in Portugal's Serra da Estrela National Park burned more than 42,000 acres and led to the evacuation of several villages. This summer was brutal to the Iberian Peninsula, which includes Spain and Portugal, and provides a clear sign that our climate is influencing wildfires and their management, not to mention the extreme temperatures in the UK. The Nature Geoscience Journal said in July that "Climate change has left parts of the peninsula at their driest in 1,200 years." Spain multiplied the burned area average by 5 times for the same 2006-21 period (741,000 acres) and in the east, Romania burned 19 times its yearly average, up to 150,000 ha (370,000 acres)

These fires lay bare the challenges faced by our wildfire community to suppression and prevention, from a drier and heavier fuel-loaded landscape and the impacts of smoke; they remind me of the importance of our association's focus as a primary global voice for the wildfire community and our goal to tackle contemporary issues toward achieving a sustainable wildland fire paradigm. The IAWF's new position paper on prescribed burning meets this effort at a very important time for our wildfire community and the landscapes and people we protect. Many articles in this edition of Wildfire reflect upon the position paper and the role that prescribed burning can positively make in healthy landscape management efforts.

The position paper's clear calls to action direct us to advocate for the use of prescribed and wildland fire where possible to meet protection- and land- and resource-management objectives; and to manage our natural resources through progressive fuels

I believe the IAWF is uniquely positioned to advance the use of prescribed burning and our wildfire community's discussion around its value and positive use.

reduction to increase landscape resilience in the face of climate change; and to educate our communities to accept our co-existence with smoke and wildland fire. This document will guide the IAWF in encouraging our wildfire community to enhance fire-adapted communities and build public understanding around the role of prescribed burning. The paper also calls for the thoughtful prioritization of landscapes that are at the greatest risk for necessary treatments and management objectives. I encourage you all to read the position paper and see how it provides guidance to agencies, our workforce, residents, and the technology and research community.

The next few months provide us with the opportunity to share the value of the IAWF's position paper to new audiences and within our own wildfire community of operations, management, research, and technology advancement. IAWF is proud to support these upcoming events and I hope to see you at them. The list is pretty impressive!

At the beginning of October, our colleagues at the Association for Fire Ecology and Pau Costa Foundation partnered with Regione Toscana and the University of Florence to host a hybrid conference in Florence and online for diverse stakeholders involved in wildfire management. At the end of October, we will gather in Edmonton for the Wildland Fire Canada Conference and smoke forum; this is the rekindling of this bi-annual conference following delays caused by COVID. The United Kingdom Wildfire Conference Nov. 10-11 in Belfast will draw lessons from the UK's difficult 2022 wildfire season and help shape a more resilient future. Later that week, The 9th International Conference on Forest Fire Research & 17th International Wildland Fire Safety Summit

will showcase the latest in forest fire science and technology as attendees meet in Coimbra, Portugal. Finally, IAWF will host the 5th National Cohesive Wildland Fire Management Strategy Workshop in Asheville, North Carolina, Nov. 14-18: the discussion on the role of prescribed burning and agency support will be very important to engage in and learn from at this conference.

I believe the IAWF is uniquely positioned to advance the use of prescribed burning and our wildfire community's discussion around its value and positive use. The position paper on prescribed burning, along with the IAWF's position paper on climate change that was released in the spring will guide us as a community into the new year with new tools for success. I look forward to 2023 as we lead this charge and expand how we as an association include new people in this effort.

ABOUT THE AUTHOR

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has been working for the last 25 years to bridge the gap between scientists and end users. In 2013, Ramirez moved to San Diego from Spain, and now works with agencies worldwide trying to convert the best 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. Since 2011, Ramirez has co-ordinated the first European M.S. in Forest Fires (www.masterfuegoforestal.es) with Prof. Rodriguez Francisco y Silva (UCO) and Prof. Domingo Molina (UdL). Ramirez is 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 M.S. in forestry from the University of Lleida, and his B.S. in forest engineering from the Polytechnical University of Madrid, Spain.

IAWF CALLS FOR ACTION

POSITION PAPER ADVOCATES LONG-TERM USE OF APPLIED FIRE

The International Association of Wildland Fire (IAWF) is an independent, non-profit organization. For more than 30 years, the IAWF has facilitated global communication on wildland fire and provided objective leadership through a neutral forum of diverse experts who consider and address all important, and at times controversial, wildland fire issues.

IAWF membership spans all continents; the association is a primary global voice of wildland fire personnel, land managers, and scientists. IAWF's goal is to tackle contemporary issues confronting wildland fire communities to achieve a sustainable wildland fire paradigm.

Prescribed burning in the Sierra de Gata (Cáceres). Photo by Juan Caamaño.



1. OVERVIEW AND PURPOSE

This IAWF position statement articulates the critical importance of intentional burning as a landscape management tool, including the skilful application of fire to meet multiple resource objectives.

For almost 400 million years, fire has shaped our planet. Humans have used fire for millennia – for land clearing, cultural practices, agriculture, hunting, migration corridors and travel pathways, and even warfare.

Across the globe there are multiple perspectives on human-environment relationships and the role of fire, and the notion of prescribed fire incorporates western perspectives on nature combined with scientific principles and methods. Prescribed fire is applied for a range of outcomes that can include managing fuels, maintaining a carbon balance, ensuring the supply of clean water, sustaining ecosystems and conserving biodiversity.

Globally diverse Indigenous groups may have different understandings of the interconnectedness of fire, people and other phenomena and those viewpoints and insights shape their use of fire for particular cultural purposes.

Contemporary uses of fire for land management broadly fit into three categories:

- fuels management (often called prescribed burning or hazard reduction burning);
- landscape and ecosystem management (often called prescribed fire);
- Indigenous cultural fire practices. (Note: many Indigenous, First Nations or Aboriginal Peoples do not consider cultural burning to be a category of prescribed fire.)

According to a 2013 article “Perspectives of prescribed burning” by Jeremy Russell-Smith and Richard Thornton, in *Frontiers in the Ecology and the Environment*, the use of fire for land management has been controversial almost everywhere it has occurred, for various reasons, from the impact of smoke on human health and agriculture to the anti-logging position that fires are visible symbols of post-harvesting debris removal.

For humans to aid ecosystems in adaptation to climate change and mitigate the impact of changed fire regimes on landscape values, the role of fire as a management tool must increase in importance.

Climate models predict drying and warming trends across many parts of the world. According to the “Sixth Assessment Report of the United Nations Intergovernmental Panel on Climate Change in 2021,” the trends are likely to exacerbate wildfire risk, both

the likelihood of fire and extreme fire consequences. Warming and drying trends will have a significant impact on the use of prescribed fire as the only broad-area management tool. It is predicted that around the globe, traditional weather windows for prescribed burning will shift and change.

2. AIMS, EFFECTIVENESS AND ISSUES ASSOCIATED WITH TYPES OF PRESCRIBED BURNING

It is widely accepted by wildland-fire managers that burning vegetation, whether through prescribed burning or leaving an appropriate wildland fire to burn, can mitigate the negative impacts of wildfire.

Challenges to conducting prescribed fires include funding, workforce capability and capacity; lack of comfort among residents with fire and smoke; and in some countries, fines for smoke pollution. In addition, many agencies are risk averse (often as a result of an escaped prescribed burn) and reluctant to allow prescribed burns, based on political and social fear. Increasing the application of prescribed burning, in some regions, will necessitate broad agency interaction to balance the risk of poor air quality from a wildfire with the risk to air quality and health under conditions during which prescribed fire can be used. Social science research can, and has, advanced the understanding of the barriers to and opportunities for prescribed fire for landowners and the public. Prescribed burning can reduce the severity of future fire behaviour, create safer communities, increase the potential success of containment efforts for wildfires, improve biodiversity, and maintain and improve the health and resilience of ecosystems.

Prescribed burning can be completed at scales ranging from small site-specific projects of less than five hectares to large, landscape burns totaling more than 50,000 hectares, with a treatment range from single to combinations of burns with various aims, and single to multiple applications over several years.

Prescribed burns can be carried out over multiple jurisdictional boundaries involving many landowners and managers. The common goal is to enable more successful landscape outcomes, which often requires significant political and social awareness for the expanded use of wildland fire to minimize fuels, support biodiversity and adapt to climate change.

i. Fuels / hazard reduction

The purpose of this type of prescribed burning is to reduce fuel levels (fuel hazard, change in structure and continuity, decrease fuel load) to:

- a. enable easier control of fires during an initial attack
- b. reduce the likelihood of fire ignitions (for example, roadsides)
- c. improve community and firefighter safety, and reduce potential economic losses
- d. provide areas of decreased fire intensity and reduced ember production for safer firefighting operations, including backburning and burnout, for increased opportunities for containment and operational safety
- e. reduce fire exposure and potential impact on firefighters, biodiversity, cultural values, communities, assets, and key infrastructure.
- f. minimize the potential for large fire runs.

Wildland fire managers have developed and refined prescribed fire as one of several modern and efficient tools to reduce future wildfire intensity and severity. While climate change is altering some of the parameters, prescribed burning remains a critical process in managing the future impacts of wildfire on our landscapes and communities.

Although prescribed fires can reduce the severity and intensity of future wildfires, the level of effectiveness decreases under extreme hot, dry, and windy weather conditions. Under these conditions the fire and atmosphere are coupled and therefore promote increased drying of fuels, fire spotting, and the generation of pyro-cumulous and pyro-cumulonimbus clouds.

Most wildfire incidents occur under moderate conditions during which litter and understorey / fuels are the primary driver of fire behaviour. The impacts of such fires can be substantially mitigated if there is an existing network of fuel reduced areas. Between 95 per cent and 98 per cent of fires are brought under control during the initial or extended attack.

A case study of the 2003 fires in Victoria, Australia, showed that reduced fuel hazard decreased fire severity sufficiently to lessen impacts on wildlife, soil, water and cultural values compared to the impacts of the same fire burning through heavy fuels, and even a wildfire burning under extreme conditions.

Managing any parcel of land for multiple values will cause potential conflict in many cases, so tradeoffs between values are necessary. For example, burning will favour some species over others. Equally, more frequent burning to protect watersheds, critical infrastructure or residential areas will have a negative impact on some species and biodiversity.

Another tradeoff is the impact of a prescribed burn measured against the severe and devastating impacts of a future wildfire. Even if a prescribed burn has some substantial undesirable effects, these should be evaluated against the damage potential of an uncontrollable wildfire.

There is a possibility that prescribed fire implemented for hazard reduction will have negative effects on biodiversity or other values if prescribed fire is too intense, too frequent or conducted in an inappropriate season. So, planning with local land managers is essential. It is also important to monitor fire effects after a burn, so practices can be improved. Decisions to conduct prescribed burns depend on the values managed in a particular landscape or a management unit, and tradeoffs between those values, which should be considered in the context of the larger ecosystem and over multiple timescales.

An additional complexity of prescribed burning is reaching a consensus on smoke management with communities and the organisations that are responsible for air quality. Smoke from wildfire significantly impacts human health and is associated with an increased risk of respiratory and heart morbidity, as reported in a 2015 literature review of 61 epidemiological studies linking wildfire and human health. Additionally, a 2018 report in the *Medical Journal of Australia* acknowledged that smoke from planned burning impacts human health and argued for factual discussions about the role of prescribed fire in risk reduction, while considering the health burden associated with fire smoke.

Managing the effects of smoke on human health is a complex problem. Agencies and affected groups need to enter a discussion that includes bushfire practitioners and managers who are able to influence burning operations. The IAWF suggests a re-focused, balanced comparison that considers the totality of risks and benefits of prescribed burning, rather than unrealistic smoke or no-smoke comparisons. It would be beneficial to contrast possible levels of smoke during prescribed burning and wildfire seasons and other impacts of wildfires (for example, impact on life, ecosystems and diversity, fuel loads, property, and critical infrastructure). According to a 2022 report prepared for the American Lung Association, prescribed burns are typically of shorter duration than wildfires, are less severe, and occur at known times of the year, so precautions can be taken in advance of a prescribed fire season. The conversation should also include the benefits of prescribed burns and natural fires that are allowed to burn under pre-set prescriptions.

ii. Ecosystem management (biodiversity, carbon, water yield and quality)

Ecological burning is a critical process for maintaining healthy ecosystems. In some systems, the purpose of ecological burning is to return fire as a natural disturbance to fire-prone landscapes, where suppression activities have excluded fire. Prescribed fire would aim to decrease the departure from natural fire regimes and therefore maintain ecosystem health. Important functions of fire include stimulating regeneration, increasing flora and fauna species diversity, disadvantaging invasive species, and providing high-quality habitat for a diverse range of species.

