

WILDFIRE

QUARTER 1, 2022
UNITING THE GLOBAL WILDLAND FIRE COMMUNITY

An official publication of the INTERNATIONAL ASSOCIATION of WILDLAND FIRE

SUPPRESSION VERSUS PREVENTION

The disastrous forest fire
season of 2021 in Greece





Can Fire Retardants Get Better? With Us They Can.

New PHOS-CHEK® LCE20-Fx offers superior performance with a lower environmental footprint

Working with global fire safety agencies and alongside frontline firefighters we're always looking to make our aerial fire retardants better. More effective. Safer. Easier deployment. Higher visibility. Hassle-free mixing and storage.

In the critical area of environmental performance, our PHOS-CHEK LCE20-Fx fire retardant represents a next generation technology – featuring lower aquatic toxicity, low impact on vegetation and high efficiency in use. Beyond taking care of our natural environment, that makes PHOS-CHEK LCE20-Fx safer to use, easier to handle and reduces disposal costs.

Let us know how we can help you with better products and services. We're listening.

Why PHOS-CHEK LCE20-Fx?

- USDA Forest Service certified
- 100% premium-grade phosphate product
- Superior aerial visibility
- Low environmental footprint
- Improved aquatic toxicity
- Improved product stability
- Easier handling
- Reduced maintenance costs
- Enhanced product safety



**Trusted.
Solutions
That Save.**

**PHOS-CHEK® SOLBERG®
AUXQUIMIA® FIRE-TROL®**

perimeter-solutions.com

ASIA PACIFIC
Tel: +61 2 9673 5300

UNITED STATES
Tel: +1 909 983 0772

EMEA
Tel: +34 985 24 29 45

NEWS AND OPINION

FIRELINE.....5

THE CASE FOR PRESCRIBED BURNING

BY LAURA KING

PRESIDENT'S DESK6

A CALL FOR PRESCRIBED BURNING

BY JOAQUIN RAMIREZ CISNERO

IAWF NEWS9

CONFERENCES, EVENTS AND UPDATES

POINT OF VIEW.....44

PRESCRIBED FIRE

Imagining a balanced future

BY LENYA QUINN-DAVIDSON

THOUGHTS ON LEADERSHIP48

INSTILLING JOY THROUGH LEADERSHIP

BY MICHAEL DEGROSKY

IJWF TOP READS.....50

FEATURES

WORLD GRAPPLES WITH WILDFIRE CRISIS..... 10

UN REPORT CALLS FOR INVESTMENT IN PREVENTION AND PREPAREDNESS

BY DAVID BRUCE

FIRED-UPq14

FIRE MANAGEMENT

Supporting Prescribed Burn Associations

BY DYLAN BRUCE

FIRE & CLIMATE 16

AN INTERNATIONAL APPROACH TO WILDFIRE

SUPPRESSION VERSUS PREVENTION 18

THE DISASTROUS FOREST FIRE SEASON OF 2021 IN GREECE

BY GAVRIIL XANTHOPOULOS, MILTADIS ANTHANASIOU AND KONSTANTINOS KAOUKIS

PRE-FIRE TREATMENT26

PLAN SAVES PROPERTY FROM WILDFIRE

BY GENE ROGERS

SHIFTING RESPONSIBILITY 30

A COMMUNITY-BASED APPROACH TO WILDFIRE OUTBREAK PREVENTION

BY ROSA DIEMONT AND TIEME WANDERS

BASQUE-ING IN FIRE KNOWLEDGE36

PAU COSTA FOUNDATION INTRODUCES PRESCRIBED

FIRE AND TACTICAL BURNS TO ALAVA FIREFIGHTERS

BY KATHLEEN UYTTEWAAL

GROUSE, GRASS AND GARGANTUAN FIRE.....40

MEGAFIRE MAY BE A NEW THREAT TO IMPERILED LESSER-RAIRIE CHICKEN

BY NICHOLAS PARKER AND DANIEL SULLINS

COVER: The 2021 forest fire season in Greece was exceptional and led to discussion about new ways to manage wildfire (see story page 18). The convection column of the fire in Evia Island, in the evening of the Aug. 7, 2021, captured from the town of Istiaia. PHOTO BY KONSTANTINOS KAOUKIS

EDITOR'S NOTE: The photo on the cover of the Q4-2021 issue, Climate crisis, of Spencer Brooks, a member of the Kamloops Bighorn Unit in British Columbia, was taken by Kathleen Cahoon.

