

# WILDFIRE

QUARTER 3, 2023  
UNITING THE GLOBAL WILDLAND FIRE COMMUNITY

An official publication of the INTERNATIONAL ASSOCIATION OF WILDLAND FIRE



8<sup>TH</sup>  
INTERNATIONAL  
WILDLAND FIRE  
CONFERENCE

## INTERNATIONAL COLLABORATION

PORTUGAL FORUM CULMINATES IN FRAMEWORK TO TACKLE GLOBAL CHANGE



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# WILDFIRE

An official publication of the International Association of Wildland Fire

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Protecting Our World

# GLOBAL PERSPECTIVES, PERSONAL EXPERIENCES

BY LAURA KING

It's always remarkable when like-minded people gather to problem-solve: issues that defy resolution by individuals are dissected into actionable segments; challenges that seem insurmountable become manageable; momentum builds; ideas become frameworks; and solutions become achievable.

This was the case in Porto, Portugal, in May, during the 8th International Wildland Fire Conference, which culminated with support for the Landscape Fire Governance Framework – Guiding Principles for Adjusting Strategies, Policies, and Management to Global Change. For three days, more than 1,300 participants from 90 countries listened, learned, debated, brainstormed and, ultimately, endorsed the document.

Conference chair Tiago Oliveria outlines the anticipated next steps and impact of the framework and the conference itself in our cover story (page 12) and provides insight and analysis.

The Porto conference was also the venue for the presentation of the 2022 IAWF awards (page 8), with most recipients in attendance. IAWF was thrilled to bestow awards in person to wildland fire trailblazers David Calkin, José Antonio Vega, Jan Kaczmarowski, and Fábio da Silva.

Conference attendance from 90 countries is indicative of the global nature of the wildland fire challenge and the magnitude of climate change. IAWF strives to provide a worldwide perspective; our stories from the United States (Robertson Draw, page 18, and Drivers of California's changing wildfires, page 36), Australia (Fired up, page 22) Canada (Indigenous impacts and solutions, page 26), and Brazil (page 30), are testimony to our commitment to cover the globe.

Also in this issue we've ensured topic diversity: health and wellness; prescribed fire; policy; research; technology; opinion; leadership; and personal perspectives.

It's fascinating to read Jon Trapp's story about the Robertson Draw fire on June 15, 2021, in Montana. The details make a great story – sipping hot morning coffee, listening to the sound of the waves – and then Trapp's

realization that his hometown was potentially in danger, and he was on vacation in Oregon.

Equally gripping are our pieces on technology: Australian fire simulation expert Rohan Fisher thinks of his computer programs as video games for fire managers, and the Internet of Things (page 40) makes an appearance in the forest to monitor temperature, humidity, soil, moisture, and air quality along with problems such as drought, pests, or diseases – and, of course, wildland fire detection.

Freelance writer Eugene Gerdon provides perspective on Brazil, where the previous government had a suppression mindset while the current regime is more in tune with global wildland fire policies.

“The new government will start more active controlled and prescribed burning,” Gerden writes. “Some regions of the Cerrado, a vast ecoregion of tropical savanna in eastern Brazil (the most biodiverse savannah in the world, which is known for Brazilian highlands) – and the Planalto have been using prescribed burning since December 2022 to reduce fuel accumulation.”

Our two regular contributors, Bequi Livingston and Mike DeGrosky, share their usual enlightened views on mental health (page 24) and leadership (page 44).

Livingston's personal and professional knowledge of trauma and its impact on wildland firefighters and managers is remarkable; her willingness to be vulnerable and share her story and her path to peace is selfless. Understanding trauma, and writing about it through a firefighter lens, is invaluable.

DeGrosky has been a consistent voice in *Wildfire* for years and is truly a guiding light for crew bosses, land managers, and those who lead organizations and agencies. DeGrosky's take on the relationship between an organization's culture and its strategy, and the importance of aligning the two, highlights the IAWF's diversity and inclusion initiative as an example of a successful cultural / strategic bond.

As we were putting together this issue, wildland fires burned in North America and Europe; some areas reported the worst seasons on record.

We'll explore those situations in the next issue.



Managing editor Laura King is an experienced international journalist who has spent more than 15 years writing and editing fire publications. She is the Canadian director for the National Fire Protection Association (NFPA), works closely with FireSmart™ Canada to help residents build resilience to wildland fire, and has participated in the development of the Canadian wildland fire prevention and mitigation strategy.



# SCIENTISTS AND TECHNOLOGISTS: PILLARS OF COMMUNITY SUPPORT

BY JOAQUIN RAMIREZ

The 2023 International Wildland Fire Conference was an immense success. We convened 1,600 attendees from around the globe in the welcoming city of Porto, where everyone enjoyed the legendary Portuguese hospitality. IAWF was part of the conference for the first time as an institutional partner, and we also enjoyed a social event and the IAWF awards ceremony.

Our focus centered on the challenges inherent in the development of a global risk governance framework. Robust discussions enriched the conference, and you can explore a plethora of results and testimonials on the conference's excellent website, [www.wildfire2023.pt](http://www.wildfire2023.pt).

The stark reality of these challenges is reflected in the 2023 Canadian fire season, which set new records early in the season. The statistics are staggering, swiftly becoming outdated as the magnitude of the crisis escalates. This situation is hard to fathom for anyone outside the dedicated fire community battling these raging fires. Efforts

are supported by global collaboration aiming to mitigate the catastrophic impact on the stressed boreal forests stretching from the North American coast to coast. We're reminded of the vast repercussions of such massive emissions and smoke exposure on everyone involved, from firefighters and citizens to rural, Indigenous communities, and the urban dwellers in places like Union Square and other big cities on the Eastern North American Coast.

In the face of such extraordinary events, it becomes evident that a collective effort is necessary to seek sustainable solutions to these challenges. Our community must take the lead in finding scientifically based, culturally sensitive strategies for long-term planning.

This brings me to my applied fire science triangle, a model that emphasizes the vital roles played by three key actors in addressing this complex problem.

## OUR COMMUNITY MUST TAKE THE LEAD IN FINDING SCIENTIFICALLY BASED, CULTURALLY SENSITIVE STRATEGIES FOR LONG-TERM PLANNING.

The scientific wildland fire community, despite being severely underfunded, persistently strives to answer pressing questions; these range from studying the microscale of plant physiology to understanding the macroscale of regional landscapes, from analyzing combustion in wildland-urban interface environments to intricate fire-weather interactions. The scientific community retrospectively investigates thousands of years of fire history while also projecting future scenarios using climate change models, which are becoming ever more crucial for understanding the pace of change we are facing. Scientists are responsible for evaluating the physical and mental health implications on firefighters and the public while driving advances in social sciences to help build resilient societies.

The users' community, which includes practitioners of risk prevention and proactive fire fighting, requires solutions that meet their needs. Technology alone isn't enough; science and technology should serve as reliable, high-performing, accessible tools that enhance their capabilities, cater to local cultural contexts, and ultimately improve their work's effectiveness.

Technologists are the third and sometimes overlooked part of this team. They bridge the gap between scientists and end users, prioritizing needs, facilitating data, and providing materials to create tools that become as indispensable as a firefighter's

Pulaski. Technologists work on myriad solutions from improved personal protective equipment, novel materials for protection, enhanced tools and techniques for prescribed burns and vegetation management, modeling and situational awareness applications for increased safety and operational response, to remote sensing technology for real-time incident monitoring. Beyond that, technologists provide the necessary training and support to effect change within organizations, transforming individual experiences that can be lost after retirement, into institutional wisdom.

In this magazine, on our portals ([wildfiretoday.com](http://wildfiretoday.com) and [fireaviation.com](http://fireaviation.com)), and during IAWF events, you'll find many such dedicated technologists and companies striving to offer affordable, actionable solutions that enhance our challenging roles. Engage with them, share your needs and feedback. Your voice, as part of the user community, is vital in guiding the advancement of science and technology that can effect meaningful change today. It is an all-hands effort, and we need to progress together.



Joaquin Ramirez Cisneros is a wildland fire technologist who 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](http://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 AND IJWF HONOR SCIENTISTS, RESEARCHER, EDITORS

PHOTOS COURTESY OF 8TH IWFC

## EMBER AWARD FOR EXCELLENCE IN FIRE SCIENCE

### DAVID CALKIN

David Calkin's contributions to the wildland fire community have markedly improved real-world decision making. Calkin's work has served to improve the effectiveness, efficiency, and safety of the wildland fire management system. Calkin was an original co-developer of the Wildland Fire Decision Support System (WFSS) in the United States; this system has become the single most important wildland fire decision support system and most comprehensive record for large and complex wildfires in the United States.

Calkin developed and is the leader of the Wildfire Risk Management Science Team within the Human Dimensions Program of the Rocky Mountain Research Station. Calkin and his team have assisted in the development of Potential Operational Delineations (PODs) that better promote cross-boundary strategic pre-fire planning and next-generation fire analytics including Suppression Difficulty Index, Potential Control Locations, and Snag Hazard.

Calkin played a pivotal role in the development and application of the US Forest Service Risk Management Assistance Program, which has grown to include an online dashboard with prepositioned analytics that

provide risk-based, structured decision-making tools to incident management teams.

During the COVID-19 pandemic, Calkin was key in assessing risks and developing mitigation measures for wildland fire response functions. Calkin is a leader in wildland fire risk management and his career contributions have positively influenced and advanced the wildland fire management system.

## EMBER AWARD FOR EXCELLENCE IN FIRE SCIENCE

### DR. JOSÉ ANTONIO VEGA

José Antonio Vega has made career-long contributions to wildland fire science through research, academic achievements, teaching, and publication in an impressive range of areas encompassing forest fire protection, forest hydrology, fire effects on soils, soil erosion, post fire soil stabilization and rehabilitation, fire ecology, prescribed fire, forest fuel reduction treatments, and forest fuel modelling.

Vega founded the Forest Fire Laboratory of the Forestry Research Center of the Xunta de Galicia in Lourizán (Pontevedra) and has managed the center and co-ordinated the Fire Research Group for 25 years.



David Calkin receives the 2023 Ember Award for Excellence in Fire Science from IAWF vice-president Kelly Martin at the 8th International Wildland Fire Conference in Porto, Portugal, in May. Calkin was also named outstanding associate editor of the International Journal of Wildland Fire for 2022.



José Antonio Vega received the Ember Award for Excellence in Fire Science at the 8th International Wildland Fire Conference in Porto, Portugal, in May for his career-long contributions to forest fire protection, forest hydrology and forest fuel modelling.



Vega was an associate professor at the University of Vigo, teaching fire science, for more than 21 years.

Vega has been an officer of the International Union of Forest Research Organizations and co-ordinator of the Group of Forest Fires of the Spanish Society of Forest Science. Vega has served as a guest lecturer, visiting professor, and visiting scientist at numerous universities, institutes, training centers, and research centers throughout Europe, South America and the United States.

Vega has an exemplary publication record, having written more than 300 publications. Vega is a well-respected leader and an admired role model in fire science and has been recognized with awards in Spain and the United States.

Vega's long-term commitments and achievements to the advancement of wildland fire science excellence truly personify the spirit of the Ember Award.

## **FIREBREAK AWARD FOR EXCELLENCE IN WILDFIRE MANAGEMENT**

### **JAN KACZMAROWSKI**

After graduating in forestry at the Warsaw University of Life Sciences, Jan Kaczmarowski has had a distinguished career in forest fire protection, and he continues to lead and inspire others.