A 2020 article in the *Journal of Ecology* titled “Fire as a fundamental ecological process: Research advances and frontiers,” states that fire is a powerful ecological and evolutionary force that regulates organismal traits, population sizes, species interactions, community composition, carbon and nutrient cycling, and ecosystem function. Fire also presents a rapidly growing societal challenge, due to both increasingly destructive wildfires and fire exclusion in fire-dependent ecosystems.



According to Marcelo Simon et al. in 2009, and Tianhua He et al. in 2019, fire is a recurrent process, a regime, which is integral to ecological function. Fire regimes have direct ecological effects and act as selective evolutionary forces. Moreover, as species are adapted to the fire regimes in which they evolve, they in turn influence the fire regimes to which they are subject. Humans have altered fire regimes in many ways such as converting forests to farmland, suppressing fire and prescribing fire. Ecological burning seeks to impose fire regimes that support healthy, diverse, resilient ecosystems. Prescribed burning, aimed at achieving ecological resource objectives, is a tool that could support ecosystem adaptation to the changing climate.

iii. Indigenous cultural burning practices

Cultural burning is a type of prescribed burn that has been ingrained in cultures for generations for ceremonial purposes, to sustain desired species and habitats, and to maintain a lifestyle synchronised with regional ecosystems and Earth. Cultural burning has been practiced by many Indigenous Peoples and pre-industrial communities around the world for millennia. It usually differs from agency prescribed burn practices in the reasons, techniques, and times for burning. Colonization often resulted in fire exclusion and brought a sudden end to many cultural burning practices. Many Indigenous Peoples do not consider cultural burning to be a category of prescribed burning, because they consider the two practices to be fundamentally different. In the last two decades, Indigenous Peoples around the globe have reintroduced cultural burning techniques and objectives on a larger scale, although it's important to note that many Indigenous groups in South America, Africa and Australia never stopped burning. For example, in California, legislation has been passed through extensive work by Indigenous groups that recognizes cultural burners and cultural burning practices. Important to this is not just the application of fire, but the resurgence of Indigenous knowledge and issues of sovereignty, autonomy, and cultural transmission between generations. Recent studies have demonstrated that Indigenous land management practices, such as cultural burning, have increased biodiversity and reduced net carbon emissions.

Many barriers still exist toward implementing cultural burning and Indigenous-led cultural burning programs, including lack of understanding, cultural appropriation, and unsympathetic laws and governance.



The Flint's Meadow prescribed burn in Banff National Park, in October 2021, approximately 37 hectares. The amount of area burned annually in Canada's national parks by prescribed fires since 1981 varies from 100 hectares to 11,000 hectares and is highly dependent on weather conditions. Photo by Jane Park.

3. CALLS TO ACTION

The IAWF's vision is to safely and effectively extinguish wildfires, when necessary, and to use prescribed burning and wildland fire where and when possible, to meet human objectives. Those objectives include human protection and safety; management of ecosystems, landscapes, resources and fuels; increased landscape resilience in the face of climate change; and support for Indigenous inherent rights to fire as a cultural practice. The pathway to this vision is the education of communities in the appreciation of the value of fire regimes culminating in a co-existence between people and wildland fire and smoke.

To achieve this vision, the IAWF proposes that the global wildland fire community:

1. Identify and enhance community co-existence with fire.
 - Develop public understanding of the overarching long-term benefits of fire on our landscapes to mitigate potential risks, and the necessity for prescribed, controlled and Indigenous burning, as well as wildfire.
2. Identify ecosystems most at risk to large, high-severity wildfires.
 - Prioritize landscapes that are at the greatest risk, for treatments and mitigation measures to build landscapes that can withstand changes in fire regimes in accordance with climate, land and resource management objectives.

The IAWF proposes that wildland fire communities and agencies consider several actions to achieve these objectives.

A. ORGANIZATIONS, AGENCY POLICIES, PRACTICES, WORKFORCE AND CULTURE

Organizations and agencies will need to balance the ever-increasing complexity in policies, procedures, planning and approvals processes with the need for agility and readiness to take advantage of the decreasing windows of opportunities to burn, which might change as fire weather and landscapes are altered by changes in climate.

As prescribed burn programs address the increasing risk to people and ecosystem services, it is inevitable that some mistakes will be made during program planning and delivery. It is important that agencies move away from a blame culture, so mistakes can be analyzed without fear of retribution. Doing so will enable organizations and agencies to learn from mistakes and improve processes, procedures and knowledge within their workforces.

Agencies need to continually maintain skills and capacity, recognizing that the challenges for fire management and effective application of prescribed burning cannot be met by any one agency, organization, or community alone. Leaders in wildland fire, weather prediction and regulators must all identify where greater collaboration is required. As landscape and community risk increases, adaptable funding mechanisms are crucial to managing the complexity of wildland fire and smoke management across multiple agencies and jurisdictions. The focus should be to set appropriate objectives for the management of the broader landscape, management units (forest block, national parks) and the use of prescribed burning.

Setting objectives also facilitates engagement with communities affected by prescribed fire and managed wildfire. Although burn-program objectives at a regional or national level are commonly used, it is essential to accommodate local scales and perspectives, to improve the types of actions that might achieve objectives, and to widen their adoption. The organisations should utilise available tools to predict and minimise smoke impact on human health.

Planned-burn programs should reflect longer-term, inter-agency strategies designed to manage for a range of outcomes. Such strategies could include the protection of life, property, industry and assets; fuels reduction and maintenance; promotion of ecosystem health and diversity; establishment and support for diverse species habitats; control of invasive species; management of air quality risks; and protection of cultural assets.

B. COMMUNITIES AND SOCIAL LICENSE

In its broadest sense, shared responsibility is about negotiating a new social contract for wildfire preparedness, management and recovery under which governments and communities agree on the allocation of rights and responsibilities.

The shared responsibility for wildland fire management is about the ways citizens and governments can work together to minimise the potential impact of future wildland fire events. This can be achieved by focusing on the meaning of shared responsibility in specific contexts and the significance and challenges for the way citizens and all levels of government can work together to manage infrastructure, air quality, health and wildfire risk. A renewed focus is required on mitigation, community resilience, maintenance of defensible spaces and collaborative planning between residents and first responders. We must recognise that different agencies, businesses and communities have different capabilities and therefore different vulnerabilities and strengths.

Gaining and maintaining social license for prescribed burning is crucial; without it, large burning programs cannot be conducted. This is where the role of community engagement and education is extremely important. Communities must be engaged in pre-fire action planning and reach a consensus on the value of fire-safe initiatives such as creation of defensible space, evacuation planning and provision of firefighting water supplies. IAWF vice president Steve Miller proposed in a 2013 webinar titled *Burning in Their Backyards and Having Them Say Thank You, Wildland Fire Lessons Learned*, that wildland fire leaders should learn from experiences in communities that were previously resistant to prescribed fire, but have come

to understand how it can work for them. Lessons and comparisons of post-fire, fire-safe communities and communities that are not fire-safe can encourage positive action. Also a comparison between healthy post-fire ecosystem recovery from prescribed burning with similar post-fire recovery of severely burned ecosystems can help communities understand the difference. Wildland fire organizations and agencies must listen to community concerns about prescribed fire, adjust their plans accordingly, and refrain from assuming what the community values. Social scientists can help to bridge the gap between wildland fire organizations and communities.

Prescribed burning can have significant benefits in terms of developing community awareness and behaviour in relation to wildfire. Through participation in planning and operations, people are better prepared for wildfire, acquire a better appreciation of the threats of wildfire, recognise when fire control will be difficult, and are better able to understand the benefits and limitations of specific fuel management operations.

C. USE OF TECHNOLOGY

Technology is critical to efficient prescribed burning, effective sharing of data, and helping people and organizations be more innovative, safe, and productive. The role of technology is to enhance prescribed burning, and to improve communication, situational awareness and safety. Technology is an enabler for improving current practices. Agencies and jurisdictions should share information and create partnerships to expedite technological development.

D. RESEARCH AND SCIENCE

Fire management needs to be based upon the best available science and this science should be made publicly available to communities it serves. Knowledge, research, science, and experience should be shared among all related wildland fire management organizations and agencies. Active fire research programs, combined with international and interagency collaboration, provide the means to make information available to all fire managers, communities and governments.

Technology, tools, research, human expertise, and both physical and social science are critical to address our 'new normal' fire regimes and to tackle unique challenges in the future. Opportunities to bring western science and traditional knowledge together for mutual benefit should be maximised. At the same time the limits of scientific methods and knowledge need to be recognised. Respect must be shown for local cultural perspectives, insights and wisdom.

The IAWF continues to support the need for extensive research and modelling to better forecast present fire danger and future change. Research and science are particularly important for better understanding our current and future state of changed climate. Priority areas for investigation include: changes in temperature, especially sustained high temperature; change in precipitation; prolonged droughts; and changes in vegetation types and species composition, especially changes that result in increased fire severity and frequency.

E. CONTINUOUS IMPROVEMENT AND ADAPTIVE MANAGEMENT

Linkages, causes and effects of wildland fire are complex and continue to evolve and change. Therefore, wildland fire management must be adaptive. Agencies must be prepared to invest in research, rethink procedures and challenge accepted wisdom. Indigenous Peoples and local communities have critical knowledge and agencies must be open to receiving it. Useful learning must result in rapid, near-term change and adaptation. Making changes through learning must become routine, not just something that happens after disasters. Land and fire management agencies, businesses and communities must learn together, so that they can respond expeditiously to problems and achieve better outcomes. Adaptation takes effort and time, and success will depend on deliberate investment across the community and agency workforces.

To achieve continued improvement and adaptive management, it is important to undertake monitoring, evaluation, and reporting (MER), which allows agencies to quantify the efficiency and effectiveness of their strategies and the work they have undertaken. Doing so allows for full transparency of management outcomes for fire management staff, to the government and community.

F. INDIGENOUS LEADERSHIP

Indigenous leadership offers new insights as many governments, wildland fire agencies and other organizations grapple with climate change and mega fires and seek new ways to deal with public safety, fire ecology, increasing suppression costs and other wicked problems.

The first step is recognition that traditional processes of leadership, governance and decision making have adapted and remain strong in many Indigenous communities across the globe, despite disruptions

to land access and many cultural practices. Ongoing connection to country, continuity of knowledge, and the exercise of traditional authority are now evident in the resurgence of cultural burning.

The legislative and policy landscape is also changing in many parts of the world, providing new mechanisms for recognizing traditional ownership of land and enabling self-determination and sustainable livelihoods. Emerging Indigenous corporations and organisations are bringing together western and traditional governance and empowering new forms of leadership in fire and natural resource management, economies, and state institutions.

Agencies seeking to address seemingly intractable fire management problems must engage with Indigenous leadership at local, regional and state levels so that diverse cultural perspectives and two-way learning can inform the strategies, policies and actions needed for a sustainable future.

OUR COMMITMENT

IAWF will continue to provide opportunities for research, knowledge and experience sharing through 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 prescribed fire.

IAWF will work with Indigenous Peoples to support Indigenous-led cultural burning practices and facilitate the sharing of knowledge and practices with other Indigenous Peoples, as well as with land and fire managers.

IAWF will continue to advocate for improved diversity in global fire management. A diverse workforce, including a variety of gender, 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 and broader thinking and progressive and deliberate actions.

Note: references available in the online version at iawfonline.org.

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CHINA

REGIONAL REGULATIONS GOVERN PRACTICES

BY YICHAO ZHANG, YIZHOU LI, AND XINYAN HUANG

The wildland in China covers about 220 million hectares, and the wildland coverage was 22.96 per cent by 2021. Most of China's wildlands are located in the Northeast (the Greater Khingan Mountains forest region), North (Inner Mongolia region), and Southwest (Sichuan and Yunnan).

After the shocking 1987 Black Dragon fire in Northeast China (193 deaths), the State Forestry Administration issued the first version of *Technical Regulations for Fire in Forest Management in Northeast and Inner Mongolia Forest Areas* to help control and manage wildfires, including prescribed burning. This regulation was updated in 2010 and again in 2020, and also guides prescribed burning in other regions.

In China, prescribed burning usually occurs from autumn to the next spring. In northern China, prescribed burning can be undertaken after the rain in the midsummer when the moisture content of forest combustibles is high. Most of the areas to be burned are selected according to the forest age and combustible conditions. The size and shape of the burned areas must be under control and within the scope of the plan with natural firebreaks and standby fire services. Today, prescribed burning is seen as



a common proactive method for wildland management and fire prevention in most wildland-dominated areas in China.