EDITORIAL

Laura King *managing editor*

laura@iaawonline.org

BUSINESS

Mikel Robinson *administration*

execdir@iaawonline.org

Kim Skufca *advertising associate*

Kim@iaawonline.org

Shauna Murphy *graphic design*

Century Publishing

Post Falls, Idaho

COMMUNICATIONS COMMITTEE (IAWF)

David Bruce

Mariona Borrás

Amy Christianson

Celia Conde

Lucian Deaton

Jennifer Fawcett

Xinyan Huang

Laura King

Adam Leavesley – *chair*

Richard McCrea

Mikel Robinson

Kim Skufca

Johnny Stowe

Ron Steffens

Michele Steinberg

Gavriil Xanthopoulos

ASSOCIATE EDITORS

David Bruce (*AU*)

G. Matt Davies (*Scotland*)

Laurie Kurth (*U.S.*)

Richard McCrea (*U.S.*)

Michael Scott Hill (*U.S.*)

Albert Simeoni (*U.S.*)

Johnny Stowe (*U.S.*)

Cathelijne Stoof (*Netherlands*)

BOARD OF DIRECTORS

Joaquin Ramirez (*U.S.*), *president*

Steven R. Miller (*U.S.*), *vice-president*

Michele Steinberg (*U.S.*), *secretary*

Sara McAllister (*U.S.*), *treasurer*

Mikel Robinson (*U.S.*), *executive director*

Amy Cardinal Christianson (*Canada*)

Tom Harbour, (*U.S.*)

Sarah Harris (*Australia*)

Trevor Howard (*Australia*)

Xinyan Huang (*Hong Kong*)

Adam Leavesley (*Australia*)

Kelly Martin (*U.S.*)

Mike Norton (*Canada*)

Nuria Prat-Guirtart (*Spain*)

Amber Soja (*U.S.*)

Naomi Eva Stephens (*Australia*)

Johnny Stowe (*U.S.*)

Garviil Xanthopoulos (*Greece*)



[ARE YOU READY FOR WILDLAND SEASON?]

GEAR UP

WITH TRUE NORTH

And stay focused on the fire line



SHIRTS

PACKS

PANTS

TheFireStore | EVERYTHING BUT THE TRUCK



THE CASE FOR PRESCRIBED BURNING

There has been a theme in the last few issues of *Wildfire* magazine.

In stories about Spain (Q4-2021), Argentina and Australia (Q1-2022) and now Greece (page 18), the authors use words such as aggressive, megafires, and sixth-generation to describe what are now familiar situations – record wildfire seasons – and the need for policy change.

Whether the proposed solutions are prescribed and/or cultural burning, prevention, education, or all three, the pleas by high-level wildfire scientists sound similar no matter the location.

As IAWF board member Gavriil Xanthopoulos and colleagues Miltiadis Anthanasiou and Konstantinos Kaoukis write in this issue, government spending to hire more firefighters may help in an immediate crisis but preventing the crisis in the first place is a better option.

Greece should, the authors say, adopt a “Formal introduction of the use of fire in fire suppression – a time-honored technique, necessary in indirect attack, which has been forgotten in Greece in the last few decades.”

As Xanthopoulos was writing the story in March about the remarkable 2021 fire season, the Greek government introduced a law recognizing that fire can be used as a firefighting tool when considered necessary by the fire service; details have yet to be worked out, which makes the initiative too late for the 2022 fire season, but it’s a step forward.

The authors, and others, also recommend creation of a legal framework for prescribed burning for fuel reduction and other forest land management objectives, and recognition that all forest fires are not bad.

As Xanthopoulos notes, “Even under the extreme conditions of 2021, within some portions of the burned areas, fire severity was relatively low either due to the presence of less flammable species or because of the resilient agroforestry landscape.”

Which brings us to the lesser prairie-chicken, “a dull, brownish, football sized grouse found in the southern Great Plains of North America,” according to writers Nicholas Parker and Daniel Sullins (page 40).

Although these fabulous creatures are resilient, their habitat is shrinking.

“The increase in megafires throughout the lesser prairie-chicken range poses yet another potential threat to the already declining species,” Parker and Sullins say.