Kaczmarowski's accomplishments include developing a national system of fire protection procedures and infrastructure, leading climate change adaptation in forestry, and representing Poland on international bodies.



Jan Kaczmarowski received the Firebreak Award for Excellence in Wildfire Management at the 8th International Wildland Fire Conference in Porto, Portugal, in May. Among his accomplishments, Kaczmarowski developed a national system of fire protection procedures and infrastructure.

Kaczmarowski shares his knowledge with others through teaching and supervising post-graduate students and is a regular contributor to forestry and fire management publications.

With a strong interest in science and research as well as a national leadership role, Kaczmarowski is also active in the field; he conducts inspections and investigations, organizes wildfire training, is involved in the management of large fires, and is a strong advocate for prescribed fire.

As a program manager, Kaczmarowski demonstrates excellence across many aspects of fire, from ecology to operations.

Beyond Poland, Kaczmarowski's expertise in fire management and training has taken him to Cypress, Lebanon and Moldova in a voluntary capacity.

Kaczmarowski is a link between foresters and firefighters, scientists and practitioners, in Poland and abroad.

## **EARLY CAREER AWARD IN FIRE SCIENCE**

### **DR. MICHAEL GOLLNER**

Michael Gollner works at the intersection of wildland fire, combustion, and fire protection engineering.

Gollner is a very active and innovative researcher with a grand vision of the crucial issues in the field of fire science. Gollner has made significant contributions to the understanding of the general problem of ignition and fire spread, heat transfer mechanisms in spreading fires and from burning ember piles to structural components, ember generation, and the link between fuel moisture and emissions.

Among Gollner's many activities and committee positions with professional organizations, he served two terms as an IAWF board member and former treasurer, working to draw engineers and physical scientists closer to the wildland fire community.



Michael Gollner is the recipient of the Early Career Award in Fire Science for his work on the understanding of ignition and fire spread.

Gollner's expertise is widely acknowledged; he has testified to the US Congress on wildland fire policy, and has given several keynote lectures at technical meetings and many invited talks.

Gollner has received awards from the International Association of Fire Safety Science and the Combustion Institute, demonstrating how he excels at the interface between applied fire research and fundamental combustion research.

As an educator, Gollner has excelled, teaching a large variety of courses, and mentoring many young fire protection engineers and fire safety scientists.

## EARLY CAREER AWARD IN FIRE OPERATIONS

### FÁBIO DA SILVA

Fábio Miguel Martins da Silva began fire fighting when he was 18 as an urban firefighter. At age 21, he began working with Portugal's helitransported brigades and has been part of the Special Force for Civil Protection since 2007. Da Silva now holds the third highest command position in the national structure where he serves as the operational co-ordinator, as well as the leader of the Fire Analysis and Use Group.

This taskforce, comprising 28 firefighters and analysts and led by da Silva, has made a significant contribution to improving Portugal's capacity to respond to wildland fires.

Da Silva led the development of the FEB Monitoring GIS system currently in use, which supports operational decisions; he is also committed to education and training.



Da Silva is a professor at the Nova University Lisbon for postgraduate courses, as well as an instructor at the National School of Fire Fighters of Portugal (Escola Nacional de Bombeiros).

In addition to sharing his experience and work at national and international conferences, da Silva is an expert from the Commission's Civil Protection Mechanism, and serves on the advisory board of the Pau Costa Foundation.

## OUTSTANDING EDITOR AWARDS

The International Journal of Wildland Fire has named two recipients of the 2022 outstanding associate editor award.

Dr. David Calkin and Dr. Hayley Hesselin are on the IWFJ editorial board.

"The reputation and performance of a journal's editorial board is vital in maintaining the quality and continually improving the stature and visibility of that journal," IAWF said in May.

Calkin (pictured on page 8) is a supervisory research forester at the Human Dimensions Program of the US Forest Service Rocky Mountain Research Station in Missoula, Montana. He co-leads the Wildfire Risk Management Science team working to improve risk-based fire management decision making through improved science development, application, and delivery. His research incorporates economics with risk and decision sciences to explore ways to evaluate and improve the efficiency and effectiveness of wildfire management programs.

Calkin received a BS in applied math from the University of Virginia, an MS in natural resources conservation from the University of Montana, and his PhD in economics from Oregon State University.

Hesselin is an associate professor in the College of Agriculture and Bioresources



Hayley Hesselin was named 2022 outstanding associate editor of the International Journal of Wildland Fire. Hesselin has been an associate editor since 2005.

and the head of the Department of Agricultural and Resource Economics at the University of Saskatchewan. She teaches resource and environmental economics and has conducted research on the economics of forestry and forest fires, environmental and resource economics, and workforce development in the north. She has done research on the economics of wildfire and fuels management including an examination of the costs of fuels treatments such as prescribed burning and mechanical fuels reduction. In addition, Hesseln

has explored the impacts of wildfire in the wildland urban interface, wildland fire policy, and the effects GIS on suppression expenditures. Current research interests include effective pedagogical approaches to learning, and the effects of emotional intelligence in the workforce.

Calkin and Hesseln have been associate editors of the IJWF since 2015 and 2009 respectively, and Calkin has been a member of the IAWF since 2005.

## IAWF SCHOLARSHIP RECIPIENTS FOCUS ON ECOSYSTEM

**Elise Brown-Dussalt** is a masters of science student in integrative biology at Wilfred Laurier University in Ontario. Brown-Dussalt was introduced to boreal burns in 2019, when she took her first field job assisting a master's student on the Chilcotin Plateau in Central British Columbia. After her first soot-coated summer, she found her interests continuing to gravitate towards boreal wildfires and forest dynamics. As a resident of Canada's Yukon territory, Brown-Dussalt sees first-hand the complex socioenvironmental effects of wildfire in the north. She started a master's with the Forest Ecology Research Group at Wilfrid Laurier University in Ontario in 2022, hoping to contribute to climate change resilience in the northern boreal. Her research looks at caribou lichen transplantation as a method of accelerating caribou winter habitat regeneration, specifically seeking ideal transplant conditions for caribou lichen in boreal burns. Brown-Dussalt conducts research on the lands of Ka'a'gee Tu, Deh Gah Got'ie First Nations, and Tłı̨chǫ nation in the Northwest Territories.



**Stella Mosher** is a PhD candidate in the department of geography at the University of Utah. Mosher received her bachelor of science in natural sciences, with an emphasis in geology from the University of Puget Sound, and her masters of science in geology from the University of Cincinnati, before choosing to pursue paleoecology and paleofire research for her PhD. Mosher has a deep interest in understanding how climate and people have modified Earth systems, and specifically how changes in fire activity have shaped (and continue to shape) our landscapes and communities. Mosher's research is focused on reconstructing fire histories over millennia in South Africa's highly biodiverse and fire-adapted fynbos biome; she is particularly interested in understanding how this ecosystem has evolved due to climate and anthropogenic changes, including the onset of pastoralism in the fynbos ~2,000 years ago, and subsequent landscape transformations through fire suppression since ~1650 CE. Mosher is reconstructing fire histories at ~two-year intervals over the past 4,200 years to better understand these climate-vegetation-fire-human linkages and hopes that her research will provide a paleo-ecological context for understanding how climate and people have influenced fire in the fynbos.



# INTERNATIONAL COLLABORATION

## PORTUGAL FORUM CULMINATES IN FRAMEWORK TO TACKLE GLOBAL CHANGE

BY TIAGO OLIVERIA

PHOTOS COURTESY OF 8TH IWFC | PHOTOGRAPHY BY DIOGO BAPTISTA

The 8th International Wildland Fire Conference, held in Porto, Portugal, May 16-19, was a significant milestone in addressing the challenges posed by wildfires worldwide.

More than 1,300 participants from 90 countries gathered in 65 sessions with more than 200 speakers who covered all steps of integrated fire management and discussed principles toward an international landscape fire governance framework.

For almost a week, the international community showcased the best of its collaborative spirit toward complexity and uncertainty posed by wildfires.

The significant attendance, diverse range of speakers, global representation, extensive sessions, exhibitors, sponsors, and exhibition area all contributed to fostering

meaningful discussions, knowledge sharing, and the advancement of fire governance and management practices. Participants recognized the urgent need to develop institutional arrangements, public policies, and guidelines to mitigate the consequences of environmental changes, socioeconomic factors, and climate change on fire regimes. The conference served as a catalyst for international collaboration and the development of a fire governance framework.

A crucial output emerged in the form of the Landscape Fire Governance Framework – Guiding Principles for Adjusting Strategies, Policies, and Management to Global Change (<https://www.wildfire2023.pt/conference/framework>). This document, which had been prepared, circulated, and discussed among



experts and government and non-government institutions, gained significant traction among the participants. After international consultations on the framework text, it was unanimously agreed that the document should be formally recognized as a guiding set of principles and goals for enhancing governance in integrated fire management. Consequently, delegates proposed that the framework be brought forward to the United Nations and international and regional intergovernmental organizations, with the aim of securing its official endorsement.

The international liaison committee, responsible for stewarding the International Wildland Fire Conferences, played a pivotal role in co-ordinating the development of the global statement and framework. The committee, along with its individual and organizational members, committed to working toward the endorsement of the Landscape Fire Governance Framework by appropriate UN bodies, including the Food and Agriculture Organization, the UN Environment Programme (UNEP), and the UN Office for Disaster Risk Reduction (UNDRR), with the support of the Wildland Fire Advisory Group and the Global Wildland Fire Network.

The impact of the conference extended beyond its immediate outcomes. The principles for a landscape fire governance framework received widespread international support, attracting attention from prominent nations and organizations. Countries such as the United States, Germany, Brazil, Canada, Australia, New Zealand, and Spain actively participated in discussions on the framework principles and expressed

their commitment to continued collaboration on integrated landscape fire management. Additionally, international organizations including the Organization for Economic Co-operation and Development (OECD), Organization for Security and Co-operation in Europe (OSCE), and the United Nations acknowledged the significance of the framework and pledged their support for enhanced international cooperation in this domain.

Notable figures and leaders of the above organizations also acknowledged the importance of effective governance in addressing the global wildfire challenge, emphasizing the conference's objective of proposing governance guidelines that empower countries to better manage fire risk. The aim was to develop a work map, aligned with the United Nations' agenda, that would enable nations to contribute collectively to reducing the impact of fires.

Taking stock on the diversity of attendees and scope of the conference, OECD also took the chance to present its latest flagship report, *Taming Wildfires in the Context of Climate Change*, which provides a global assessment of wildfire risk, underlining the need to scale up climate change adaptation efforts, limiting wildfire risk. This report was based on a cross-country comparative analysis and, also provides a set of policy recommendations to support countries in wildfire risk reduction, and therefore was quite in line with the conference's topic and tone.

There was also an opportunity for Portugal's Agency for Integrated Rural Fire Management, which is known





**PARTICIPANTS RECOGNIZED THE URGENT NEED TO DEVELOP INSTITUTIONAL ARRANGEMENTS, PUBLIC POLICIES, AND GUIDELINES TO MITIGATE THE CONSEQUENCES OF ENVIRONMENTAL CHANGES, SOCIOECONOMIC FACTORS, AND CLIMATE CHANGE ON FIRE REGIMES.**

by the acronym AGIF, to present the evolution of the system that has been in the works since 2017, and share the results and next steps toward international best practices. It should be noted that the existing system in Portugal, and AGIF's activities, closely follow those contained in the framework.

Last, but not least, Food and Agriculture Organization of the United Nations (FAO) announced its FireHub initiative, which will bring together the best knowledge and practices on integrated wildfire management; the hub will be a good development ground for the framework's principles as more countries join its activities.