Nevertheless, in 2004, a prescribed fire in the Greater Khinganling Forest went out of control near the city of Heihe due to a sudden weather change. This disaster

lasted for a week before it was controlled. Since then, the central government has tended to reduce the use of prescribed burning to avoid unexpected risks and regulate the proper actions to implement the prescribed burning. Local governments also set more policies to standardize the control of prescribed burning.

Phenological point-burning technology is a method with distinctive characteristics to select the burning time under current regulations; it guides the determination of the burning time through the combination of biological, meteorological, and hydrological phenology of wildfires. The phenological phase is the main basis for the burning time, but meteorological factors are merely as the reference basis. These principles are further expanded into technical guidelines for wildland fires in Inner Mongolia and northeast China, including (1) if ignition locations



Prescribed burning in April 2022 (Greater Khinganling). Photo by Zhaohua Ding, Forest pest control station of Genhe Forest Industry Company.

are suitable or not, (2) if the burning time is allowed or not, and (3) the uncertain conditions depending on the situation. The regulation also covers the methods of burning, organization, management, and precautions of prescribed burning. These principles serve as a reference for the prescribed burning in northern forest regions.

Sichuan in Southwest China has 20 million hectares of wildlands, eight per cent of which are natural forests. Recently, extreme wildfires have occurred frequently, and many have approached the wildland-urban interface. The Sichuan Fire Services Department defines several regulations based on ecological protection, so there are complete legal provisions regarding prescribed burning. There are eight no-burn principles – no prescribed burning (1) without permission, (2) in bad meteorological conditions, (3) in complex terrains, (4) without firebreaks, (5) without training, (6) without responsible personal, (7) during major holidays and social events, and (8) under disputable land ownership. Sichuan has the most detailed regulations on prescribed burning, even regulating practices for specific tree species. Although the practice of prescribed burning is widely recognized, its smoke and pollution still cause public concerns.

Yunnan, on China's southwest border, has complex terrain and diverse wildlands and species, including many state nature reserves. In particular, Xishuangbanna National Nature Reserve has established a domestic prescribed burning regulation for nature reserves, which considers the potential impact on domestic wild animals. Regulations in Fujian, on the east coast of China, stipulate that for prescribed burning tasks, the first thing to do is conduct a survey, and then scientifically develop the burning and emergency plans. Since 2008, the provincial government has promoted public education on wildfire prevention to popularize the benefits and



Prescribed burning in January 2021 (Panzhihua, Sichuan). Photo by Qihang Zhang.



Forest Fire Brigade of Sichuan Panzhihua. Photo by Qihang Zhang.

scientific significance of prescribed burning before burning every year.

In short, there are active prescribed burning practices in China's fire-prone habitat and forest ecosystem, and regulations are detailed, constantly updated, and varied in different wildland regions.

ABOUT THE AUTHORS



Yichao Zhang is a visiting student at Hong Kong PolyU and his research focuses on peat fire.



Yizhou Li is PhD student at Hong Kong PolyU and his research focuses on AI-drive wildfire forecast.



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SPAIN

CHANGING THE ALL-AGAINST-FIRE MANTRA

BY JOSÉ ALMODOVAR

Between 1988 and 1996, the slogan “All Against Fire” became famous in Spain. During those years, a large number of wildfire managers – many still in service – were instructed to consider fire to be a negative disturbance. This perception existed not only at the street level but was also taught at the university level, in programs such as forest engineering. Changing this paradigm, both at a public and technical level, was not easy and still the All Against Fire mantra is deeply rooted in some Spanish areas.

For many years, farmers and ranchers have carried out burning, especially in the northwest of the country and the Cantabrian coast. However, it was not until the beginning of the 1990s that the first burning plans came to light with the aim to solve the wildfires that non-planned burnings were creating. The “prescribed burning” concept came later, and it was not until the beginning of the 21st century that prescribed burning



became popular. Prescribed burns have helped advance planning, technification and fire-impact monitoring, in addition to becoming essential to managing the ground fuels in forested areas.

Since the end of the 20th century, thanks to the great disseminating work of José Antonio Vega from Galicia, Domingo Molina from Catalonia, and Francisco Rodríguez y Silva from Andalusia, managers learned that fire should be considered a tool for fire prevention and suppression. By that time, anyone who wanted training had to go to North America. However, in 2006, we had the chance to be trained in Spain, thanks to the Lleida University and the Gran Canaria Council prescribed burning courses. Those led to the progressive implementation of prescribed burn techniques at a national level. The training allowed managers to apply prescribed burning activities at a local scale and, at the same time, to train our local crews.



Prescribed burning in *Pinus nigra* in the Iberic System. Photo by José Almodóvar.



Prescribed burning with scientific objectives down to the *Quercus faginea* and *Pinus nigra* canopies in the Iberic System.
Photo by José Almodóvar.

It is worth mentioning that research centers in forest sciences played a fundamental role in the implementation of prescribed burning. Excellent collaborations between science and techniques such as the joint participation and collaboration of firefighting and scientific organizations in projects such as FIREPARADOX, GEPRIF, CILIFO or VIS4FIRE, allowed the introduction of prescribed burning in a wide range of places and, simultaneously, to conduct further research on this topic.

The gradual implementation of prescribed burning as a tool for management has led to a generalization and technification of the use of fire as a fire suppression tool. This advance has been given by the improved fire behavior knowledge and capacities gained through prescribed burns, thus becoming the best training for fire suppression.

In Spain, each autonomous region has regulatory agency for forestry issues. Even though the bureaucracy required to conduct prescribed burning varies for each region, in general terms, this activity always requires authorization from the regulatory body. In the regions where the prescribed burn is conducted by the same agency that authorizes the burn, the bureaucracy and the implementation of the burn are generally better. However, in regions where

the authorization is given by a different agency, the process is generally slower and more complex. In any case, it is a fact that in places where the prescribed burning techniques are well consolidated, the bureaucratic steps to obtain authorization work well no matter the complexity of the process.

When prescribed burns take place in natural protected sites such as national or natural parks, additional authorization is often required; this extra step often complicates the process.

In most Spanish regions, prescribed burns are executed exclusively by public services, often the same agencies that oversee wildfire suppression. Following the good practices developed by neighboring Portugal, opening the implementation of the burns to the private sector is considered a necessary step in the future. Another needed practice is the consideration of prescribed burning as a silvicultural tool that can be implemented independently from the type of land ownership. To achieve this goal, a system will need to be set up to certify the competencies for planning, coordinating, and executing burns.

Basic technical recommendations for the implementation of prescribed burns exist at a national level. Those are approved by the Comité Nacional de



Prescribed burning in *Pinus nigra* in the Iberic System. Photo by José Almodóvar.



Prescribed burning under *Pinus canariensis* canopy (Canary Islands, Spain) Photo by Juan Caamaño.

Lucha contra Incendios Forestales as a common framework for the management of prescribed burns. The recommendations specify the essential knowledge that participants in a prescribed burn should have, as well as safety measures. Other than that, the training for planning, co-ordinating and participating in burns depends on each region. Thus, the responsible agency from each region has trained its staff internally.

Prescribed fires started as a pilot in the 1990s and the 2000s in Spain, but it was not until the 2010s that implementation and growth expanded. At present, Spain is in a stage of consolidation and integration of prescribed burns into the fire prevention and mitigation strategies of the different agencies. As an example, the large Castilla-La Mancha region in the centre of Spain is committed to developing prescribed burning techniques and steadily increasing the number of hectares managed each year.

Acknowledgements: Nuria Prat, Juan Caamaño, Juanjo Fernández and Javier Madrigal for their contributions and comments.



ABOUT THE AUTHOR

Jose Almodovar is a forestry engineer and a wildfire manager. He works for the Forest Fire Service in Castilla-La Mancha, a region in the center of Spain where he has been an incident commander for wildfires for more than 20 years. He is also involved in the prescribed burning planning and training in the region and a member of the Pau Costa Foundation.



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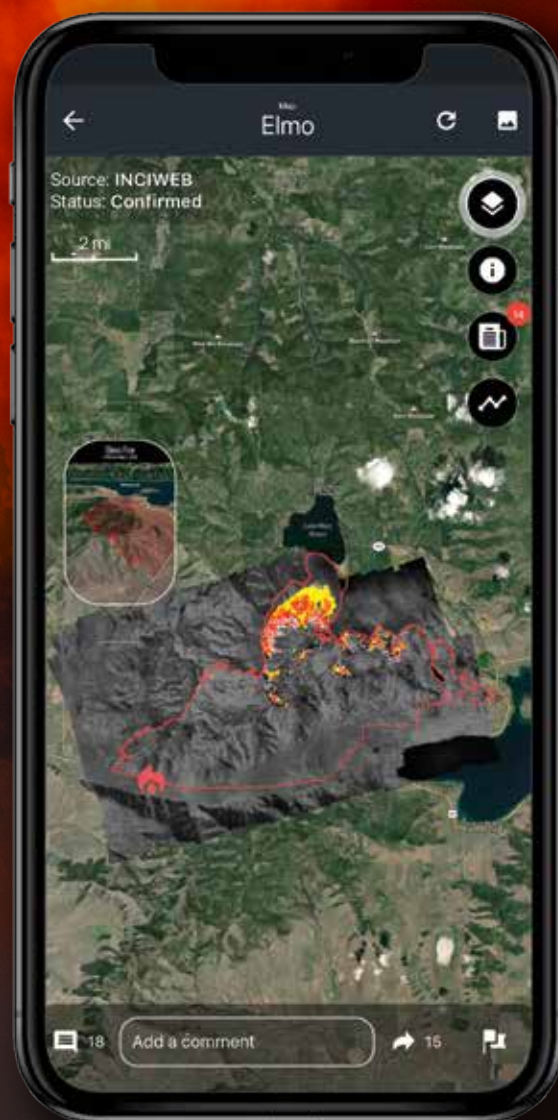
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PORTUGAL

A DIFFICULT PATH FROM EXPERIMENTATION TO POLICY, AND FROM POLICY TO PRACTICE

BY PAULO FERNANDES

Prescribed burning has been going on for nearly five decades in Portugal. It was in the mid-70s that the pioneer José Moreira da Silva conducted the first forest service trials in the pine forests of the northwest of the country. In 1982, da Silva designed the first regional prescribed fire program in southern Europe. The concurrent scientific research assessed the ecological impacts of the practice and legitimized it, and over time resulted in good practice manuals and decision-support tools for prescribed fire planning, operations, evaluation and training.

Despite these efforts, prescribed burning development and adoption has been slow and unsteady, to the point of almost disappearing after the early 1990s. Opposition to the practice was generalized within the Forest Service and its no-fire culture inherited from Central-European forestry. It is revealing that, despite all the science and experience available, it was never possible to apply prescribed burning in the state-owned coastal forests of maritime pine (*Pinus pinaster*), of which half were eventually lost to the 2017 wildfires. In contrast, the maritime pine plantations established in southwestern Australia have been regularly treated with fire since the 1970s.

Policy and institutional support for prescribed burning in the early 2000s resulted in training standards for burn bosses and burn crews and the first hands-on training initiatives. But it was the severe wildfire seasons of 2003 and 2005 that changed the outlook for prescribed burning in Portugal. A dedicated legal and regulatory framework was set up, including the



formalization of planning procedures for burn operations. The first national fire plan (2006) foresaw a role for prescribed burning within its “increased resilience to wildfire” axis and program for strategically placed fuel break networks and fuel-treatment mosaics.

The 2006-2010 period was thrilling for fire lighters, and was one of capacity building and various fruitful exchanges between European practitioners promoted by FIRE PARADOX, a large international R&D project that launched the idea of integrated fire management in Europe.

The GEFoCo program and the newly created fire analysis crews made possible expansion of the treated area during that period. GEFoCo was short-lived but it circumvented the chronic deficit of resources for burning through expedited funding mechanisms and sharing of resources.

Prescribed burning in Portugal has always been vulnerable to changes in organizations and dependent on individual (un)willingness. Like in the past, and despite increasingly higher acceptance and knowledge transfer, its development stalled after 2010 due to an unfavorable environment in the forest service. Then came the catastrophic fires of 2017 and the subsequent imperative for a more balanced policy in terms of fire suppression versus prevention and mitigation. An ambitious (considering the scarce resources available) national plan was prepared for 2018 to 2020 to substantially increase prescribed burning area, but it underachieved by a large margin. Currently (the National Plan for the Integrated



A prescribed fire operation in northern Portugal shrubland. Photo by Paulo Fernandes.



Results of a thin and burn treatment in a maritime pine stand regenerated after wildfire. Photo by Paulo Fernandes.

Management of Rural Fires, 2020-2030), fire use is featured as an integrated strategy comprising not just prescribed burning but also pastoral burning and managed wildfire.