“Although prairie-chickens are adept at avoiding small fires, many may be killed in the path of fast moving and intense megafires.”

The solution?

“When prescribed fire is used in conjunction with grazing in a patch burn grazing system, it is especially beneficial for lesser prairie-chickens,” the authors say.

Unfortunately, the authors note, prescribed fire is not a

common practice in the grassland region occupied by the lesser prairie-chicken, rather suppression is the dominant practice.

That said, local grazing groups and prescribed burn associations (PBAs) have made some progress and are providing information to landowners who are becoming interested in using prescribed fire.

IAWF communications committee member Jennifer Fawcett knows a thing or two about PBAs. Fawcett, the subject of our Fired-up feature on page 14, is completing a doctorate in education, exploring educational needs of Prescribed Burn Association members.

“PBAs have successfully increased prescribed fire use by landowners and land managers, mainly by making it easier and safer to use,” Fawcett says. “In 2020 alone, one PBA in North Carolina safely conducted 48 burns on 4,600 acres and has a membership of more than 300 people.”

Leyna Quinn-Davidson also writes about PBAs, on page 44.

In 2017, Quinn-Davidson and some colleagues brought the PBA model to California; now there are more than 18 grassroots prescribed fire groups “training community members, implementing burns, and inspiring their neighbors and agency partners.”

Imagine, Quinn-Davidson writes, “Homes are hardened and communities are fluent in fire, and backyards, parks, and nearby forests are a patchwork of blacks and greens, depending on when they were last burned. More people are trained in prescribed fire than not, and states have fully assumed liability for their essential work.”

It sounds radical, and, it turns out, it is.

“Radical imagination,” Quinn-Davidson explains, “is the ability to imagine the world, life, and social institutions not as they are, but as they might otherwise be.”

Quinn-Davidson and her colleagues are optimists.

“We can envision a future in which local and traditional knowledge are guiding this work,” she writes.

“We can envision landowners and land managers having a deep comfort with fire and using it regularly. We can envision holding on to our remaining forests, woodlands, and prairies, threading the needle between too much and not enough fire. We can envision people from all backgrounds being trained and certified as burn bosses and effectively leading this work, with real incentives and protections from the state. We can imagine what future generations might thank us for, and we are trying our best to do it.”

That’s good news for California, and, if the model succeeds, for the rest of North America, for the lesser-prairie chicken, and, perhaps, for Greece.



A CALL FOR PRESCRIBED BURNING

As we gather in May in Pasadena and June in Melbourne for our association's first Fire & Climate conference, I am happy to say that it is with a strong purpose because the challenge we face across landscape management, community risk and the safety of our wildland firefighters is clear. Our wildfire community sees first-hand that climate change is resulting in drying and warming trends across the world.

In January 2022, IAWF released a formal position statement on climate change and wildfire that sets forth our association's vision and calls to action to our wildland fire community. We must act now to create the wider public collaboration required for this change. As the position paper acknowledges, "In many cases, fire seasons will lengthen, become more extreme and extend into landscapes previously unaffected by wildland fires. This will increase the risk to the health and safety of firefighters, the community, the environment, industries and the economy."

Fire & Climate 2022 sets our focus in motion. I am excited as the session agendas demonstrate the

breadth of our community's efforts to address where the climate scenarios are taking the pyroscapes worldwide.

I am also thankful to IAWF's past president, Alen Slijepcevic, who guided the development of the climate change position paper and the accepted vision it sets forth for IAWF's future efforts. I feel that one of the strongest pronouncements made by the position paper is that prescribed burning must be implemented at all levels as a management tool in this new environment.

As IAWF's position paper recognizes, "Prescribed burning and wildland fire used under prescriptive conditions can reduce the severity of future potential fire behavior, increase the potential success of containment efforts and maintain and improve the health and resiliency of ecosystems." It also recognizes that such cross-jurisdictional activities require a shared responsibility and increased collaboration for success.

The position paper also acknowledges some sobering realities. First, that the complexity under which incident management teams operate is increasing and includes a more complex wildland urban interface.

IAWF VISION

To safely and effectively extinguish wildfires, when needed; use prescribed and wildland fire where possible to meet protection and land and resource management objectives; manage our natural resources through progressive fuel reduction to increase landscape resilience in the face of climate change; and educate and prepare our communities to accept our co-existence with smoke and wildland fire.