The president of the Portuguese Republic, Marcelo Rebelo de Sousa, highlighted the invaluable resource that forests represent and the devastating impact that

fires have on the environment and socio-economic well-being. Rebelo de Sousa stressed the importance of governance based on a long-term vision, transcending political cycles, to effectively tackle wildfires.

Gordon Sachs, chair of the international liaison committee, emphasized the strength that arises from collaboration. Sachs underscored the significance of common strategies, policies, and management practices in enabling nations to combat the global threat of fires effectively. Sachs also expressed his belief that the conference had provided invaluable information to guide expectations, manage uncertainties, and transform fire governance.

The success of the 8th International Wildland Fire Conference can be attributed to the collaboration and dedication of numerous stakeholders, including the



institutional partners who supported the event's organization. The involvement of institutions such as the FAO, OECD, GFMC, Forest Europe, the International Association of Wildland Fire (IAWF), and the European Forest Institute contributed to the conference's success and its ability to foster global co-operation and knowledge exchange.

The conference provided a platform for knowledge sharing, collaboration, and the formulation of strategies to mitigate the impact of wildfires on the environment, society, and security.

The outcomes of the conference have the potential to shape international policies, institutional arrangements, and public strategies related to fire management, as the framework gains recognition and support from relevant international organizations. The conference paved the way for increased collaboration, co-operation, and the adoption of balanced and technically supported solutions to manage fire risk effectively.

The 8th International Wildland Fire Conference stands as a testimony to the shared determination of the global wildfire community to mitigate the impact of wildfires, protect ecosystems and communities, and ensure the sustainable management of fire-prone landscapes. Through continued collaboration and the implementation of effective fire governance practices, nations can collectively work towards a safer and more resilient future.



**Attendance:** The conference attracted a substantial gathering of **1,345** attendees. These participants included fire management experts, policymakers, researchers, practitioners, and representatives from various organizations, all united in their commitment to addressing the complex issues associated with wildland fires.

**Diverse speakers:** With **200** speakers contributing their expertise and insights, the conference provided a platform for sharing knowledge, experiences, and innovative approaches to fire management. The diverse range of speakers ensured a comprehensive exploration of topics vital to understanding and mitigating the impact of wildfires.

**Global representation:** The event witnessed representation from **90** countries, highlighting the truly international nature of the conference. This global participation further emphasized the shared challenges faced by nations worldwide and the necessity for collaborative efforts in addressing the consequences of wildfires.

**Extensive sessions:** The conference featured an impressive lineup of **65** sessions, covering a wide range of topics relevant to fire governance and management. These sessions served as avenues for in-depth discussions, knowledge exchange, and the exploration of innovative strategies to enhance fire resilience.

**Diversity:** With roughly **two-thirds** of the presentations about integrated fire management, and the rest about its governance, this was a step forward from previous conferences, discussing topics related to wildfires that are not usually debated in such events. Another milestone was about gender balance, as women accounted for about **40** per cent of the presentations.

**Exhibitors:** A total of **47** exhibitors showcased their products, technologies, and services related to fire management and mitigation. The **2,000**-square-meter exhibition area provided an opportunity for participants to engage with cutting-edge solutions and advancements in the field, fostering collaboration and knowledge sharing.

**Sponsorship:** The conference enjoyed support from **15** sponsors, whose contributions played a crucial role in facilitating the event's organization and success. The sponsors' commitment demonstrated their recognition of the conference's significance and their dedication to promoting effective fire governance worldwide.



Tiago Oliveira is chair of the AGIF board of directors.

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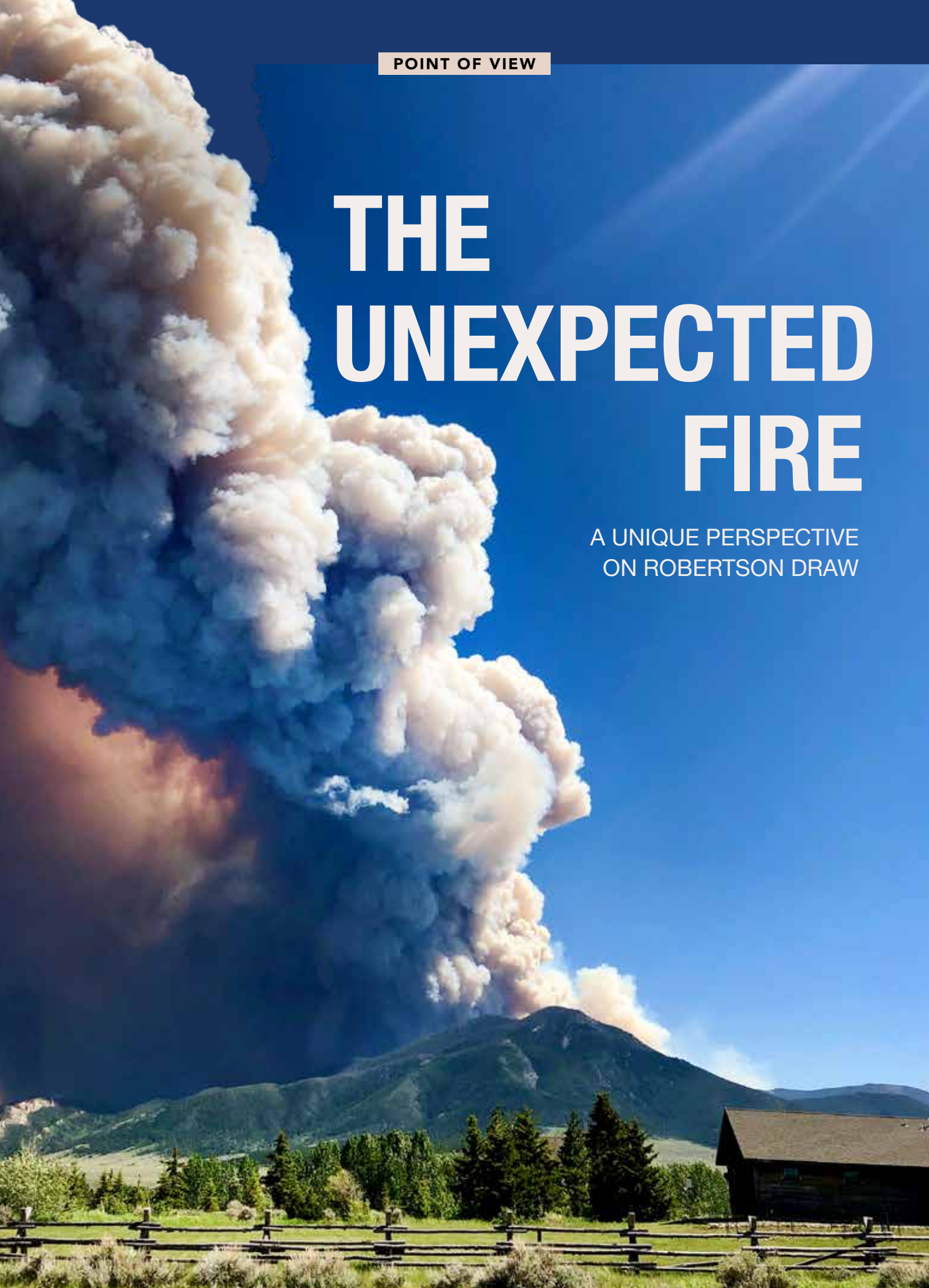
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POINT OF VIEW

# THE UNEXPECTED FIRE

A UNIQUE PERSPECTIVE  
ON ROBERTSON DRAW



BY JON TRAPP

It was a beautiful day on the Oregon coast. It began early with me walking from the campsite to the coffee shop with my dog. The family was still fast asleep. Once my mug was loaded up with hot caffeine, I walked to the beach for a few moments of zen before the day's activities kicked off. I listened to the sounds of waves crashing on the beach and watched a whale swimming near the haystack (one of the many rock formations that rise out of the ocean along the coast). Life was good. It was Tuesday, June 15, 2021.

I had heard there was a small human-caused wildfire south of my hometown of Red Lodge, Montana, but I wasn't particularly worried. Early season fires in the forested areas of Montana typically are easily controlled with relatively low fire intensity. Hell, that's exactly why I take my family vacation before July (when fire activity really starts picking up).

The sun wasn't very high in the sky before my phone started lighting up with increasing messages of growing concern. The fire, which started on June 13, had grown from 200 to 2,000 acres in the last day. The initial photos started coming in and I thought, "Damn, that's a real fire, and it's not even fire season yet!" The flame lengths, fire intensity and rate of spread were unusual for June. As a fire behavior analyst on a national team, I knew where to get the information I needed to predict the fire behavior in the upcoming operational periods.

I popped open my laptop in the camper, connected to the wi-fi and got to work. I told my family I would catch up with them on the beach after I got a better idea of what was happening near our hometown. I typically start assessing the same factors that a brand-new firefighter should be looking at: fuels; weather; and topography.

## Here's what I saw:

### FUELS

The primary fuel on Mount Maurice was 100-plus year old lodgepole pine with some Douglas fir and grass and sagebrush on the surrounding foothills. With decent snowpack, the dead fuels on the mountain would retain enough moisture to resist moderate to high fire intensity this time of year. But this year we didn't have any decent snowpack, and, in fact, our area of Montana was in a

long-term drought. Precipitation from Jan. 1 through June 15 was one to three inches below normal. Fuel sampling by the Beartooth Ranger District on June 10 showed dead fuel moisture for 1,000-hour fuels at 10 per cent. Ouch! In our area, we start getting concerned when 1,000-hour fuel moisture drops below 13 per cent. What about live fuels? Lodgepole and Douglas fir are just starting to come out of dormancy in June, resulting in some of the lowest live fuel moistures of the year. Live fuel moisture for lodgepole was as around 100 per cent, with Douglas fir even lower; compare that to more than 200 per cent live fuel moisture during green up.

### WEATHER

The National Weather Service in Billings issued a red-flag warning that was in effect from 10 a.m. to 10 p.m. on June 15. Uh oh. Red-flag warnings are usually a combination of high winds, high temps and low relative humidity. This warning was forecasting winds at 15 to 25 miles per hour from the southwest, with gusts to 35, near record-breaking temperatures and relative humidity as low as seven per cent. Double uh oh. Things were lining up for a real rodeo and it wasn't even the fourth of July!

### TOPOGRAPHY

The fire had started in Robertson Draw, which is on the eastern edge of the rugged Beartooth Mountains. Although the fire had started near a dirt road, it quickly grew upslope and was difficult to access by firefighters on the ground. The continuous fuels and complex terrain limited options for control lines. The forecasted winds were set to align with topography for a big fire day on June 15.

As I looked at the fire behavior models, I knew it was going to be a big day. My wife asked if I needed to fly home. I was torn by my obligations to my family and to the fire department and community. I pulled the extended weather forecast and started running the numbers. The models showed that fire spread would slow down in the days to come. By the time I would be home, fire activity would be greatly diminished. I decided to stay. Besides, with the way things were going, it was looking like I'd be out on fires for the rest of the summer.

As the sun came up the morning of June 16, the fire had grown to more than 20,000 acres; it was fueled by a perfect alignment of fuels, weather, and topography. My phone had been blowing up all night with pictures of flames seen from town. Some friends had to evacuate their home and ended up watching the fire from the hot tub at our house. It sounded like an awesome show!