The major objective of prescribed burning in Portugal is fuels reduction. Research indicates decreased fire severity in treated pine stands intersected by wildfire but a modest effect on wildfire extent. The latter is an outcome of low treatment effort: where prescribed burning is practiced, it amounts on average and annually to around 0.5 per cent of the landscape,

that is, one order of magnitude below the needs of wildfire control. Burn units are small and dispersed and their placement is seldom studied to optimize impact on wildfires. Additionally, the effect of treatments on wildfire spread is mostly passive, as the bulk of fire suppression resources are engaged in civil protection duties at rural-urban interfaces, and wildland firefighters are scarce.

Prescribed burning in Portugal is essentially (90 per cent) carried out in shrublands located in mountain common lands, and as such it contributes to management goals other than decreasing fire hazard. Common lands often have pastoral use and overlap with fire-adapted Natura 2000 habitats, and both benefit from prescribed burning. On the other hand, it can be argued from a risk-analysis perspective that prescribed burning is practiced where it is less needed, because those areas are characterized by frequent unplanned fires for pastures renewal and fuel-age mosaics that have been shown to limit wildfire size.

The largest and most severe wildfires in Portugal occur in large continuous tracts of pine and eucalypt forest and mature shrubland and woodland. The former, either planted or regenerating, are commonly undermanaged or abandoned. Considering the socioeconomic impact and substantial threat to rural communities and rural-urban interfaces, these areas should be prioritized

for fuel management. Prescribed burning could play a significant role here, namely in high-density post-fire regeneration where the scale of intervention makes mechanical thinning prohibitive. However, the fact that these lands are privately owned and the prevailing small-sized properties constitute a tough challenge for forest management in general.

The current fire management policy in Portugal is quite progressive by European standards. As always, the difficulty will be to develop the policy into action, as prescribed burning expansion faces several cultural, institutional and practical barriers. Notwithstanding, Portugal is now co-leading (with France) prescribed

burning activity in southern Europe. Limited funding and the amount of trained and dedicated human resources are the two major obstacles to prescribed burning development. And, while the need to scale-up prescribed fire treatments is manifest, its integration with fire suppression must improve. Other challenges are more technical than political, but affect the quality of treatment outcomes and should be tackled accordingly, namely the increased use of decision-support tools for better planning, increased emphasis on the results obtained, improved operational documentation, and implementation of institutional monitoring.



Paulo Fernandes is a wildland fire professor and researcher at the University of Trás-os-Montes and Alto Douro and the ForestWISE CoLab, Portugal. He is an associate editor for the International Journal of Wildland Fire and has served in the IAWF board of directors.

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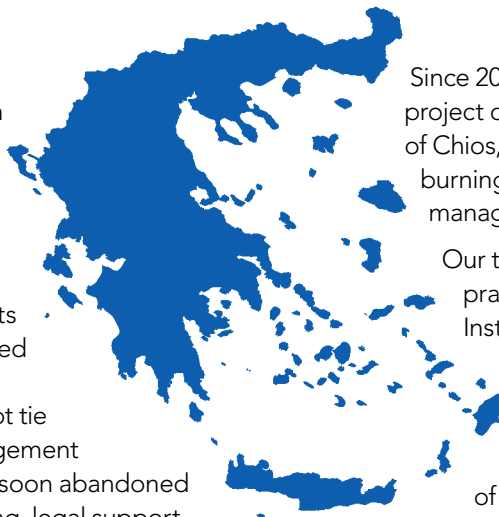
GREECE

PILOT PROJECT AIMS TO CHANGE POLICY

BY MILTIADIS ATHANASIOU, TRIANTAFYLLOS BOUCHOUNAS, EVANGELIA KORAKAKI,
ELIAS TZIRITIS, STAMATIA SITARA, AND GAVRIIL XANTHOPOULOS

The first efforts to introduce and prescribed burning in Greece began in the 1970s, when members of the forest scientific community and the forest service applied prescribed burning experimentally. Although researchers made some steps to document the use of fire and study its impacts before introducing prescribed burning as a tool to prevent forest fires, those sporadic attempts did not tie bonds with the forest and fire management community, and the endeavour was soon abandoned mainly due to lack of constant funding, legal support, logistics, continuous scientific guidance and clear objectives.

Almost half a century later, fire is still not used in fuels management and wildfire prevention in Greece, and there is no institutional framework for the implementation of prescribed burning, even though it is needed to provide a diversity of public benefits, including wildfire hazard reduction, improved forest resilience, and biodiversity conservation.



Since 2021, we have run a two-year pilot project on prescribed burning on the island of Chios, aiming to introduce prescribed burning as a tool for forest fuels management.

Our team consists of researchers and practitioners from WWF Greece, the Institute of Mediterranean Forest Ecosystems (IMFE), the Hellenic Agricultural Organization (ELGO)-DIMITRA of ELGO DIMITRA, the Forest Directorate of Chios Island, and the Voluntary Action Team OMIKRON, and we are conducting planned field prescribed burning experiments, matching fire behaviour with the fire impact on soil properties, the effects on trees, and the plant biodiversity. A series of parameters is monitored, measured, and recorded before, during and after the implementation of prescribed burning. Fire Service of Chios Island and Municipality of Chios support the pilot project by supplying water trucks and personnel during the burns. The project is sponsored by Procter



Using fire to maintain a fuel break in Chios, in February 2022. Photo by Elias Tziritis.



The partially shaded fuel break in the area shown (above) in Chios, after the prescribed burn. The left photo was taken in February 2022, after mop-up, and the right photo in April 2022. Photos by Miltiadis Athanasiou and Triantafyllos Bouchounas.

& Gamble. The General Directorate for Forests and Forest Environment of Ministry of Environment and Energy have provided all necessary permits for the implementation of pilot application of prescribed burning in Chios.

Prescribed burning is both science and technique and its successful implementation is not only science but art, as well; it can be a very accurate and effective fuels management tool, increasing social-ecological resilience to wildfire and contributing to a climate-resilient future. Prescribed burning improves fire resilience over a particular landscape, reduces the probability of fire ignition, affects fire behaviour, making fire fighting easier and safer, mitigates fire severity and reduces fire damages.

Our pilot project is expected to be the starting point for the application of prescribed burning in Greece.

It will a) contribute, through applied research, to the standards and procedures development for the use of prescribed fire in Greece, b) strengthen the role of the forest service in fuel management, c) build the capacity of the volunteer firefighters' teams on issues related to wildfire prevention and fuel management, d) increase knowledge and improve experience on fire behaviour, fostering actionable science, e) further strengthen, improve and expand local alliances and f) improve landscape resilience and prevent forest fires.

Through our effort we expect, in the long run, prescribed burning to be institutionalized in Greece, and assimilated by competent services and local communities, as a tool for fuels management and consequently forest fire prevention through documented policy and law proposals that will be based on the results of this pilot implementation.



Evangelia Korakaki prepares the necessary equipment before the implementation of a planned field prescribed burn experiment in pine litter to monitor, measure, and record sap flow. Photos by Georgios Mantakas and Stavros Sofronas.



Conducting a planned field prescribed burn experiment. Photos by Elias Tziritis.

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Miltiadis Athanasiou holds a B.Sc. degree in environmental science from the University of the Aegean, Lesvos, Greece, a M.Sc. in prevention and management of natural disasters from the National and Kapodistrian University of Athens and a PhD in wildland fire

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Triantafyllos Bouchounas holds an Intergrated M.Sc (B.Sc. plus M.Sc.) in forestry and natural environment from the Aristotle University of Thessaloniki, Greece, and a M.Sc. in planning and development of natural resources and forest informatics from the same university. He has also attended classes of the post graduate program Prevention and Management of Natural Disasters in National and Kapodistrian University of Athens, Greece and has been a volunteer firefighter for 16 years. He has worked for ESRI Greece/Cyprus) in Geographical Information Systems software support and consulting for four years, in the Greek National Cadastre & Mapping Agency of the Forest Maps & Natural Environment Directorate for two years and he is working as project manager in national and international programs.

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Forest Department for 10 years (2008-2018), in the Institute of Forest Research and IMFE (ELGO DIMITRA) and in the Forest Directorate of Athens. She has been involved in several projects aiming at improving fire prevention policies and practices, as well as post- fire rehabilitation in Greece. Currently, she is involved in a pilot project on the island of Chios, on introducing prescribed burning in wildfire management in Greece.

Elias Tziritis works as co-ordinator of wildfire prevention at the Conservation Department, WWF Greece. He holds a B.Sc. in political science from the Panteion University of Social and Political Sciences, Athens, Greece, and a M.Sc. in environmental policy and management from the University of the Aegean, Lesvos, Greece. Since 2004, he has been the liaison of WWF Greece policy team on wildfires, and he organizes wildfire prevention awareness campaigns. He has been a volunteer firefighter for 24 years.

Stamatia Sitara holds a diploma in agricultural science from the Agricultural University of Athens, and she is a volunteer firefighter, member of Chios Volunteer Team "Omikron." She is participating in the prescribed burning pilot project on Chios island, supporting fuel moisture content measurements.

Gavriil Xanthopoulos is an associate researcher specializing in forest fires at the Institute of Mediterranean Forest Ecosystems of the Hellenic Agricultural Organization "Demeter." He holds a B.Sc. in forestry from the Aristotelian University of Thessaloniki, Greece, and an M.Sc. and PhD in forestry with specialization in forest fires from the University of Montana. He has been active in European forest fire research for more than 30 years, with a parallel involvement in many aspects of operational fire management, post-graduate teaching and forest fire management training. He has served as member of the board of directors of the International Association of Wildland Fire (2005-2010 and 2017-2022) and as an associate editor for the International Journal of Wildland Fire. His research interests include forest fire policy, fire prevention, fire danger rating, fire behavior, fuel management, firefighting, post-fire rehabilitation, forest fires and climate change, and new technologies in fire management. His publications cover a broad spectrum and reflect his involvement with both research and operational applications.

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AUSTRALIA

FIRE-STICK FARMING

BY ADAM LEAVESLEY, DAVID BRUCE, NAOMI STEPHENS, TREVOR HOWARD, SARAH HARRIS, AND ALEN SLIJEPCEVIC

Australian landscapes were managed with the firestick for thousands of years until the practice succumbed to colonisation by European settlers beginning in 1788.

Until recently, many Australians chose to describe traditional Aboriginal fire practice as lost, but the reverence and joy observed in Aboriginal people today when they meet together, walk on country and apply the “right fire” to the landscape shows that perception to be mistaken.

Caring for country, caring for resources, caring for family and meeting spiritual obligations can all be achieved with the right fire and this has become a clarion call across Australia – from Tasmania to the Top End and from Byron Bay to Steep Point.

In contrast, the colonising Europeans came from a green landscape in which fire was rare and destructive.

The European way of life transplanted into Australian landscapes brought dwellings fixed in place, domesticated livestock and fences in a landscape that was prone to fire and flood.

To the European settlers fire was anomalous, something to be prevented and suppressed.

Prescribed burning regulations across most of Australia today owe little in their conception to the good work that can be achieved when fire is skilfully applied to the landscape, instead focussing on containing the risk and holding the practitioners personally accountable for escapes.

Australian courts are unlikely to find landholders responsible for heavy and dangerous fuel loads that



feed large, severe bushfires (wildfires), but at the same time whoever ignites a prescribed burn is responsible for that burn and is held accountable for any damage it might cause.

Another key factor in the use of prescribed fire in Australia is the entrenched attitudes to burning derived from the decades-old forest wars that have pitted the people

and communities seeking to make a living from forests against the environment movement.

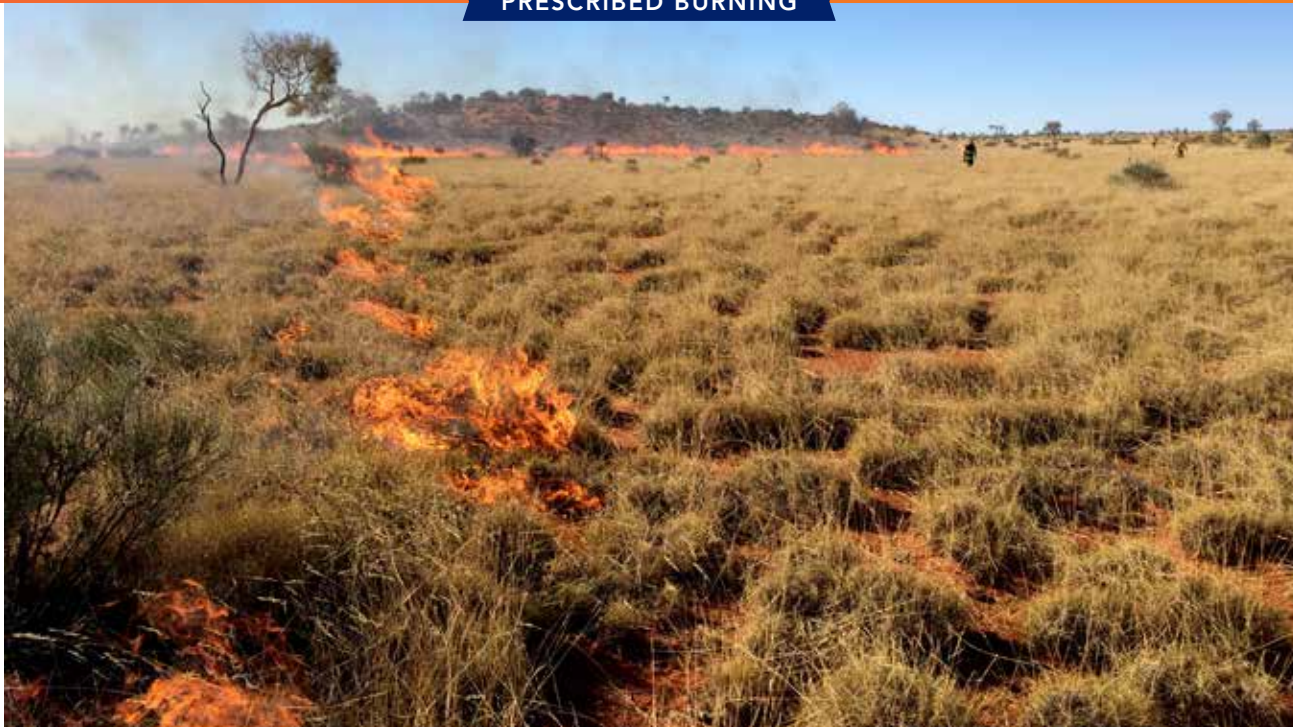
Burning has long been a part of the management for extractive use of native forests for timber and stock feed in southern Australia, and Aboriginal people will tell you they showed the foresters and farmers how to do it.

Many years of inquiries and government reports – amplified by media headlines – have told much the same thing, that prescribed burning is an essential function of management.

But this is often strongly opposed by the environment movement who fear that high frequency burning is incompatible with the maintenance of biodiversity.

Both sides in this battle select the science and evidence of practice to support their positions and the debate is often at cross-purposes, proceeding in opposing narratives that do not engage with opposing points of view.

Deliberate burning for asset protection and public safety can be complex, producing smoke, affecting air quality, disrupting traffic and community events, and



A prescribed burn in the Western Australian rangelands. Photo by Ryan Butler.

leaving a blackened landscape where people have chosen to reside and recreate.

The upshot is that forest burning in heavy fuels in the more densely settled and regulated south often lacks a clear, strong social licence.

The combination of the effects of regulation and the variation in landscape factors mitigates against liberal use of fire where risks are higher so that the biggest, best, most varied, and adaptable burning programs are all found in remote locations with few human assets and generally light, fast-growing grassy fuels.

Arguably, the most functional and effective landscape burning program in Australia occurs in the *Eucalyptus tetradonta* savannah woodlands in northern Australia, right across the continent, north of the 600-millimetre isohyet.

The program was established by resourcing Aboriginal traditional landowners to burn country in the tropical savannahs by delivering a body of science that demonstrates a reduction in carbon emissions by re-kindling the tradition of landscape fire management.

Emissions are reduced by burning the cured grasses in the early dry season when conditions are mild so that the flame remains close to the ground.

The canopy is preserved and the *Eucalyptus tetradonta* saplings are singed but nonetheless survive and grow, accumulating carbon.

Remotely sensed fire mapping is used to calculate the difference between the total emissions produced for

a reference period when burning was not conducted and the total emissions produced each year follow the late dry season bushfires.

The difference is used to generate credits that are sold on the carbon market.

The suite of risk management, social, ecological and resource benefits derived from the program is attractive to sponsors who are enthusiastic to be associated with the project.

Aboriginal ranger groups follow the advice of elders in choosing where and how to burn but use modern techniques such as geographic information systems, helicopters, aerial incendiary machines, ultra-light tankers such as the Toyota Landcruiser and leaf blowers to effectively cover a vast area of the tropics.

As the program has met with success, government agencies, pastoralists and environmental non-government organisations have combined their holdings in large tenure-blind blocks working together to deliver better fire management.

The program is being exported to Botswana in southern Africa via an Australian government aid program and the United Nations University.

The contrast between the prescribed burning programs of the southern forests and the tropical savannahs is stark.

It is curious that public support for prescribed fire in the tropical north has inflamed the imagination of the Australian public and been exported to the world



Burning in the mallee heath of southern Australia. Photo by David Bruce.

as an example of great Australian innovation and ingenuity, while analogous systems in the southern forests are often viewed with suspicion.

The 2019-2020 fire season in eastern Australia has left some forests burnt to stumps and it has been an increasingly common occurrence since the Canberra fires in 2003.

A careful program of burning in forests in advance of bushfires delivers much the same outcome as the program in tropical northern Australia.

The effect of prescribed burning in forests is longer lasting so that the reduction of slowly accumulating surface litter can stop a bushfire for two to three years after burning and significantly reduce fire severity for up to eleven years.

Both outcomes deliver benefits to incident management teams, providing a safer and more effective operating environment for firefighters, and reduce impacts on water catchments and precious ecosystems.

In contrast, savannah burning is largely an annual requirement because the abundant rains of the wet season stimulate vigorous grass growth.

Prescribed burning will never be free of negative ecological, social, or economic effects, but the choice to not burn comes with a larger set of negative consequences.

Climate change is here, and we need to act, based on the knowledge from thousands of years of experience on the Australian landscape and the latest scientific advances.

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Lighting up in the sub-alpine forests of southern Australia. Photo by David Bruce.



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UNITED STATES

FIRE LIGHTING IN AMERICA: A CALLING

BY KELLY MARTIN AND RON STEFFENS

Prescribed fire. These two words can conjure up significant fear and emotion, mainly because some large, uncontrollable wildfires have started from innocuous prescribed burns, but without intentional burning, large mega-fires will persist.



reduce wildfire impacts to communities. The larger the patch sizes of prescribed fire, the greater our ability to use these large prescribed fire footprints to contain future wildfires. A look at the Fuel Treatment Effectiveness tools at https://iftdss.firenet.gov/landing_page/ supports our exploration

WHAT SHOULD PRESCRIBED FIRE LOOK LIKE TODAY?

For more than a century, natural wildfire has been – and is still being oppressed or sidelined as a natural means to maintain healthy ecosystems. The backup plan for reintroducing fire's vital, regenerative process is to apply prescribed fire at a scope and scale that will reduce the intensity and severity of future wildfires, which will, in turn, provide opportunity to

of how large-scale treatments can have beneficial community outcomes. Likewise, the release of new fire management mapping tools for the southeast United States provide a new framework for fire managers and fire-impacted communities (<https://www.landscapepartnership.org/key-issues/wildland-fire/fire-mapping/regional-fire-mapping/se-firemap>).

The Idaho Fish and Game partnered with BLM Idaho to conduct a series of controlled burns designed to remove dead vegetation and improve wetland productivity. This burn, in April 2022, is in the Market Lake wildlife management area. Photo by Austin Catlin, Bureau of Land Management / Flickr.



How did we lose this skill, and can we bring it back? Between 50 and 100 years ago, prohibitions were inscribed against Indigenous cultural burning, wrongly believing we were protecting trees from fire when in reality our landscapes have evolved with fire. Even the regions with the strongest traditions of habitat burning — the Southeast and Midwest — were curtailed by misguided forestry practices for 50 years beginning in the 1920s. By the 1970s, research helped return habitat burning to the regions. And as we transitioned out of a timber and logging economy, we lost the opportunity for many wildland firefighters to hone their skills as prescribed fire burn bosses. Now, with very little prescribed burning from timber harvesting, firefighters find themselves gaining wildfire suppression experience but limited practical experience as landscape prescribed-fire burn bosses. We can bring back these skills, with climate-focused active landscape management and a rejuvenation of cultural and habitat burning, but doing so will require a complete revamp of our existing human and fiscal infrastructure to produce landscape prescribed fire at a scale that can and will become the antidote to destructive megafires.

We are gaining momentum and congressional funding to meet the wildfire crisis in the coming decade. A January 2022 report from the US Forest Service, “Confronting the Wildfire Crisis,” proposed a 10-year plan to treat 20 million acres of United States Forest Service lands and 30 million acres on other federal, tribal, state and private lands. The Biden administration’s new Bipartisan Infrastructure Act includes funding for prescribed fire treatments and California recently approved \$1 billion for forest resiliency projects.

Don’t get us wrong, small local burns tied to mechanical treatments around homes are valuable investments but fall short of using landscape fire to remove and thin vegetation near high-risk communities or critical habitats to really make a difference.

THE FALSE DICHOTOMY OF SUPPRESSION VERSUS PRESCRIBED

The current state of wildland fire fighting has become a normal part of the summer American experience. The US Forest Service reports that firefighters are 98 per cent effective at suppressing all wildfires. But many of these wildfires occur early season or late season when fire danger is low to moderate, resulting in a potential missed opportunity for these more moderate fires to help reduce dangerous down and dead and

overly dense timber and brush build up. Aggressively fighting large wildfires is costly, inefficient to the point of voracious expenditure of funds, and misguided, or at least difficult to meet objectives, which is exactly what’s right about prescribed fire, or fire lighting.

The reality — from the encroaching size and flammability of the urban interface, to delaying risk in part due to a growing industrial suppression complex and insufficient fuels management, to climate change — means we continue to aggressively fight wildfires rather than adapt and live with fire.).

But it’s time to look at prescribed fire not as an off-season tool for landscape management but as a key (even primary) tool for wildland fire management, suppression in particular. If fire season is year round, perhaps this also means that prescribed fire as a tool is also year round.

The message from escaped prescribed fires, the National Forest pause in the prescribed-burn program, and the September 2022 National Prescribed Fire Program Review: we can and must manage fire with the hazard of the flames, yet we should also recognize that unburned/untreated dead and down vegetation is a potential future mega-fire.

WHO IS HELPING? WHAT ARE THEY DOING?

Over the past five years, more non-federal groups have been applying fire in their communities and on private land; this is a tremendous step forward that would have been unthinkable or very limited just 10 years ago. Prescribed burn associations are sprouting up and putting fire in the hands of people who want to be part of a healthy, resilient community.

Non-governmental organizations such as The Nature Conservancy (TNC) have celebrated the use of fire on private lands for 60 years. TNC has also been the leader in Training Exchanges (TREN) to bring fire to people who can become prescribed fire practitioners in their communities.

A PHASED APPROACH TO PUTTING MORE GOOD FIRE TO WORK

Putting together a strategic phased approach to applying fire on large landscapes takes planning and engagement with many stakeholders and may be a way to help accelerate the scope and scale of treatment. All these approaches are essential — as the IAWF position paper notes.



Burning of the marshes in the Market Lake wildlife management area will help to maintain the preferred 50:50 split of cattail/bulrush to open water and set the marshes back to early successional stages that are more productive. Photo by Austin Catlin, Bureau of Land Management / Flickr.

Phase 1 – Inside communities – More communities are at increased risk to wildfires than ever before. Communities are beginning to understand and accept they live in a wild environment where uncontrolled wildfires can cause serious threats to life and property. Community members must take this first step and be willing to develop community wildfire protection and evacuation plans that will include where and when prescribed fire is acceptable.

Phase 2 – Defense zone – Reducing vegetation to help create spaces that allow firefighters to contain unwanted wildfires and provide an area that can be maintained with the use of fire over time. Work here includes understory thinning, chipping and pile burning.

Phase 3 – Once phases 1 and 2 have been completed, larger landscape fires can and should be considered; this includes the use of wildland fire mid- to late-season. Using fire at a landscape scale serves as a bumper for future wildfires to help slow the spread and severity of uncontrollable wildfires.

WHAT PRESCRIBED FIRE WILL LOOK LIKE TOMORROW

Landscape prescribed burning will take years to build up dedicated, trained and experienced teams – nothing like this exists today.

We invite more community members and fire professionals to become fire lighters and prescribed fire advocates to broadly increase fire's essential role in healthy landscapes. We all belong to communities and the health and vibrance of our communities are inextricably linked to the health and resilience of our treasured landscapes. Our lands evolved with fire and it's time to welcome fire's return as an essential part of our own lives and a part of thriving communities. Fire was a key tool that shaped our many histories with these lands, and fire is the tool that will help us adapt and sustain our communities to a changing climate.