The fire had started in Robertson Draw, which is on the eastern edge of the rugged Beartooth Mountains. Although the fire had started near a dirt road, it quickly grew upslope and was difficult to access by firefighters on the ground. The continuous fuels and complex terrain limited options for control lines. Photo courtesy of KMB Communications.

## MOVING FORWARD

The wildland fire service does a great job learning from our experiences. So, what can we take away from a fire like the Robertson Draw fire?

We have had this beaten into our heads over the last few years, but the climate is changing at an alarming rate.

Bigger fires, more intense fires, more frequent fires and yes, the fire season is lengthening. We must fully acknowledge this and plan for it.

Fire managers need to have their radar up year-round, not just during the fire season. The Beartooth Ranger District did a great job of this, recognizing early warning signs in June 2021; that's why there were fuel samples taken on June 10 (three days before the fire started).

Fire managers must continue the effort to extend the working period of seasonal firefighters, aircraft, dispatchers, and other essential personnel. Initial incident commanders on the Robertson Draw fire recognized that more resources were needed and ordered them, but pickings were slim. Most air resources and hand crews were already committed on fires in the southwest. Only two helicopters were available in Montana when the Robertson Draw fire started. According to the National Interagency Fire Center, by mid-June 2021 the United States was approaching 29,000 fires, which was over the average by about 4,000.

Fire managers need an adaptive initial attack strategy. As we know, we have done a pretty good job of suppressing fires over the last century, especially low-intensity fires – we knock them down hard and fast. But we need to consider letting those low-intensity fires burn when conditions are right and resources are available. Fire-dependent forests need frequent low- to moderate-intensity fire to remove the steadily accumulating amounts of dead and regenerating fuels. This applies to federal, state, tribal and private lands.

Fuels management. Prescribed fire and fuel mitigation work is essential. I know firefighters know this, but we have to keep pushing the message to the public. We must highlight successes with fuel-reduction work and own our

failures. When a prescribed fire gets away, we need to identify why and publicize how we are going to fix the problem in the future. Well-executed prescribed fire and fuel-mitigation work not only reduces hazardous fuels, but also helps to improve species diversity, forest health and resilience. We must blow our own horns and publicize the thousands of prescribed fires that go well and meet objectives!

We shouldn't be surprised by our changing fire climate. We should approach all fires, regardless of the time of year, with the same question: What's going on with fuels, weather, and topography? We also need to evaluate weather and fuels year-round, not just during the fire season. We must increase our capacity to mitigate hazardous fuels and to respond.



Jon Trapp is an Air Force veteran who served as a captain in the United States, Asia and Europe. After active duty, Trapp used the GI Bill to get a master's degree focusing on carnivore and wolf ecology. Trapp worked on multiple state and federal wolf-management programs in the southwest and the northern Rockies. When the opportunity to become a career firefighter/paramedic presented itself, Trapp took it. He is now an assistant chief, leading Fire and SAR operations in Montana. Trapp also serves on a national incident management team as a fire behavior analyst and continues to guide wolf tracking trips into Yellowstone National Park.

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# ORGANIZING CHAOS

## SIMULATION EXPERT MERGES TECHNOLOGY WITH LOCAL KNOWLEDGE OF WILDFIRE

BY DYLAN BRUCE

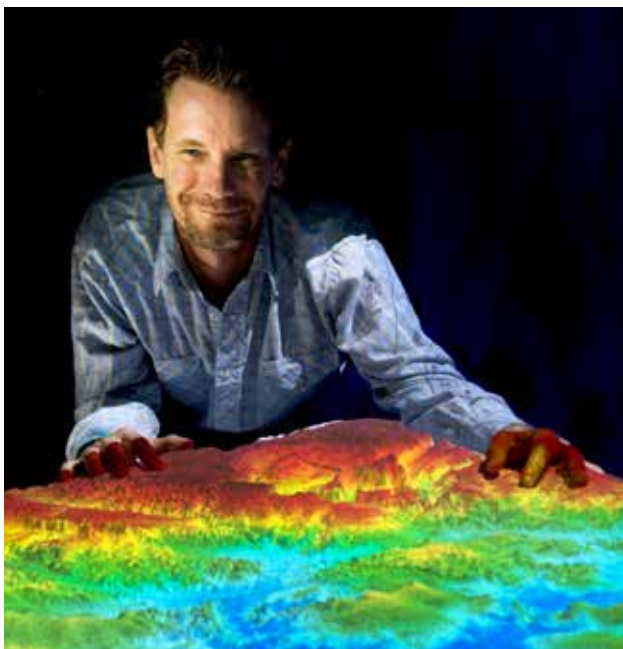
Fire is known as the element of chaos – uncontrollable and totally unpredictable – but with the help of fire-simulation technology, researchers can deepen everyone’s understanding of how fires spread and make educated projections about a blaze’s likely path. The information produced by fire-simulation technology is invaluable for those fighting and managing fires, so they can better plan and coordinate their efforts.

Rohan Fisher is one of northern Australia’s foremost experts in fire simulation and is an advocate for the technology’s use as a powerful educational tool.

Working as a fire researcher with Charles Darwin University, Fisher develops fire-simulation technologies for use by those managing land in Northern Australia.

“I see the fire simulations I have developed as serious games and encourage people to play with the complex array of variables affecting fire behaviour,” says Fisher.

Fire simulations can be used to output a visualisation of a fire’s likely spread, and this can be projected onto



a 3D printed landscape to further enhance how the information is conveyed. As the effects of climate change intensify, Fisher says effective and informed fire management will be an important part of responding to the increased threat of fires.

“Throughout remote Australia, increasing extreme fire weather is producing severe bushfires,” says Fisher.

“Good fire management in these landscapes is urgently needed, and, in the northern tropical savannas, Indigenous-led fire management at the landscape scale is already producing some of the world’s best fire management outcomes.”

Fisher has worked closely with Indigenous communities in Northern Australia to create fire simulations that visualise how old and new ways of managing fire affect the environment, providing them with an engaging way to share local fire management knowledge and pass on cultural experience to the next generation.

“Each fire simulation is developed in collaboration with the Indigenous groups for their land, to support their specific fire training and outreach needs,” says Fisher.

**“MY SIMULATIONS ALLOW USERS TO VISUALISE HOW FIRE BEHAVIOUR IS AFFECTED BY INTERACTIONS BETWEEN LANDSCAPE AND FIRE WEATHER VARIABLES AND FACILITATES THAT COMMUNICATION OF GOALS BETWEEN A CULTURALLY DIVERSE SET OF LAND MANAGERS.”**

**-ROHAN FISHER**

Fire-simulation expert Rohan Fisher, with Charles Darwin University in Australia, views wildfire simulations as “serious” video games that enable people to play with the complex variables that affect fire behaviour. Photo courtesy Rohan Fisher.

“The fire management stories the simulations are used to tell is entirely up to the groups themselves.”

Fisher has supported communities across Northern Australia and Eastern Indonesia to bring together their local knowledge with the latest technologies, such as satellite data, to safely and effectively manage fires.

“My simulations allow users to visualise how fire behaviour is affected by interactions between landscape and fire weather variables and facilitates that communication of goals between a culturally diverse set of land managers,” says Fisher.

With wide savannas and a small population, fire simulations for Northern Australia differ from those used in European, North American, or even Southern Australian contexts. Fisher says that this biome requires

a specific focus on the propagation and extinguishment of fire to support land management objectives, rather than primarily supporting emergency responses. While fire simulations are a valuable tool, it’s important to remember that they aren’t a crystal ball – a simulation is limited by the quality of the data with which it is made, and even good information isn’t a guarantee of accuracy.

“Even when good data is available, accurate spread prediction remains problematic due to the uncertainties associated with variations in fuel, weather, and topography and the complex interaction between these variables,” says Fisher.

“That’s why my simulation work aims to broadly support fire management discussion rather than explicitly predicting outcomes.”

Dylan Bruce is a writer from Melbourne, Australia, who is passionate about the impacts of fire on the environment and society.



# FIRED UP

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

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# THE JENGA BLOCKS OF TRAUMATIC STRESS

BY BEQUI LIVINGSTON

What is trauma? And what does it mean to be traumatized?

The term traumatic stress was coined by French psychologist Pierre Janet in 1889 after publishing the first scientific account of this disorder, claiming that, “trauma survivors are prone to continue the action, or rather the (futile) attempt at action, which began when the thing happened.”

When we talk about stress, we recognize that all humans experience stress, however, our reactions to stress often determine how it will affect us. Eustress is known as good stress, distress is the not-so-good stress, and traumatic stress, the worst. Using the example of overtime pay in the wildland world, most wildland firefighters rely on overtime to compensate their paychecks. The eustress of earning more money; the distress of being away from our homes and loved ones; and the traumatic stress of becoming burned out, ill, injured or losing our most precious relationships – all in the name of OT!

It’s well known that all stress includes some kind of physiological expression in the body – everything from sweaty palms, racing heart, tension, and shortened breath to heartbreak. Perhaps you can think of a time that you felt especially stressed and physical sensations were present. There may even be a time that you were so frightened you were frozen in fear, immobilized and unable to move. These are all normal reactions to abnormal circumstances – exactly what our bodies and primal brains are supposed to do to keep us safe and out of harm’s way.

But what happens when the system goes awry, when this traumatic stress becomes cumulative, ongoing, without resolve? I liken it to playing Jenga blocks; we start by building a secure block foundation, slowly and mindfully building the stack, one-by-one, until

completed. It looks solid and stable, right? Imagine these same Jenga blocks as the foundation of our lives. We build our foundation slowly, but then with every stressor, with every trauma and every loss, one of the blocks gets removed. You continue building, and slowly, blocks are removed, yet the stack still stands. You get to a point where the stack seems pretty secure and stable. However, you didn’t realize blocks were slowly being taken away, without knowing which one would be the catalyst, the crisis, the point at which all the blocks come tumbling down.

A common definition of trauma is, “an event where the individual feels that they are powerless to control the circumstances or event; the circumstances/event is either frightening and/or perceived as a moral injury; and the circumstances/event changes the individual’s beliefs about themselves, the world and their interactions in the world.”

Trauma falls into two categories: environmental trauma includes natural disasters (such as entrapments and burn overs), car accidents, and medical procedures; and interpersonal trauma, which occurs in the course of a relationship, sexual abuse, domestic violence, religious abuse, and trauma that occurs in childhood, such as neglect, abandonment and abuse. These traumas have a clear and concise way of impacting and injuring our autonomic nervous systems, especially when cumulative, relational and on-going.

**WHAT WE KNOW ABOUT TRAUMATIC STRESS IS THAT ONCE THE SYSTEM HAS BEEN ACTIVATED, IT TAKES OUR STRESS HORMONES UP TO 72 HOURS JUST TO BEGIN TO SUBSIDE.**



The body is a miraculous machine, and everything that happens to us is perfectly orchestrated. Let's look at how our brain operates when stressed or traumatized, using wildland firefighting as an example. We get the dispatch and our autonomic nervous system goes into high alert. Our brain's alarm system is activated, sometimes referred to as amygdala hijack, causing a cascade of stress hormones, along with slowing down our cognitive brain, or pre-frontal cortex. This cascade of stress hormones allows the reflexes to fight or flee, pumping much needed energy to our muscles, allowing us to prepare for a wildfire. Under normal circumstances, stress hormones will decrease back to normal once the stress has passed. However, with the stress of wildland fire, these stress hormones take much longer to subside, spiking quickly and disproportionately in response to stressful stimuli. The constant and cumulative cascade of these hormones can wreak havoc to our health and well-being, physically, mentally, emotionally, relationally and spiritually.