ABOUT THE AUTHORS



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CANADA

THE IMPACT OF FIRE-EXCLUSION LEGISLATION

BY AMY CARDINAL CHRISTIANSON, JANE PARK, ROBERT GRAY,
SCOTT MURPHY, KIRA HOFFMAN AND GREGG WALKER



Fire is an important part of many of Canada's ecosystems. Natural, lightning-caused fires spread regularly across the Canadian landscape. Pre-colonization, Indigenous Peoples applied fire to their territories for a variety of reasons to achieve specific cultural objectives. European settlement of Canada brought a temporary increase in the use of fire for land clearing, settlement, and agriculture, until fire exclusion laws were enacted. Newfoundland was one of the first regions to regulate fire, in 1610; it was declared that no one should set fire to the woods. All provinces and territories eventually legislated fire exclusion, which has resulted in fuel build-up, increased incidence of high-severity fire, increased area burned at high severity, and increased threats to society, the environment, and the economy; this also turned attention, policies, and most of the funding to suppress wildfires.

In the early 1900s, the scientific community began to recognize the need for fire on the landscape and to advocate for the use of prescribed fire. The first use of prescribed fire was for hazard reduction: for example, in British Columbia in the 1910s, prescribed burns were used to remove logging debris, and this activity was institutionalized in 1938 in Section 113A of the provincial Forest Act. In the 1970s, prescribed fire gained more institutional support from fire management agencies, though the scale of actual

burning remained relatively small.

In a 1992 review of the use of prescribed fire in Canada, M.G. Weber and S.W. Taylor listed six main uses: hazard reduction; silviculture (including site preparation, managing competing vegetation, stand conversion, and site rehabilitation); wildlife habitat enhancement; range burning; insect and disease control; and conservation of ecosystems.

Currently, the Canadian Interagency Forest Fire Centre uses the following definitions:

- Prescribed burning – The deliberate, planned, and knowledgeable application of fire by authorized personnel and in accordance with policy and guidelines to a specific land area to accomplish pre-determined forest management or other land use objectives.
- Prescribed fire – Fire deliberately utilized in a predetermined area in accordance with a specified and approved burning prescription to achieve set objectives.

Wildfire management agencies in Canada follow various legislation, acts, and policies regarding the use of prescribed fire, which differs by province and territory. The mandates of wildfire management agencies in Canada often focus on suppression and do not include ecological land management

goals. Because of this, agencies with the skills to potentially implement prescribed fire need other government departments and land users to be proponents for prescribed fire. Even so, in large fire years, the lack of resources to conduct the burns and/or attention to high priority wildfires overrides the ability or political will to conduct prescribed fires.

In British Columbia, burn plans are required to be approved by officials as per Section 23 of the Wildfire Act. The preparation and approval of a burn plan can take months to years, depending on the complexity. In Manitoba, most of the burning takes place through the Manitoba Controlled Crop Residue Burning Program on agricultural lands. In Ontario, the Prescribed Burn Policy is governed by several statutes of Ontario and/or policies,

including the Forest Fires Prevention Act, the Forest Protection and Prevention Act, the Environmental Assessment Act, the Environmental Bill of Rights, and the Endangered Species Act. Significant changes were made to prescribed fire operations in Ontario after the Esnaami Lake tragedy, during which seven people died as a result of a prescribed fire. The incident and legal proceedings resulted in a long pause to prescribed fire applications. The 53-day inquest into the incident resulted in 36 recommendations outlining how the ministry could improve prescribed fires. Currently, burn application forms must be submitted to the local fire management office, which can take six to nine months to be approved. Once the application is approved, a burn plan needs to be submitted at least 60 days in advance for low-complexity burns and 75 days in advance for high-complexity

The 100-hectare airstrip sub-unit of the Compound Meadows prescribed fire on May 9, 2022. The burn was adjacent to the Town of Banff and the TransCanada highway and was conducted in collaboration with the Town of Banff. Objectives for the burn were wildfire risk reduction for the town, overwinter habitat for elk and deer, and to stimulate the growth of deciduous trees and valley bottom grasslands. Photo by Jane Park.





The Stoney Meadows prescribed fire on Oct. 2, 2020, covered approximately 915 hectares. Some specific burn objectives for Parks Canada have included creating grizzly bear habitat, increasing ungulate habitat, promoting five-needle pine, reducing mountain pine beetle impacts, and wildfire risk reduction.. Photo by Jane Park.

prescribed burns before the intended ignition date. The plans must be fully approved 30 days before an ignition, and no major changes can be made within 14 days of the burn.

According to Kira Hoffman and colleagues in a 2022 paper “Western Canada’s new wildfire reality needs a new approach to fire management,” the use of prescribed fire has decreased over the 25 years in British Columbia due to increased regulation (including problems with agency approval processes and timelines), smoke concerns, fear of escapes, and a lack of qualified and experienced practitioners. There is no prescribed fire certification framework in Canada: The Canadian Interagency Forest Fire Centre does not have any prescribed-fire related certification, so people lean on U.S.-based

certifications that do not necessarily apply in Canada. The only prescribed fire planning course is offered by Parks Canada and Alberta, but enrollment is limited. Because there is prescribed fire training/certification, people who largely conduct ignition for wildfires (during increasingly extreme burning conditions) are seen to have expertise to put prescribed fire on the landscape. However, those skills don’t translate to the art/science of burning in less volatile conditions, and those who are certified may lack the intimate knowledge of ecological fire effects and habitat needs for various organisms/ecosystems

Hoffman and colleagues point out there has been an increased interest among wildfire management agencies and the public in cultural burning

conducted by Indigenous Peoples. However, a 2022 paper by Hoffman and other colleagues “The right to burn: barriers and opportunities for Indigenous-led fire stewardship in Canada,” shows many barriers exist to prescribed fire and cultural burning including a lack of understanding, governance, regulations, accreditation, training, liability, insurance, capacity, and resources.

PARKS CANADA

Parks Canada is an outlier in terms of use of prescribed fire by wildfire management agencies in Canada. Parks Canada has used prescribed fire since the 1970s in national parks and at historic sites to reduce wildfire risk, promote more resilient landscapes, and restore and maintain ecological integrity and cultural landscapes. Parks Canada conducts prescribed fires in all ecosystem types (Figure 1). Some specific burn objectives have included creating grizzly bear habitat, increasing ungulate habitat, promoting five-needle pine, reducing mountain pine beetle impacts, and wildfire risk reduction. In recent years, Indigenous knowledge of fire has become more widely recognized and cultural burning practices are being supported in certain parks, including the Gulf Islands National Park Reserve where Indigenous partners and the park are revitalizing cultural burning practices for Garry oak ecosystems.

Despite actively using and supporting prescribed fire, there are still relatively small numbers of prescribed fires and area burned per year compared to wildfires. Parks Canada statistics on prescribed fire and wildfires show that since 1981, the annual number of prescribed fires has been highly outpaced by wildfires. For example, the largest number of prescribed fires Parks Canada has conducted in one year was in 2015, when there were 28 prescribed fires but 122 wildfires. The amount of area burned annually by prescribed fires since 1981 varies from 100 hectares to 11,000 hectares and is highly dependent on weather conditions. It is important to note that Parks Canada has conducted

ECOSYSTEM	NO. OF PRESCRIBED FIRES	AREA BURNED IN HECTARES
Aspen Parkland	18 (15%)	13,757 (55%)
Grassland	25 (21%)	3,174 (13%)
Montane	12 (10%)	2,730 (11%)
Sub-Alpine	21 (17%)	2,606 (10%)
Mixed-wood	13 (11%)	1,849 (7%)
Boreal	9 (7%)	918 (4%)
Deciduous	9 (7%)	28 (<1%)
Savannah	13 (11%)	8 (<1%)
Barrens	1 (1%)	1 (<1%)

Figure 1. Parks Canada prescribed fires by ecosystem and area burned across all sites, 2009-2018.

prescribed fires consistently since the late 1990s, unlike other agencies, which have reduced the numbers of prescribed burns.

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STRATEGIES

LONG-TERM FIRE RETARDANT TO MAKE PRESCRIBED BURNS SAFER

BY RON RALEY

In May of this year, USDA Forest Service Chief Randy Moore put a 90-day moratorium on all prescribed burns on lands administered by the forest service, following the Calf Canyon/Hermits Peak fire in New Mexico that started after prescribed burn operations. With this moratorium came a hard internal look at new tools and procedures that could help to make prescribed burns safer and with less risk of escape. One of the not-so-new tools is the use of phosphate-based long-term fire retardants, a technology that has been safely used for decades by forest service and fire professionals, but that is gaining significant attention for expanded use as part of prescribed burn plans.

As the U.S. government and communities look to reintroduce the beneficial use of wildfire into the landscape, long-term retardants are helping to make

the burns safer while protecting critical assets. Fire management agencies are incorporating the use of long-term retardants to reinforce control lines by applying it on both sides of the lines to reduce the chance of escape. Long-term retardant is also being used around homes and outbuildings to create a firebreak in the fuels leading up to each structure, and on vegetation to maintain a habitat for wildlife after the prescribed fire.

HISTORY OF PRESCRIBED BURNS

The USDA Forest Service established what was called the 10 a.m. policy in 1935, which required that every fire should be suppressed by 10 a.m. the day following its initial report. Other federal land-management agencies quickly followed suit and joined the campaign



In 2021, Pheasants International, in collaboration with a Midwest power company, used long-term retardant to treat around high voltage power lines in advance of a prescribed burn. Individual polygons of vegetation were treated or left untreated to allow for diversity in existing pheasant habitat. Photo by Perimeter Solutions.

to eliminate fire from the landscape. According to the website foresthstory.org, these strong measures to suppress fires have resulted in ecosystems that have developed, primarily, through a dominant influence of fire exclusion. These ecosystems are characterized by longer “fire return intervals” and long-term changes in forest structure and composition. These changes have resulted in significantly larger numbers of trees per acre, more biomass in brush species, more dead and down vegetation, and a dominance of fuel ladders. All of this has contributed to larger, more intense fires resulting in much greater resource damage and unacceptable permanent ecological changes.

Fire suppression efforts were later aided, in the 1960s, by the development of new technologies, such as fire suppression chemicals. It was much later that fire managers started to realize the positive role fire played in forest ecosystems. This change in attitude led to advancements in USDA Forest Service policy in the 1970s. Prescribed burns became more prevalent and land management plans began to include both prescribed burns and “managed wildland fire” as strategic objectives. The use of long-term retardant as a tool in prescribed burning also became more prevalent.

Examples of this use are plentiful. The Shasta Trinity National Forest, as well as many other land management agencies, starting in early 1980s, carried out a widescale program of “block broadcast burning” as a silvacultural tool after timber harvest to prepare sites for planting. Long-term retardant was applied on log decks, wildlife trees and slash piles to keep them from igniting and creating subsequent containment concerns.

In addition, in 2007, prescribed burns were conducted in Hawaii to eliminate the invasive species of Gorse (*Ulex europaeus*). To protect the sensitive soil profile and the viewshed from residual visual effects, long-term retardant was used for control lines; this eliminated the need for either bulldozer lines or handlines resulting in less impacts to soils.

Starting around the beginning of the 1990s, fire-suppression efforts had to account for the growing wildland-urban interface (WUI), the area where developed land occupied by homes and businesses intersects with the natural environment. The use of long-term retardant, in a preventative manner, can assist in preventing escapes and reduce potential impacts.

According to the College of Natural Resources at North Carolina State University, between 2011 and 2019, the use of retardant in forests and rangeland areas around the country increased by 28 per cent, and in 2019 prescribed burns were used to treat more than 10 million acres in the United States.

The USDA Forest Service conducts an average of 4,500 prescribed burns every year, and, according to its website, plans to increase that number over the next 10 years; this will include an additional 20 million acres on National Forest System lands, and up to an additional 30 million acres of other federal, state, tribal, and private lands.

SUPPORTING PRESCRIBED BURNS WITH ADVANCED FIRE RETARDANT

Recent advancements in long-term, ground-applied retardants complement the introduction of prescribed fire back onto the landscape. Retardants can be applied days or even weeks ahead of the prescribed burn on cellulosic material, including utility poles or railroad infrastructure, live fuels, as well as dead and down flammable vegetation. After the retardant dries on the vegetation, it is effective until it is physically removed by up to a quarter of an inch or more of rain. Due to the durability of long-term fire retardant, it can be applied well in advance of the initiation of the prescribed burn project; this becomes especially important when weather and smoke dispersion issues postpone the prescribed burn ignition. As weather conditions are prone to change in the days and weeks leading up to an actual burn, application of the long-term retardant helps to reduce risk of fire escaping-control lines. In addition, long-term retardant assists in keeping the prescribed burn within containment lines during post burn conditions, when low humidity, high temperatures and unexpected winds return to the prescribed-burn site

Long-term fire retardants are available in colored and uncolored form. Uncolored retardant is nearly clear, while the colored product is bright red and fades to earth tones after exposure to sunlight; this allows prescribed-fire managers to select the product that best meets the visual requirements of the project.