Using our wildland fire scenario, we can understand how our ANS and brains react, when the stress of simply being dispatched causes the hormone waterfall that continues throughout the assignment. Our bodies are now prepared for fighting or fleeing, not only pumping adrenaline and cortisol through our systems, but protecting us through what is known as armoring, which is another brilliant protection mechanism keeping our bodies safe from attack. How often, while on a fire, do you notice your upper chest, upper back, shoulders and neck become tense or tight?

I find it ludicrous that wildland folks are still provided with only two days of R&R, thinking that this will

give them time to relax and recover! What we know about traumatic stress is that once the system has been activated, it takes our stress hormones up to 72 hours just to begin to subside. That's why we often feel like we are just beginning to settle down just as R&R is over. Think about the harm this does to our bodies when we don't even allow ourselves the time it takes to truly recover, especially with fire season now 24/7/365.

Another huge component is the effect of the stress-hormone cascade in our bodies, because these traumatic and stressful events create a fire storm in our fascia, muscles, connective tissue, bones, organs and cells, especially when not addressed in a healthy way. It is known that all traumatic stress manifests physiologically or somatically, in the body. It's no wonder that so many of us deal with ongoing chronic pain and illness long after fire season subsides. It's also important to understand why some wildland firefighters develop post-traumatic stress, while some don't. People who experienced developmental trauma as a child, or adverse childhood experiences, are 20 times more likely to develop post-traumatic stress or complex post-traumatic stress.

My wish is that this information helps you begin to understand the complexities of traumatic stress, including grief while helping you to begin to connect the dots in your own wildland world. I would have given anything to have had this kind of knowledge and wisdom going into my Jenga blocks crumbling. And, please know, despite the chaos that accompanies post-traumatic stress, there is always a healing path forward; it's called post-traumatic growth. More on that in future articles.



Bequi Livingston was the first woman recruited by the New Mexico-based Smokey Bear

Hotshots for its elite wildland firefighting crew. She was the Regional Fire Operations Health and Safety Specialist for the U.S. Forest Service in Albuquerque, New Mexico. Contact her at [bequilingstonfirefit@msn.com](mailto:bequilingstonfirefit@msn.com).

# INDIGENOUS IMPACTS AND SOLUTIONS

## FIRE, FLOODS, AND CLIMATE CHANGE

BY RICH MCCREA

Cultural burning has long been a tradition in Canada and other parts of the world. But practices – often driven by policy – have changed over time, sometimes amid frustration and controversy. At the IAWF Fire & Climate 2022 conference in Pasadena in May 2022, Canadian Brendan Mercer took delegates on a journey through cultural burning and traditional practices of First Nations peoples, in parts of the beautiful province of British Columbia.

Mercer lives and works in the Tk'emlúps te Secwépemc Traditional Territory in Kamloops. His position is with the First Nations Emergency Services Society (FNESS) as the manager of the decision support department. FNESS is a non-profit governed by a First Nations board of directors, which collaborates with communities on various emergency management initiatives to improve overall health and safety.



Mercer's presentation focused on the impacts of wildfires and traditional use of fire by Indigenous Peoples and their First Nations communities.

FNESS supports all First Nations communities across the province with emergency-management related services, including wildfire mitigation and climate adaptation initiatives. FNESS is working on solutions in British Columbia that integrate traditional ecological knowledge and western science using interactive decision support tools, which facilitate multi-agency information sharing to support integrated fire management planning.

There are 204 First Nations communities in British Columbia, each with unique risks and highly valued resources. First Nations Peoples have faced many challenges, barriers, and limitations in emergency management. Climate change and improper forest management contributed to the worst wildfire season on record in British Columbia in 2021.

Historically, Indigenous communities used fire as a tool to enhance the environment and improve their way of living, including food gathering and hunting. These practices were largely eliminated over the years because of laws put into place restricting Indigenous rights to practice traditional burning.

The traditional ecological knowledge of First Nations is part of the solution to the wildfire problem as well as the use of science and integrated fire management planning. Historically many areas would have burned once every 30 years, reducing fuel loading, understory vegetation and tree densities, which helped to limit large high severity wildfires.

Canadian Brendan Mercer talks about the importance of cultural burning in British Columbia during the IAWF Fire & Climate 2022 conference in Pasadena in May 2022. Photo by Joaquin Ramirez.

In Pasadena, Mercer spoke about his great-grandfather, who used to go out and strategically burn certain areas to enrich the fruits and berries and enhance the growth of grass so the game could have better feed. This wise use of fire enhanced wildlife populations such as moose, deer, bighorn sheep, blue grouse, and porcupine and made for a more biodiverse forest.

What follows is an edited and synopsis of Mercer's presentation.

## THE IMPORTANCE OF FUELS MITIGATION

In June 2021, an intense heat dome weather pattern settled over British Columbia. Lytton First Nation band members indicated that it was 52 C that day (126 F) with an extremely low relative humidity of eight per cent. On June 30, a wildfire ignited near the town of Lytton and spread rapidly; pushed by high winds, the fire turned into a major conflagration. Lytton First Nation evacuated the village, as did several other nearby First Nations. The Lytton Creek wildfire destroyed structures on several First Nations reserves and the majority of the village of Lytton. The village of Lytton is in the mountains of southern British Columbia, in a heavily forested region. The Lytton Creek fire burned a total of about 84,000 hectares (207,000 acres).

After the flames subsided an evaluation of burn severity was completed. There was a substantial area impacted by high-severity burning, which directly or indirectly impacted the First Nations reserves, especially watersheds adjacent to villages. Mary Louie, a Syilx Nation elder, sometimes refers to water

### **SOME REPORTS INDICATE THAT BRITISH COLUMBIA SPENT MORE THAN \$3 BILLION ON WILDFIRE SUPPRESSION IN ABOUT 15 YEARS, AND ONLY \$73 MILLION ON MITIGATION OF FIRE EFFECTS.**

In past decades FNESS has worked in partnership with several First Nations communities, including Nicomen First Nation village, to complete tree thinning and fuel reduction projects. All the structures in that village survived the Lytton wildfire.

as Mother Earth's blood, because water can provide the necessary physical, mental and spiritual nourishment to her children, therefore it's necessary to keep water sources clean.

In past decades FNESS has worked

Some areas higher up the mountainsides that were not treated displayed patches of high intensity fire, which destroyed entire rooting systems and impacted soil stability. These high severity wildfires can also reduce the water absorption capability across the landscape, resulting in more water flowing over land. About 150 hectares (370 acres) of fuels mitigation had been completed in past years, near the Nicomen village, and these efforts appear to have made a difference. The fire response team used these areas to conduct back burns because team members felt confident the fuels mitigation would reduce fire behavior.

Efforts to conduct fuels mitigation are sometimes hampered by funding limitations, internal capacity, and lack of collaborative efforts to effectively share data and information. It took the people of Nicomen more than 10 years to complete their fuels-mitigation projects, and it still was not enough to prevent long-term impacts to the community. There were no houses lost in Nicomen during the Lytton wildfire, but the entire community was evacuated three times since the summer of 2021 and now has a much higher risk of a landslide.

Heavy rains in the fall of 2021 over the Lytton Creek wildfire area brought devastating landslides, floods and debris flows, and impacted water quality. These post-fire events completely undercut some of the bridges accessing the community; this impacted key travel and escape routes for villages in the burn area.

Losses of traditional foods and other long-term impacts to communities may not be talked about as frequently as wildfire suppression related costs, because these things are typically hard to account for. Some reports indicate that British Columbia spent more than \$3 billion on wildfire suppression in about 15 years, and only \$73 million on mitigation of fire effects. Essentially, taxpayers and private residents are on the hook for many recovery costs, which makes it so that the poor and minorities often bear the largest burden. To put it simply, more fire prevention and fuels mitigation projects on a much bigger scale will help to reduce the risk to communities.

FNESS provides programs and services that utilize innovative technologies, which strengthen prevention and mitigation activities across the province. Wildfire mitigation projects have reduced the risk to communities, and better protected ecosystems. Benefits from fuels mitigation projects and prescribed fire that First Nations have implemented include:

- Reducing insect pests and invasive plants
- Improved forage for game animals, and better hunting opportunities
- Crop management – burning to improve yields of raspberries, strawberries, and huckleberries and facilitate gathering acorns
- Insect collection – some tribes collect and roast grasshoppers and crickets, or use fire to collect honey and pandora moths
- Pest management – burning can be used to reduce rodent, snake, ticks, black flies, and mosquito populations
- Range management – large scale burning was used to keep reduce encroaching vegetation, thus improving the ecosystem for many species
- Risk Reduction – better protection of communities and special areas from wildfire by pre burning around them
- Travel corridors were cleared for safety and improved visibility
- Improved physical and mental health: Activities involved in Indigenous land management such as cultural burning are seen to enhance well-being, as well as physical and mental health. These practices empower people and strengthens their sense of identity and give the ability to foster important relationships with members of their community, in addition to providing access to traditional foods and promoting physical activity.

## THE POWER OF PLACE

Mercer’s presentation about the challenges First Nations face from large wildfires that threaten their communities and homes was very compelling.

The Lytton Creek fire not only destroyed homes in First Nations villages, but the post-fire impacts from floods and landslides caused considerable damage to structures and highways, and limited people’s access to their communities.

As a listener, it was fascinating how this presentation depicted the deep relationship between First Nations and the traditional use of fire to enhance and improve their environment and reduce the chance of high severity wildfires.

First Nations have been planning and implementing fuels mitigation projects, using state-of-the-art planning tools. The importance of collaboration among organizations such as FNESS, First Nations, and other organizations was emphasized. There is a need for integrated wildfire management planning that incorporates all the land values into one easy-to-use database that can be utilized by multiple agencies to support planning efforts. Interactive databases should be shareable by nations, agencies, and governments, which will improve planning initiatives.

Mercer’s talk gave thought-provoking insight into managing fire in the deep woods of British Columbia and celebrates the power of place and landscapes.

Episodes of flames in the forest are a natural and recurring event and learning more about traditional Indigenous practices will benefit us all.



Rich McCrae worked 32 years in fire management and forestry with federal agencies in the United States. Outfitted with a degree in forestry, McCrae started his career as a seasonal employee with the forest service as a forestry technician and member of the Helena Interagency Hotshot Crew, then moved on to permanent positions with the Bureau of Indian Affairs as a forester and fire management officer at three different field locations and at the National Interagency Fire Center. The last 12 years McCrae has worked as a fire management consultant and a freelance writer and historian.

Mercer’s presentation included details about the Lytton Creek fire that devastated a community in the summer of 2021. Photo by Joaquin Ramirez.

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# BRAZIL DEVELOPS PREVENTION STRATEGY

GOVERNMENT COMMITS TO PRESCRIBED BURNS AND MORE FIREFIGHTERS

BY EUGENE GERDEN

The situation with wildland fires in Brazil remains complex despite recently announced tightening of firefighting measures.

In accordance with an order issued by Marina Silva, Brazil's minister of the environment and climate change, an environmental emergency was declared March 14 in several regions, including Rio de Janeiro and Sao Paulo, due to a high risk of wildland fires, and was expected to last until the end of the year.

The red alert for the risk of forest fires came days after the Brazil National Institute for Space Research reported record deforestation of Brazil in the month of February. According to data from the institute, there were 290.75 square kilometers of land and forest deforested in Brazil because of fires in 2022, compared to 198.67 square kilometers recorded as the highest previous figure in 2021.

According to a survey conducted by Monitor do Fogo, a part of MapBiomas platform that measures forest fires in Brazil in partnership with the local Amazon Environmental Research Institute (IPAM) – a scientific, non-governmental organization that oversees sustainable development of the Amazon – the area of forest and

wildland fires in Brazil grew by almost 80 per cent in 2022 compared with 2021.

Last year the total area under wildland fires in Brazil amounted to 2.7 million hectares and the 2023 figure may be even higher. Traditionally the most complex situation is observed in the Amazon rainforests, where in 2022 the area under fires grew by 111 per cent, with two million hectares of forests and wildland destroyed; this has a negative impact on the country's ecosystem.

“Even a single fire has huge impacts on the vegetation structure, as degraded forests store 25 per cent less carbon for at least 30 years”, explained IPAM science director and MapBiomas Fire co-ordinator Ane Alencar in an interview with Brazil Metropoles business paper,

Conservation specialist Osvaldo Barassi Gajardo with WWF-Brazil said that despite increased rainfall in the

first three months of 2023, “Brazil remains still the second country in South America behind Venezuela, with a significant increase in forest and wildland fires in recent months.”

According to the Brazil National Space Research Institute, this year the number of wildfires in Brazil nearly quadrupled

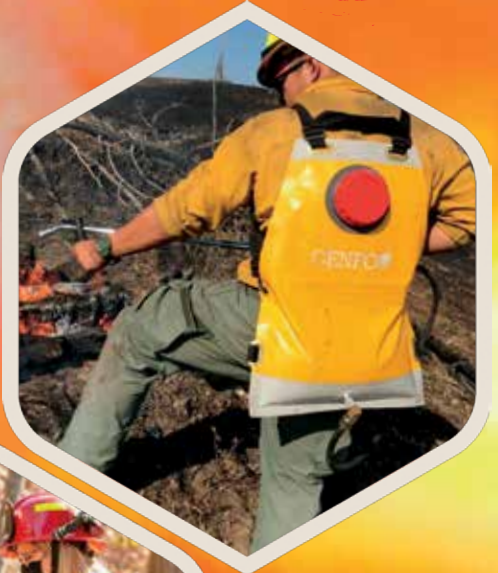


WWF experts brief members of Brazil's fire brigade. Photos by Pi Suruí / WWF-Brazil.



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between January and February to 3,602 from 937 outbreaks in 2022. The most complex situation was observed in Mato Grosso State, located in the Midwest region (Cerrado and Amazon Biomes).

“States in the Amazon region such as Pará and Rondônia are on the top list of fire increases,” said Gajardo. “It is important to highlight that the state of Pará is directly linked to deforestation. Due to the political context of 2022, forest fires in Brazil grew by 14 per cent compared to previous years. According to Mapbiomas Fire, Brazil has lost 163,000 km<sup>2</sup> of forests to fire. Most of the fires took place in the Amazon and Cerrado Biomes, which is equivalent to 95 per cent of destroyed area. In the case of Amazon there is a direct relationship with deforestation.”

According to Gajardo, the beginning of rainfall season resulted in stabilization of the wildland fire situation in some areas, such as Pantanal, (which was highly affected by forest fires during 2020 when almost 30 per cent of the biome surface was impacted by fire), however the current situation is still complex.

Most analysts were expecting 2023 to be a tough year for Brazil, as the risk of new wildland and forest fires remained high, mainly due to El Niño and a high risk of further droughts in regions such as the Amazon.

The Brazil government is taking measures to prevent (and better respond to) massive wildland fires, including various prevention actions and the more active hiring of training of brigades.

According to Gajardo, the hiring of wildland firefighters was seriously delayed by the previous government and “only became effective in June when the fires start to enter the most critical phase, with high peaks of fires between August and September.” Gajardo said it’s critical to more actively fight fires to prevent further deforestation.

“This fire risk measure comes after the National Institute for Space Research (INPE) pointed out a deforestation record for February since the beginning of the historical series, in 2016. There were 290.75 km<sup>2</sup>. Gajardo said the deforestation issue takes on importance, particularly in the Amazon, because there is a direct relationship between deforestation and forest fires; often deforestation is meant to increase area for livestock.

“We emphasize that a hectare of clean land is worth much more than a hectare of forested land, promoting this perverse system of deforestation and burning.”

Most analysts hope that recently re-elected President Lulu da Silva will take decisive action to prevent a repetition of last year’s wildfire situation Brazil, which was attributed to the poor prevention measures by the previous government.

During Jair Bolsonaro’s four years as president, the environmental and firefighting policies, were criticized due to low efficiency and insufficient funding. In addition, there was serious criticism of the previous government for dismantling of environmental protection



Portions of the Amazon rain forest that were burned by wildfire in 2022. Photos by Pi Suruí / WWF-Brasil.



# STOPPING THE DESTRUCTION BY WILDFIRES STARTS NOW.

The relentless tally of losses makes it clear the US is facing a significant wildfire problem. Without a new approach, we are destined for more unmanageable loss of life and property. The time is now to face two harsh realities:

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policies and weakening of environmental bodies, as well as attributing of wildland fires to people of mixed Indigenous Brazilian and European ancestry.

In general, according to analysts, the destruction of forests by wildland fires in the Amazon reached an alarming new level during Bolsonaro's reign.

The new government will start more active controlled and prescribed burning. Some regions of the Cerrado, a vast ecoregion of tropical savanna in eastern Brazil (the most biodiverse savannah in the world, which is known for Brazilian highlands) – and the Planalto have been using prescribed burning since December 2022 to reduce fuel accumulation.

According to some Brazil media reports, many states are planning a calendar of controlled burnings as well as tightened security measures given that some of Brazil's large fires in recent years – the Amazon in 2019, and the Pantanal, the largest flooded inland plain in the world, in 2020 – were mainly the result of intentional fire setting. The ministry last year presented a plan to combat wildland fires and forest fires in the country by hiring of more than 6,000 special security agents in major states and provinces, with particular focus on the Amazon, Cerrado, Atlantic Forest Caatinga regions and most importantly Pantanal. According to Greenpeace Brazil, this is of particular importance, given the status of Pantanal as a biodiversity hotspot with the highest concentration of wildlife on the continent. A significant population of jaguars lives there, and the biome also hosts one of the largest hyacinth macaw sanctuaries.

Brazil's justice ministry has said it will co-ordinate the work of these security agencies, while all the costs associated with their work will be covered by the federal government. These security agents will monitor and carry out effective actions in places where there are major fire outbreaks, in addition to investigating crimes.

It is important to recognize that up to 90 per cent of forest and wildland fires in Brazil have a criminal origin, and that many illegal fires are set for clearing pastures and building roads. Some of these fires are the result of expansion of agribusiness with the increase in planting of grain and other agricultural crops.

Particular focus will be paid to the state of Amazonas, which has the largest extension of continuous dense tropical forests on the planet with the South

of Amazonas area being considered as the more vulnerable for fires part of the region.

The Amazon rainforest is a humid environment, and natural fire happens very rarely in its territory, only every 500 years. Even in the dry season, when there are more favorable environmental conditions and fuel material, the high humidity would not allow for hot spots if there were no human action. In this regard, the beginning of more active patrolling forests by security services will contribute to the reduction of risks of intentional burning.

According to the business newspaper Brazil de Fato, in September 2022 a large fire hit the Brasília National Park, the largest park in an urbanized area in the world. According to the Chico Mendes Institute for Biodiversity Conservation the fire destroyed more than 3,500 hectares of forests and lands sparked serious concerns from environmentalists and the country's authorities.

Vera Arruda, a senior expert of the Amazon Environmental Research Institute, said in an interview that wildland fires in Brazil have different origins and have a negative impact on the entire ecosystem of the country.

"They have been used directly or indirectly associated with deforestation and land grabbing processes, seeking to consolidate the expansion of the agricultural frontier," she said. "Forest fires here in Brazil are not only an environmental problem, but also a social, cultural, political and economic one."

Regular drought periods also increase risk of forest fires in Brazil, most commonly in the Midwest, Northeast and Southeast regions.

According to a study conducted by the Brazil ministry of environment, three out of every four hectares destroyed by fires this year in Brazil corresponds to native vegetation, mainly natural grasslands, and one out of five to forests.

At the same time, according to state experts, about 90 per cent of forest fires in the country could be prevented by adequate actions of the state.

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# DRIVERS OF CALIFORNIA'S CHANGING WILDFIRES

## STATE HAS POTENTIAL TO BE A MODEL FOR CHANGE

BY TAMARA WALL, GLEN MACDONALD, CAROLYN ENQUIST, AND SARAH LEROY

In recent decades, the western United States and Canada experienced striking increases in the size and severity of wildfires, which resulted in a steep rise in fire suppression costs.

In an article recently published in the *International Journal of Wildland Fire*, 19 authors affiliated with the Southwestern Climate Adaptation Science Center synthesized available research and assessed the major drivers of changing wildfire dynamics in California.

- The authors specifically addressed four questions:
- How has wildfire and land cover changed since 1980?
- What is the role of climate change?
- What is the role of historical land management policy (pre-1980)?

What are the effects of recent land management approaches and variations in ignition sources on California fire regimes since 1980?

### How have wildfire dynamics and land cover changed since 1980?

While recognizing that wildland fire is a natural and ecologically beneficial process in many of California's ecosystems, we identified several key trends related to shifts in wildfire dynamics and land cover since 1980. The first is the growing prominence of large fires (figure 1). This is evident through a significant increase in annual area burned over the same period that the annual number of wildfires decreased (1980-2020). Second, since 1984, fire severity has increased in forests at low and middle elevation (and some high elevation forests), with negative impacts on landscapes and communities. Third, land-cover changes such as development and fire exclusion have influenced the abundance of fuels. For example, California fire

histories reconstructed from fire-scarred trees (e.g., mixed conifer) indicate that for centuries before 1850, these same areas tended to burn every five to 20 years, which controlled fuel loads and reduced fire severity. In fact, more than four million acres may have burned each year in these areas. Following decades of fire suppression and resulting accumulation of fuels, some of these forests experienced severe wildfires between 2015 and 2020, contributing to the state's significant increases in yearly acreage burned, especially at high severity.

Land-cover changes associated with the spread of human communities and development into higher fire-risk areas have increased the economic and human costs of wildfires, such as the loss of community, homes and businesses, lives and the stress of evacuations. For example, the estimated economic cost of the 2018 California wildfires was \$27.7 billion in capital losses, \$32.2 billion in health costs, and \$88.6 billion in indirect losses, such as the impacts to businesses that had to shut down or reduce operations. While human development and wildfire losses have spread into habitats throughout the state, most structures damaged by California wildfires are in vegetated settings outside of forests.

### How has climate change affected wildfires in California since 1980?

Human-caused increases in greenhouse gasses are the leading contributor to climate change and are contributing to warmer temperatures, drier air masses, longer and more severe droughts, longer fire seasons, and drier vegetation, all of which contributed to increases in the annual area burned in California. The current climate of California has likely become warmer and more arid than any in the past 1,000 years. With warming, the wet season in California has shortened

over the past six decades, contributing to a longer fire season. Warming has also accelerated snowmelt in the Sierra Nevada since the mid-twentieth century; wildfire itself may be contributing to this trend with fire-scarred areas showing reduced snowpacks. Increasing atmospheric vapor pressure deficit (VPD) has drawn recent attention as a particularly important drought metric that is directly linked to drier vegetation conditions that fuel severe fires. These climatic drivers of fire activity affect habitat throughout the state and are projected to grow stronger this century, leading to extremely hot and dry weather events with high fire risk more likely (Figure 1, page 38).