In 2021, Pheasants International, in collaboration with a Midwest power company, used long-term retardant to treat around high voltage power lines in advance of a prescribed burn. Individual polygons of vegetation were treated or left untreated to allow for diversity in pheasant habitat. The retardant also protected the cellulosic poles, while fireproofing most of the

flammable vegetation under the lines. This application proved to be very effective and demonstrated the environmental and ecological benefits of using long-term retardants to help maintain the wildlife habitat.

In addition to the ecological and environmental benefits of using long-term retardants as part of prescribed burns, there is a significant element of risk reduction that can be provided to communities, homes, and valuable assets that are within or near the intended burn area. As the prescribed fire location is being prepared, 20- to 100-foot defensible barriers can be placed around homes, buildings, communication towers and other valuable infrastructure. Retardant may also be used to keep the burn away from sensitive or threatened habitat, important trees (relic stands such as Sequoias) and other ecologically important landscapes. Old-growth trees can be protected by applying retardant on top of their root structure and at a certain distance up the bole of the tree. Application of retardant to the surrounding vegetation will help maintain soil productivity by protecting microbial life and enhancing nutrient cycling necessary for the health of retention trees..

Environmental organizations have been major proponents of reintroducing fire into the landscape, and have used ground-applied, long-term fire retardants in some prescribed burns to protect ground cover around trees. Discussions are ongoing with environmental leaders about how to safely and effectively apply retardant around many groves of trees as part of future burns. The use of phosphate-based retardants is better for the environment than other solutions, as the residual phosphate that is left after the burn will provide nutrients for soil health and plant uptake. Targeted application of retardant on native vegetation, and avoiding application in and around invasive plants, will favor native species over invasives; this helps to provide sustainability in favor of desirable endemic species.

The retardant lines that are applied from the ground and placed in advance of the prescribed burns work the same as the red fire retardants dropped from air tankers on an active fire. The products can be surgically applied by use of ground equipment such as water tenders, type 3/6 engines, hydroseeders and spray equipment that is in the back of vehicles or in spray trailers. In many cases, aerially applied fire retardant is



Long-term fire retardants are a proven successful solution that helps to establish or reinforce control lines, prevent fire escape, and protect critical assets within or outside the burn area, improving the safety of firefighters and the public. Photo by Perimeter Solutions.

applied just ahead of the active fire to help render the vegetation non-flammable and give firefighters on the ground time to establish adequate firelines on the other side of the fuel. In a prescribed-burn scenario, once the firelines have been constructed, retardant can be applied on the fuels located on both sides of the firelines; this serves to provide an additional layer of fire safety to the burn by preventing short range spotting and slopovers (burning over established lines) and reducing the probability of escapes. Critical assets can be further protected by applying retardant around their perimeter.

In July, long-term fire retardant was used in a prescribed burn by Atascadero Fire and Emergency Services in California. The burn was close to housing, utility infrastructure, and roads, which the municipal fire department wanted to protect. Battalion Chief Dave Van Son said after the burn, "The application of PHOS-CHEK® FORTIFY® long-term fire retardant ahead of the burn gave us an added layer of confidence that the burn would be conducted safely, while at the same time demonstrating that the preventative and proactive application of the product could be valuable in helping to prevent roadside ignitions as well as under utility infrastructure."

We believe the preventative application of long-term retardants will become standard procedure for prescribed burns, agency administrators, and prescribed fire managers, and that burn bosses will be encouraged to incorporate this affordable tactic prior to or during many prescribed burns, as the cost of failure – in even one per cent of burns – will be measured by the societal cost of loss of life, property, and resources.

In both prescribed burns and in wildfire suppression activities, long-term retardants can be used to establish and enhance safety zones. The establishment of safety zones is an important part of firefighter safety. The size of safety zones and deployment zones has been a continual discussion point in the fire service; in many fuel types, a tremendous amount of ground must be cleared to mineral soil. The use of retardant can serve to increase the size and survivability of these zones.

The resource damage from wildland fire is well understood. A recent example of such negative impacts was seen on the McKinney fire on the Klamath National Forest in northern California, where

tens of thousands of fish were killed from sediment and ash loading in the streams. Prescribed fire has potential to also cause significant impacts to valuable aquatic resources. Retardant can help to mitigate such impacts by careful application near waterways. A significant advantage of these treatments is realized by precision application with ground resources. Unlike aerial assets, the buffer zones for ground application are far less and governed by local jurisdictions' statutes and county ordinances; this can create a situation in which the treated fuels and organic litter are left intact on the soil to assist in filtering ash and sediment.

Having the ability to use the best fire retardants in the industry from any ground-based equipment is a tremendous advantage to fire agencies. Things don't always go according to plan, and prescribed fires always present an inherent level of risk. Experience has demonstrated that escapes will occur. Agencies conducting prescribed burn programs should readily have, and use, all tools available to them to adequately mitigate risk. Long-term fire retardant is one of those tools that should be in the box to help reduce and, in many cases, eliminate bad outcomes.

The tragic events surrounding Calf Canyon/ Hermit's Peak fire brought national attention to prescribed burn programs, and it has led the USDA Forest Service to reexamine how it conducts prescribed burns. While the agency pauses and considers options, and reviews new technologies, it is important that it take advantage of a solution it has relied on for nearly 60 years. Long-term fire retardants are a proven successful solution that helps to establish or reinforce control lines, prevent fire escape, and protect critical assets within or outside the burn area, improving the safety of firefighters and the public.

ABOUT THE AUTHOR

Ron Raley serves as agency liaison for Perimeter Solutions and has worked in wildland fire management for 53 years, spending 35 years with the United States Forest Service. He finished his career as the deputy director of fire and aviation management for the Pacific Southwest Region. While with the USFS he held numerous positions on incident management teams, including service as a type I incident commander dealing with complex incidents across the country.

THOUGHTS ON LEADERSHIP

THE IAWF MISSION AND POSITION

BY MICHAEL DEGROSKY

Leadership is a vital organizational function. Leaders provide clarity of purpose, direct the organizations' resources, improve efficiency, influence and motivate people, achieve goals, and guide the organization to achieve its mission. Leaders assure the organization has the resources it needs to operate, satisfy stakeholders, produce desired outcomes, and create the societal or environmental impact intended. Leaders want organizations and institutions to be effective. There exists no single definition of organizational effectiveness, so I just think of it as the degree to which an organization achieves what it set out to achieve.

Organizational effectiveness begins with a strong sense of mission, a shared understanding of the reason the organization exists, the scope of operations the organization means to pursue, what the organization intends to achieve, and how the organization aims to serve its key stakeholders. Management thinkers seem to be coalescing around the idea that a mission-focused culture influences organizational effectiveness and tends to drive organizational success. In my experience, organizations attending to their mission in a focused way are effective because they align the efforts and outcomes of the organization with the contribution to society the organization was created to make.

This issue of Wildfire highlights the IAWF position on prescribed burning. One might ask what business the association has issuing such a statement. Simply put, that's the IAWF mission.

The IAWF's mission is to facilitate communication and provide leadership for the wildland fire community, promote better understanding of wildland fire, communicate with the entire wildland fire community, and provide global linkage for people with shared interests in wildland fire and comprehensive fire management. That mission rests on a foundational belief that an understanding of fire as a dynamic natural force is vital for natural resource management, firefighter safety, and harmonious interaction between people and their environment.

So, in this issue, the association has taken an informed position on a contemporary, important, and at times controversial, issue confronting wildland fire communities around the world, and communicated it globally. There it is: alignment of organizational effort, outcomes, and the societal impact, or mission, for which the IAWF was established.

Organizations without a strong, shared sense of mission tend to drift off course and struggle to align their purpose with the efforts of people, the efforts of people with outcomes, outcomes with goals, and goals with the contribution to society the organization was created to make.

I have noticed that business writers and the organizations they influence have re-discovered the concept of mission, and there is a lot of buzz about mission in the popular business and leadership press these days. A quick web search reveals plenty of organizations that describe themselves as "mission-

driven,” “mission-focused,” “mission-centered,” and so-on. However, for me, a truly mission-driven organization enables stakeholders to draw a direct line between the stated purpose of the organization and the outcomes the organization consistently produces. You can blah-blah about your mission-driven enterprise all day but if I can’t see, on a regular basis, a focused connection between the organization’s mission and its products, services and performance, I’m thinking “Oh . . . uh-huh.”

There are many reasons for organizations to take a mission-driven approach to organizational effectiveness, among them:

Mission-driven organizations and institutions have clarity of purpose, which prevents drift; every organizational stakeholder knows why the organization exists, its scope of operations, what it intends to achieve, who the stakeholders are, and how the enterprise aims to serve them.

Mission-driven organizations instill their personnel with a sense of identity and purpose; identity and purpose prevent drift. Increasingly, we understand that for people to truly engage in their work, they need to see the meaning and purpose of that work and sense that their efforts contribute to a larger, meaningful goal.

A mission-driven approach helps an organization’s personnel better understand the organization’s core constituents and stakeholders, and to identify, create, connect with, and serve community.

A truly mission-driven enterprise unifies the efforts of its personnel, makes sure every organizational element contributes to the same goals, and keeps organizational activity consistent with desired outcomes that achieve intent regardless of circumstances. For me, that is the essence of organizational effectiveness: alignment that consistently enables the organization to achieve what it set out to achieve.

Organizations and institutions are effective when they consistently achieve, to a high degree, what they set out to do. In my experience, people leading highly effective organizations do a great job aligning the efforts and outcomes of the organization with the fundamental purpose for which the organization exists; in other words, their

A truly mission-driven organization is one in which stakeholders can draw a direct line between the stated purpose for which the organization exists and the outcomes that the organization consistently produces.

organizations are mission-driven. Achieving that level of organizational alignment requires a deeply shared, organization-wide commitment to, and focus on, making the organization’s established mission drives both its strategy and operations – and that is cultural. The organization’s values, expectations, and practices all clearly flow from the organization’s mission and both guide and inform the actions of all the organization’s personnel. That is the kind of organization in which, I, as a stakeholder, can see on a regular basis, a focused connection between the organization’s mission and its products, services, and performance. Mission-focused cultures do not just happen, and organizational culture and organizational leadership are closely linked. On this point, I have long been influenced by Edgar Schein, former professor of management at the MIT Sloan School of Management, who wrote, in his influential text *Organizational Culture and Leadership*, “Organizational cultures are created in part by leaders, and one of the most decisive functions of leadership is the creation, the management, and sometimes even the destruction of culture.”



ABOUT THE AUTHOR

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FIREFIGHTER FIRST AID

PILOT PROGRAM TEACHES TECHNIQUES SPECIFICALLY FOR THE FIRELINE

BY TODD MINER

Wildland firefighting is tough and dangerous. Given the physical nature of the work, the environment, the seasonality and uncertainties of employment, the pay scales, the time away from home and family, and especially the dangers faced, firefighting agencies need to do better for those all-too-often ignored critical workers. One of the most pressing and most easily addressed needs is to reduce the impact of injuries through rigorous and specific first aid training for not just medics, but all frontline wildland firefighters.

You don't need to read this article to know that wildland firefighting is a hazardous occupation. You know the risks. You have likely experienced an injury or illness while fighting wildfires yourself. You've seen your crew members get injured or become ill.

But let's go beyond personal experience and look at some of the evidence regarding wildland firefighter injuries. That evidence, limited as it may be, is sobering and it supports our gut ideas and all those anecdotal reports of the hazards. Some examples from the sparse literature:

- According to a 2021 report by the Thomson-Reuters Foundation, one in four United States Forest Service firefighters has a work-related injury or illness every year.
- Sixty per cent of Spanish helitack crews were found to suffer from chronic pain.
- Researchers studying a 2002 Florida fire found that firefighters on average were seen by the medical tent two times each in just a 19-day span.

Other researchers, more generally, have documented a disturbing number of injuries. As Montana researcher Taylor Purchio put it in 2017, "[T]oday's wildland firefighters, regardless of crew type or physical fitness, are suffering injuries at an alarming rate." From the

other side of the world, Australian researcher Annamarie De Vos and colleagues called wildland fire fighting "one of the most difficult and hazardous of occupational activities associated with a range of uncertain and unpredictable work-related risks."