### **What is the role of historical land management (pre-1980) in California wildfires?**

Indigenous burning practices have a long history across California and there is growing support for Indigenous-led cultural burning practices. Modern prescribed fire strategies are used primarily to reduce wildfire risk and promote ecological benefits. In contrast, the broader cultural and stewardship goals of Indigenous cultural burning practices offer insights into how our societal approach might move to a land stewardship focus where fire is fully integrated into a larger set of goals and objectives.

It is challenging to generalize the effects of reduced Indigenous burning and more recent land management of the past 150 years because fire regimes and land use have always been highly variable in California. For example, interior chaparral, sagebrush, and pinyon-juniper ecosystems of the Great Basin likely burn today at higher frequencies than under pre-colonial conditions, yet the apparent driver is not more-frequent anthropogenic ignitions but rather the invasion of non-native annual grasses, such as cheatgrass (*Bromus tectorum*). Nineteenth and 20th century logging practices and aggressive fire suppression altered forest structures and composition, ultimately increasing vegetative fuels for fire in some regions. Higher elevation forests above 8800 feet have not experienced the same degree of fire suppression-driven ecosystem change as the lower elevation drier forests, simply because their natural fire frequencies are much lower—although the incidence of fire is increasing in high elevation forests in the Sierra Nevada. A lack of conclusiveness regarding past conditions in specific areas can lead to uncertainty among managers attempting to restore past, presumably more resilient conditions. For example, wet coastal forests in northern California support a

complex fire regime where Indigenous ignitions were locally frequent before settler-colonist settlement (although these areas also had ignitions by lightning).

### **What are the effects of land management and ignition sources on fire regimes since 1980?**

#### **1. Recent changes in fuel conditions related to management practices**

Forest fuel management is a stated priority for California, but is expensive. Costs to carry out fuel reduction projects that do not have economic outlets are very high, sometimes exceeding \$5000/acre (\$12,500/hectare). The closure of most of the sawmills across California and the collapse in the originally robust bioenergy market have created an economic barrier to mechanical forest thinning efforts. Managing a forest for timber resources while simultaneously maintaining a healthy fire regime can, however, also create conflicting priorities. For example, a 2022 study of yellow pine and mixed-conifer forests in California found that fire severity in privately managed industrial forests was 1.8 times greater than on similar public forest lands. The authors of that study concluded that current management approaches on the private timberlands may be driving these high-severity fires.

#### **2. Patterns of ignition related to human activity**

Human-caused ignitions sparked more than 90 per cent of recorded fires in most California counties between 1919 and 2016, driven by arson, debris burning, smoking, recreational activities, equipment operation, vehicles, and power infrastructure. Human-caused ignitions are particularly dominant in lowland ecosystems west of the Sierra Nevada and along the coast, while lightning sparked more fires in higher-elevation mountain ranges and deserts. Eight of the 20 largest wildfires recorded in California history are attributed or partially attributed to human activity. Human-ignited fires are also responsible for at least 12 of the 20 most destructive fires in terms of structures and lives lost.

Although the number of human-caused fires increased with population growth in the early to mid-twentieth century, their frequency has declined since 1980 (with the exception of wildfires sparked by powerlines). The decline in most human-caused ignitions in the past 40 years likely reflects a number of factors, including increasing efficiency of fire prevention, fire-resistant infrastructure, declining rates of smoking, anti-arson measures, and wide public wildfire messaging and education. Given these factors, this suggests that the

trend of increasing area burned in California over the last four decades cannot simply be explained by increasing numbers of human-caused ignitions. However, human-caused ignitions remain a major contributor to the current wildfire regimes in California and the western United States.

### 3. Recent practices in fire management and suppression strategies

The importance of fire, including a mixture of severity levels, in the maintenance and restoration of many California ecosystems is widely recognized. Within some wilderness areas, such as Yosemite and Sequoia & Kings Canyon National Parks, resource managers have minimized suppression of naturally ignited fires when critical resources are deemed at lower risk of harm from the wildfire event. This practice, although it can initially contribute to annual area burned totals, has proven effective in reducing fuels, increasing forest resilience, and minimizing the severity of subsequent wildfires. Yet, five decades after federal agencies formally recognized the importance of fire as an ecological process, both managed wildfire and prescribed fire remain underutilized as management tools in the western United States.

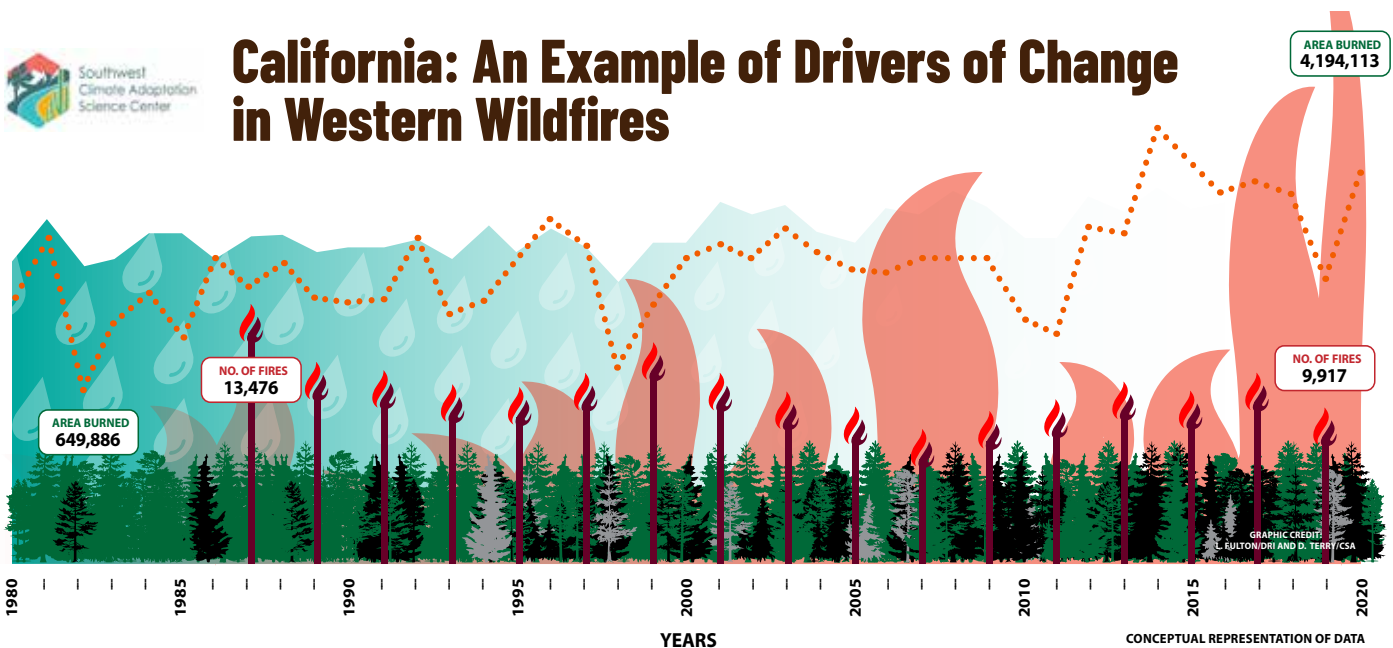
Fortunately, recent developments in California show reason for optimism, including the uptick in tribal and non-tribal private interest in traditional prescribed and Indigenous cultural burning, the development of new National Forest plans that promote managed wildfire, passage of the 2021 Bipartisan Infrastructure Law (which includes unprecedented investments for fuels management and firefighting resources), and the 2021 California Wildfire and Forest Resilience Action Plan. The plan sets rigorous targets for vegetation management, fire use, and integration of Indigenous burning practices while also proposing avenues for funding and implementation.

### The future of wildfire in California

California's 21st-century wildfire regimes reflect the confluence of intersecting factors including the overarching influence of climate change, past and present forest management and land-use, and the role of human- and lightning-caused ignitions. The challenges posed by climate change for fire management will continue to grow. Going forward, it will be important to recognize the diversity within California's ecosystem types, land-uses, and



## California: An Example of Drivers of Change in Western Wildfires



**CLIMATE**  
California and across the Southwestern U.S. are warmer and drier. Atmospheric concentration of greenhouse gasses is largely driving climate change; given current trends, this effect will strengthen.

**TEMPERATURE**  
Annual average temperature increase of about 2° F since 1980.

**VAPOR PRESSURE DEFICIT**  
The water content of the air has been steadily decreasing since 1980.

**LAND COVER**  
Colonization, fire suppression policies, and climate-driven tree mortality have led to highly flammable and thick forests in California and across the West.

**NUMBER OF FIRES**  
The annual number of fires shows a statistically significant downward trend between 1980-2020. While the annual number of fires has decreased, the annual area burned has increased to record-breaking size. The severity of fires has also increased in some regions.

**AREA BURNED**

**TREE DENSITY**  
High density land cover driven by colonization and fire suppression policies  
Climate- and insect-driven tree mortality  
Increased mortality due to high severity wildfire

population density in the selection, prioritization, and implementation of fuel and fire management strategies. People and infrastructure in many regions across California will remain vulnerable to high severity fire under all but the most robust local fuel reduction, defensible space, and fire-hardened building requirements. Yet, by leveraging the state's innovative human capital and appreciable financial resources, California has potential to serve as a wildfire resiliency model for diverse wildfire-prone regions across North America and around the globe.

**Acknowledgement**

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Glen MacDonald is a Distinguished Professor of geography at UCLA, holds the endowed chair of California and the American West, and is director of the UC White Mountain Research Center. He conducts research on long-term climate change, its drivers and impacts.



Carolyn Enquist has worked at the nexus of science, communication, and practice to enhance the effectiveness of biodiversity conservation and climate change adaptation for more than two decade. She has served as a lead author on the IPCC Working Group 2 6th Assessment Report's North America chapter and as an author on three U.S. National Climate Assessment reports. Enquist currently works for the U.S. Geological Survey and is the acting federal director for the Southwest Climate Adaptation Science Center.



Sarah LeRoy holds degrees in ecology and geosciences from the University of Arizona. Sarah now works as the science applications and communications coordinator for the Southwest Climate Adaptation Science Center (SW CASC), where she bridges the gap between science and society by working closely with decision makers to get them the scientific information they need to make decisions to prepare for the impacts of climate change.

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# THE DIGITAL FOREST

## IS SENSOR TECHNOLOGY THE WAY FORWARD?

BY BEN JONES

The Internet of Things (IoT) is a rapidly growing field with applications in a wide range of industries. Early adopters were drawn to its potential for making homes more convenient and efficient, but recent developments have shown that IoT can also be used to improve healthcare, transportation, and manufacturing.

The IoT can be thought of as a network of physical objects – or things – that are embedded with sensors, software, and network connectivity to collect and exchange data. The data collected from IoT devices can be used to improve efficiency, productivity, and decision making in a variety of industries.

Advancements in sensor technology, cloud computing, wireless connectivity, and artificial intelligence have led to a rapid growth in the use of IoT. IoT devices are now being used in a wide range of applications, including healthcare, manufacturing, and fleet management.

For example, in the healthcare industry, IoT is being used to monitor patients remotely, track medical equipment, and improve patient care. Wearable devices can be used to collect data on patients' vital signs, which can be sent to doctors for monitoring; this can help doctors identify potential problems early on and intervene before they become serious.