While the few studies that have been done paint the picture of a dangerous occupation, many experts think the real injury rate is much higher than published reports or is at best poorly understood. In addition to describing how hazardous firefighting is, De Vos pointed out that the hazardous are usually underestimated. Despite the obvious risks and hazards, as fire health expert Kat Navarro commented in 2019 in



"Today's wildland firefighters, regardless of crew type or physical fitness, are suffering injuries at an alarming rate."

– Taylor Purchio

the journal *Environmental Research*, "very little is known about the exposures and health outcomes associated with wildland fire fighting." Researcher Taylor Purchio probably summed it up best in his 2017 master thesis: "Unfortunately, the amount of data on [wildland firefighter] injuries is underwhelming, and research shows that injuries . . . are often underreported."

Although the hazards are obvious to those in the field, and injury rates have been found to be very high, there has been no broadly delivered or accepted specific first aid training for wildland firefighters. Specific first aid training has been developed, and is sometimes required for many other occupations – most far less dangerous than wildland fire fighting – but none for those working the fireline. Wilderness First Aid (WFA) and Wilderness First Responder (WFR) have been developed, and one or the other is often required for wilderness guides. Lifeguards have their own first aid training. The military has developed, and it delivers first aid training for its soldiers. Specific first aid training has been designed and required for some structural firefighters. Even babysitters have had specific first aid training developed for their needs.

Given the hazardous nature of fighting fires, there is a very clear and significant need to develop first aid training specifically designed for the unique needs and environments of wildland firefighters. And once designed, the training needs to be made easily available to frontline wildland firefighters.

In response to the needs of wildland firefighters, the University of Colorado School of Medicine began developing a unique course, Wildland Firefighter First Aid (WFFA), in 2019. The school's Wilderness & Environmental Medicine Section (www.ColoradoWM.org), a unit of the Department of Emergency Medicine, noting the lack of first aid training for wildland firefighters, researched the epidemiology of wildland firefighter safety, the settings in which they work, and the resources available to them. The researchers then took an existing curriculum, Wilderness First Aid, the most germane curriculum to the wildland firefighter situation, and adapted it for the fire line. Since being first rolled out and tested, the curriculum has been continually tweaked to better fit the needs of wildland firefighters and to respond to the latest research.

The Colorado School of Medicine prides itself on teaching evidence-based medicine. In developing and updating the course, every effort has been made to follow the limited evidence, and when that is not possible, to distinguish between teachings supported by research and those supported by expert consensus or tradition.

Wildland Firefighter First Aid is a 16-to-24-hour introduction to emergency medical response program for front line wildland firefighters. As a U.S.-based curriculum, the course is designed to train firefighters to follow the National Wildfire Coordinating Group's Treatment Principles and to competently follow the Patient Assessment protocols of the Incident Response Pocket Guide (IRPG). The course teaches the specific treatments – and much more – from the IRPG. More about the IRPG, which is also available in Spanish, can be found at <https://www.nwccg.gov/publications/461>.

Wildland Firefighter First Aid is 16-to-24-hour introduction to emergency medical response program for front line wildland firefighters AT the University of Colorado School of Medicine.

Students carry out an injured firefighter during a scenario. Photo courtesy National Interagency Fire Centre.





The Wildland Firefighter First Aid program emphasizes prevention, assessment, and evacuation. Photo courtesy National Interagency Fire Centre.

The class is focused equally on knowledge and skills. Knowledge is gained through PowerPoint lectures, case studies, and group exercises. Skills are demonstrated by faculty and then practiced by students. Knowledge and skills are brought together and enhanced through scenarios, in which a common injury is simulated, and participating firefighters have to realistically respond. For skills and scenarios, only supplies and equipment normally available are used to keep things as realistic and transferable as possible.

Wildland Firefighter First Aid emphasizes prevention, assessment, and evacuation. Can the firefighter stay on scene and just rest? Does the firefighter need to get out of the field and back to definitive care, but on a non-emergency basis, or is this a full-on, life and death emergency? However, the class also goes beyond just assessment as it teaches treatment for the following



Students in the wildland firefighter first aid course demonstrate improvised cervical spine protection. Photo by Justin Kesler, University of Colorado School of Medicine.

medical issues, all of which have been shown to be common and or life-threatening injuries:

- trauma
- bleeding
- shock
- fractures and musculoskeletal injuries
- head injuries
- heat injuries
- mental health.

Scenarios, which students generally find to be the most valuable parts of the class, are designed for small groups of three to five firefighters, and in which one of the participants is the “patient.” The patient has a simulated and moulaged-injury, which the other participants must treat. The scenarios, which last about 30 minutes, are then debriefed with an experienced facilitator. In scenarios firefighters must apply their didactic and hands-on learning in as realistic a situation as is possible. Several rounds of scenarios are run with the goal of improving with each round.

The course has been offered to the USFS Advanced Academy for the past two years to very positive feedback by both firefighters in training and USFS training managers.

Wildland Firefighter First Aid was first offered in early 2020. Due to the COVID pandemic, the class was delivered entirely online. As one would guess with a course that is half skills and scenarios, and is team-based, delivery was difficult. Scenarios were not done and there is no doubt that skills, practiced without live, real-time feedback, suffered.

However, despite the many COVID challenges, in the four classes that were offered in 2020 participants gave the classes an overall rating of nine out of 10. Stellar

ratings continued in 2021 when the class was half online and half in-person. Below are some comments from class evaluations:

- The best part was thinking outside the box, doing most with what limited tools and resources you have. A ton of great, straight forward information.
- I have little medical experience, so this helps me feel more confident out in the field.
- Lots of good information that usually isn't covered in our fire medical refreshers.
- It was interesting to see a wilderness take on medical. Normally we just get a lot of street medicine that isn't practical in our job.
- I really enjoyed reviewing how to handle these situations with what we have on hand. Case studies were especially helpful, especially when we needed to use our MIR and develop a plan for evacuation.
- As an EMT, the course was a good review of my initial EMT class. The benefit is teaching practical skills such as spinal immobilization or wound cleaning but utilizing items that are immediately available to crew on a wildland fire. All wildland firefighters should take this class.

Crew bosses and managers also thought highly of the class. Some of their comments:

- This was great – my crew learned a ton.
- I feel a lot better after this class, knowing the crew has taken the class.
- I appreciated how the material was accurately focused on the specific needs of firefighters.

A key to the classes' success has been the involvement of the crew bosses; they became vital players sharing concrete examples, leading discussions, acting as dispatch in scenarios, helping to debrief scenarios. The crew bosses' years of experience and their credibility added immensely to the participants' learning.

More information about Wildland Firefighter First Aid, including a sample syllabus and registration links, can be found at www.ColoradoWM.org. The course can be done in a minimum of 16 hours, though more time (up to 24 hours of training) allows for more skills and scenarios practice and is recommended. The course can be delivered anywhere, either in person or as a hybrid offering.

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Wildland firefighters, beyond the USFS Advanced Academy, need and deserve specific training in wildland firefighter first aid. In the United States and other countries, wildland firefighters are expected to be able to take care of initial medical emergencies in case of an accident. Pull out a copy of the NWCG Incident Response Pocket Guide and carefully read the expectations of wildland firefighters when it comes to a medical emergency. The Guide assumes firefighters have the knowledge and skills necessary to perform comprehensive emergency medical care as described in the Medical Incident Report. For instance, the Guide assumes a firefighter knows how to stop bleeding; it assumes everyone knows how to keep an airway clear and the sometimes-necessary techniques such as the recovery position. The Guide assumes firefighters know what is normal for circulation and how to take a pulse and likewise for respirations. The Guide states “Stabilize patient” – assuming a firefighter knows what that means.

At the end of the Patient Assessment page in the Guide, complete with dozens of bulleted tasks, is the statement, centered and in bold “Make a transport decision.” That’s a big call. Of course, one expects the decision would be done in conjunction with a dispatcher; still the Guide assumes there is competency by the firefighter who may well be the on-scene IC, at least until outside medical help arrives.

Wildland firefighting first aid training is needed by all wildland firefighters; it should not be reserved just for medics or those attending the USFS Advanced Academy. If firefighters are expected to use and follow the IRPG they must get focused, comprehensive, evidence-based first aid training.

In addition, as research on wildland firefighter mortality and morbidity is limited, more study is needed to better



A student applies an improvised leg splint. Researchers studying a 2002 Florida fire found that firefighters on average were seen by the medical tent two times each in just a 19-day span. Photo by Justin Kesler, University of Colorado School of Medicine.



A student holds a patient’s head and neck “spine stable.” According to a 2021 report by the Thomson-Reuters Foundation, one in four United States Forest Service firefighters has a work-related injury or illness every year. Photo by Justin Kesler, University of Colorado School of Medicine.

understand wildland firefighter injuries and illnesses so that evidence-based medical responses and training can be developed.

If we are to continue to improve wildland firefighter first-aid training, it will be very helpful to know the epidemiology of injuries and illnesses so that the proper attention and prioritization can be made for different issues. What are the injuries? What causes the injuries? Who is at risk? Better and co-ordinated tracking systems of accidents and events, whether during training, transport, or fire fighting itself are needed.

More study on the effectiveness of Wildland Firefighting First Aid, or other firefighter first aid training, is also needed. External evaluation would provide unbiased measures and perspectives in examining value, along with objective feedback from new perspectives.

The Wildand Firefighter First Aid pilot offerings have been successful from firefighters’ and managers’ perspectives. Wildland firefighters deserve more opportunities to train with a course like this or something similar. Let’s take one of the most dangerous occupations and make it safer.

ABOUT THE AUTHOR



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CONSIDER COLLEAGUES FOR IAWF HONOURS

NOMINATIONS FOR FOUR AWARDS OPEN THROUGH DEC. 19

The IAWF encourages members (and others) to gather information to nominate some very deserving folks for four prestigious 2022 awards – the Firebreak award for excellence in wildland fire management, the Ember award for excellence in fire science, the early career in fire science award, and the early career in wildland fire operations award. The recipient does not need to be an IAWF member to receive an award. If you've nominated someone in the past and they were not selected as the recipient, please do not hesitate to re-nominate them. At times the IAWF receives nominations for numerous deserving folks, however, we are able to select only one person per award.

Contact us with questions: execdir@iawfonline.org or 406-625-7059.

Nominations can be submitted at www.iawfonline.org/awards

FIREBREAK AWARD FOR EXCELLENCE IN WILDLAND FIRE MANAGEMENT

The management award was established to honor achievements and excellence in the management of wildland fire programs. This award recognizes an individual who has made lasting contributions in program management and inspired others through creativity, innovation, leadership, application, guidance, and communication in response to challenging and controversial wildland fire management issues.

EMBER AWARD FOR EXCELLENCE IN WILDLAND FIRE SCIENCE

The purpose of the IAWF Ember award is to acknowledge sustained achievement in wildland fire science. The name Ember was chosen to reflect the fact that research and science often move slowly, and their benefits or impacts may not be apparent for years or decades.

EARLY CAREER IN FIRE OPERATIONS AWARD

The early career in fire operations award recognizes a promising early-career professional who has demonstrated outstanding ability in any field of wildland fire science. Early career is normally taken to include professionals who are under 40 years of age when nominated.

EARLY CAREER IN FIRE SCIENCE AWARD

The early career in fire science award recognizes a promising early-career professional who has demonstrated outstanding ability in any field of wildland fire science. Early career is normally taken to include professionals who are under 40 years of age when nominated.

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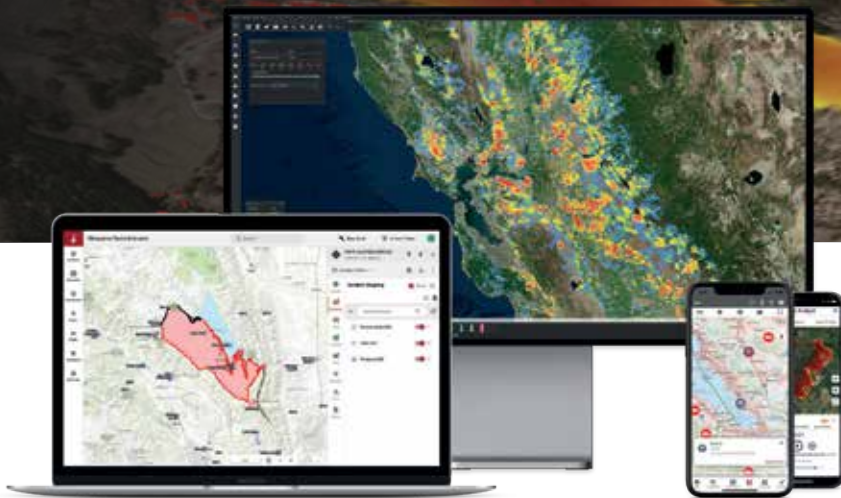
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