### THE DIGITAL FOREST

Another arena that's benefitting from proliferating IoT use-cases is the forest. Forest health monitoring assesses and ensures the well-being of forest environments by evaluating various indicators such as tree growth, tree mortality, and outbreaks of pests and diseases. Before the emergence of disruptive IoT technologies, this work would primarily have been conducted manually, often by human observation and fieldwork.

However, deploying IoT sensors in the forest provides forestry owners and other stakeholders with valuable real-time data such as temperature, humidity, soil moisture, and air quality. This information can then be used to identify potential problems, such as drought, pests, or diseases.

While in-depth, qualitative research and monitoring will always have an important role to play, the digitization of forest health monitoring yields many benefits. Human-led efforts are very labor-intensive, time-consuming and face significant issues when it comes to covering and monitoring large forests – especially remote ones. There will also be a lag in data availability due to the data needing to be manually collated and interpreted.

IoT technology has revolutionized forest health monitoring by enabling real-time data collection, automated monitoring, and remote data transmission. Sensors placed in the forest can now provide continuous and up-to-date information on crucial parameters, allowing for rapid actionable insights and therefore greatly enhancing the effectiveness and efficiency of forest health monitoring practices.

Companies such as Ireland-based Treemetrics uses advanced technologies such as drones, remote sensing and IoT sensors to collect data on tree inventory, growth rates, and timber quality. In the United States, SilviaTerra combines remote sensing, machine learning, and IoT technologies to offer forest inventory and management services. Berlin-based Dryad Networks specializes in forest monitoring solutions using IoT sensors; its solar-powered sensor network collects real-time data on environmental factors such as temperature, humidity, soil moisture, and air quality. This data helps in assessing forest health and detecting potential risks.



Deploying Internet of Things sensors in the forest provides forestry owners and other stakeholders with valuable real-time data such as temperature, humidity, soil moisture, and air quality. Photo courtesy Dryad Networks.





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## A PRESSING PROBLEM

One of the most pressing and devastating risks that forests face is wildfires. Wildfires are a major source of greenhouse gas emissions, with some estimates claiming that they account for up to one-fifth of all emissions. When forests burn, they release carbon dioxide, methane, and other pollutants into the atmosphere. These gasses contribute to climate change, which in turn makes wildfires more likely and more severe.

As well as providing forest health monitoring insights via its IoT mesh network in the forest, Dryad's initial focus is on wildfire detection. By monitoring environmental conditions within a forest, the system is able to – with the help of artificial intelligence – detect a smoldering fire. Because the environmental conditions change when a fire first starts, Dryad's network of sensors is able to provide wildfire alerts within minutes, giving firefighters a crucial head start.

## THE ELECTRONIC NOSE

Dryad's system can be thought of as an electronic nose that's finely attuned to the smell of the forest. When this smell deviates from what is expected, Dryad's IoT network of sensors and gateways can check whether a smoldering fire is within the vicinity. If this is the case, an alert is sent across the mesh network to the end-user's cloud platform, raising the alarm. Firefighters can then use this information to quickly locate the fire.

## SENSORS, CAMERAS, OR SATELLITES?

There are many benefits to leveraging IoT technologies when it comes to wildfires. While legacy approaches such as cameras and satellites will have a role to play, sensor-based solutions offer advantages when it comes to early detection.

Firstly, IoT sensors provide continuous and real-time monitoring of environmental conditions; this allows for immediate detection of changes in temperature, humidity, and smoke, enabling rapid response and early wildfire detection.

Secondly, deployment of sensors within the forest itself ensures rapid detection; this means wildfires can be detected at their early stages, even in remote or inaccessible locations, reducing response time and preventing fires from spreading.

Sensor-based approaches are often more cost-effective than relying solely on cameras or satellites. Cameras require infrastructure setup, maintenance, and have a limited field of view, while satellites can be expensive and have limitations in terms of coverage and frequency of imagery. In contrast, IoT sensors are relatively affordable, easy to deploy, and can cover a larger area.

Finally, sensor-based approaches allow for integration with advanced data analytics and other IoT tools. By combining sensor data with machine learning algorithms, the digital forest allows for advanced analysis, pattern recognition, and early warning system optimization, further enhancing the accuracy and effectiveness of wildfire detection.

The potential benefits of IoT are vast, and the technology is evolving. The future of wildland fire detection is being shaped by IoT and sensor technology, hopefully leading to a safer and more sustainable coexistence between humans and nature.

Ben Jones has held a series of marketing, PR and project management roles in biotech, agri-tech and the circular economy. During his time in the university sector in the UK before moving to Dryad Networks, he created and managed an accelerator programme for biotech and agri-tech startups. In his current role, Jones leads Dryad's marketing and public relations efforts.



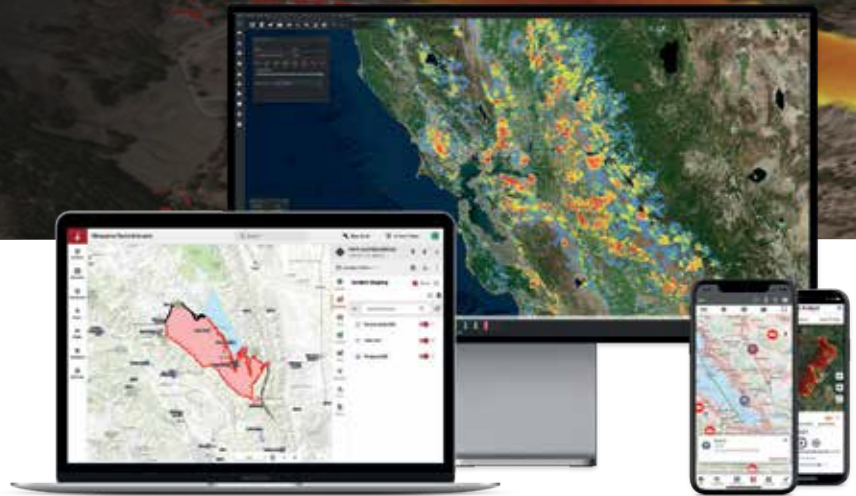
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# DOES CULTURE REALLY EAT STRATEGY FOR BREAKFAST?

BY MICHAEL DEGROSKY

Business writers frequently and, as it turns out, wrongly attribute the quote “Culture eats strategy for breakfast” to Peter Drucker, the acknowledged founder of modern management.

According to the Drucker Institute, Drucker never really said that, and the adage seems more likely derived from a blend of ideas of several big thinkers, including Drucker and Edgar Schein, who passed away this year.

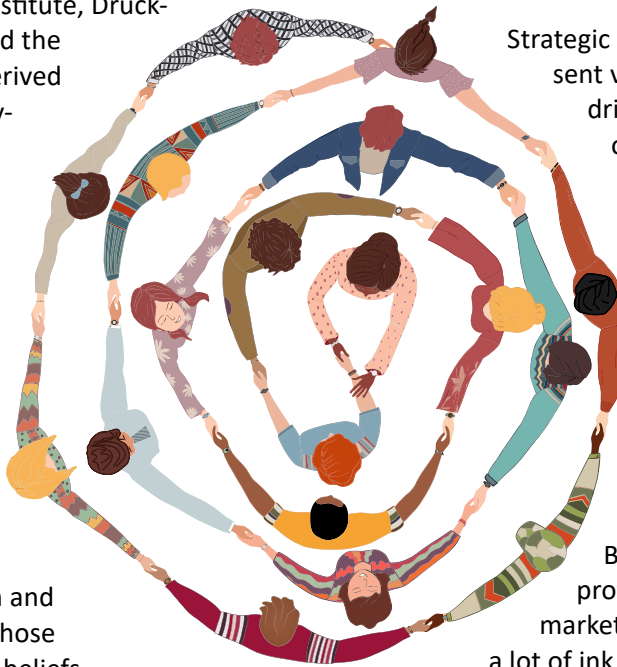
Culture is the word we have chosen to describe the shared values, goals, attitudes, and beliefs that characterize a workplace and how the behavior of people in that workplace – including communication, interaction and decision making – reflects those values, goals, attitudes and beliefs.

Organizational culture can be so deeply engrained that it is not uncommon for experts to describe an organization’s culture as its DNA. Leaders can

inform, create and, when necessary, destroy and recreate culture through the values, rituals, and rules they put into practice. However, it must be said that an organization’s culture exists whether leaders actively work on it or not.

Strategic thinking and planning represent vital organizational processes driving focus and guiding the organization toward desired goals. I believe in the power of a good strategy. I think that in my last job my most important contributions were getting our fire program on a solid strategic footing and hiring the awesome people who are executing that strategy today.

Business writers, college professors, and consultants marketing their wares have spilled a lot of ink around the idea of culture eating strategy. Oddly enough, quite a few get it wrong, creating the impression that it is culture versus strategy – that culture and strategy are some-



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how separate, competing forces, and that perhaps a good culture replaces the need for a good strategy.

Thinking about this popular maxim in any of these ways is to misunderstand the underlying thinking. While Drucker never said culture eats strategy for breakfast, he did say “Culture, no matter how defined, is singularly persistent.” Schein said culture “contains strategy.” Both were describing the inescapable nature and the durability of organizational culture.

I have heard culture described as the habitat in which a company’s strategy lives or dies. While the organization’s strategy critically provides direction, it is culture that creates the environment in which people are either enabled to effectively execute the strategy or not. It is in this way that culture eats strategy for breakfast. Culture determines how individuals work and function within an organization, permitting the organization’s success at carrying out its mission and achieving its strategic vision. No matter how well-crafted, a strategy will prove very hard to effectively implement if the organization’s strategy and culture are not well aligned or if people feel unempowered or unsupported and resist the very change the strategy is intended to bring about.

Let us look at the IAWF as an example. It was so rewarding to see the association as an institutional partner for the 8th International Wildland Fire Conference in Portugal in May. We have, of course always been an international association, and it has long been the stated mission to engage with the entire wildland fire community to provide global linkage for people with shared interest in wildland fire. IAWF aspires to be an acknowledged resource for local- to global-scale scientific and technical knowledge, education, networking, and professional development that is depended upon by members and partners in the international wildland fire community. I see formal partnership with the 8th International Wildland Fire Conference as well as the upcoming 7th International Fire Behavior and Fuels Conference, which will be simultaneously

## ORGANIZATIONAL CULTURE CAN BE SO DEEPLY ENGRAINED THAT IT IS NOT UNCOMMON FOR EXPERTS TO DESCRIBE AN ORGANIZATION’S CULTURE AS ITS DNA.

conducted from the United States, Australia, and Ireland, as big steps in carrying out that mission and achieving the association’s strategic vision.

But one might ask, what about aligning the IAWF strategy with its culture? The current IAWF board comprises eight women and six men from Australia, Canada, China, Ireland, Spain, and the United States. Board members represent industry, government, academia, and an NGO. I participate on the IAWF membership committee, and a frequent topic of discussion is making the association more relevant and accessible to fire personnel in developing nations. I am a former IAWF president and a 30-year member, and this is the most international I have ever seen the International Association of Wildland Fire. With that diversity comes diversity of perspective, and with diversity of perspective comes culture change. It is exciting to watch the association hit its international stride. Combine that with the IAWF’s diversity and inclusivity initiative, and you see an organization actively aligning its culture with its strategy.



Michael DeGrosky is a student of leadership, lifelong learner, mentor, and coach, sometimes writer, and recovering fire chief. He taught for the Department of Leadership Studies at Fort Hays State University for 10 years. Follow Mike via LinkedIn.

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