This reflects greater public scrutiny, the impacts of smoke on public health, and the specter of urban conflagration. Second, that our wildland firefighters face increased health and safety risks, including stress, fatigue and mental health strain due to extreme fires and less time for recovery between severe seasons.

To address these points, IAWF encourages a seven-point call to action to drive awareness and collaboration because this future is not one that we can tackle alone. These actions are supported by our belief that we must develop public understanding of the overarching long-term benefits of fire on the landscape, formulate and implement safe, effective, efficient risk-based wildland fire management decisions, and prioritize landscapes that are at the greatest risk for treatments and mitigation measures to withstand future change in fire regimes.

The broader global influences on wildfire mean that an all-inclusive approach to the future of wildland fire management is needed; this includes a new model for workforce development and an ecosystem approach to create greater effectiveness and efficiency in prescribed burning treatments over larger landscapes.

Our call to action is also based in support for active fire research programs that are shared with international and interagency collaboration to diversity information and identifying more nimble ways that our wildfire community can adapt to the rapidly changing conditions we all face.

As we meet in May in Pasadena and June in Melbourne and in your own work before and after the conference, consider how you can advance IAWF's call to action on climate change and wildland fires.

On a final note, our brothers and sisters in Ukraine – a generous country that just last year sent support to Greece and Turkey during a terrible fire season – are suffering from a devastating war that has to stop. Just when we started to recover from the COVID-19 pandemic, the worst part of humankind reminds us again that our values of democracy cannot be taken for granted. Please consider supporting Ukraine in the many initiatives occurring, from organizations providing support in the field to the examples of colleagues from Portugal, France, Spain, Poland, and the United States sending needed equipment.

CALLS TO ACTION

Identify ecosystems most at risk to large, high-severity wildfire

Identify and enhance fire-adapted communities

Foster safe and effective interagency wildfire response

Increase prescribed burning

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

Reimagine and invest in the wildland fire management workforce and systems

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

Create opportunities for continuous improvement and adaptive management.



ABOUT THE AUTHOR

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) 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.

**WHEN THE
WORLD
DEMANDS
MORE,**

***AIR TRACTOR
DELIVERS.***

An Air Tractor aircraft is shown in flight, dropping a large volume of water onto a forest fire. The fire is intense, with bright orange flames and thick black smoke rising into the sky. The aircraft is white with green accents and is positioned in the center-right of the frame. The background is a dark, smoky sky.

**AIR TRACTOR DELIVERS THE
PERFORMANCE, EFFICIENCY, AND
PRECISION THIS JOB DEMANDS.**

IT'S TIME YOU DEMAND MORE.

CONFERENCES ON THE CALENDAR!



Registration for Wildland Fire Canada Conference opens May 16.

Wildland Fire Canada brings together wildland fire management agencies, partners, and collaborators in Canada and around the world. This biennial conferences focus on wildland fire management, ecology, and science in Canada. Canada has a diversity of fire-prone environments that bring a unique perspective to wildland fire challenges and opportunities. **Visit <https://wildlandfirecanada.com>.**



The IX International Conference On Forest Fire Research & 17th International Wildland Fire Safety Summit runs Nov. 11-18 in Coimbra, Portugal.

The conference aims to provide an update on the developments in forest fire science and technology and an opportunity to promote international co-operation. The conference will cover the main topics related to fire management from a research perspective. There will be six major themes: the wildland urban interface; fire risk management; decision support systems and tools; fire management; fuel management; and socio-economic issues. Two courses, the VI Short Course on Fire Safety and the IX Short Course on Forest Fire Behaviour will be held before the conference, as related but separate events. **Visit www.adai.pt.**



The 5th National Cohesive Wildland Fire Management Strategy Workshop is set for Nov. 14-18 in Asheville, NC, and will focus on

"Keeping pace with reality – accepting the hard truths and boldly undertaking the hard work." **Visit <http://cohesivestrategyworkshop.org>.**



CANADIAN NAMED IJWF OUTSTANDING EDITOR

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.

On this note, the International Journal of Wildland Fire is pleased to announce that Dr. Marc-Andre' Parisien is the winner of the Outstanding Editor Award for 2021.

IJWF recognizes Parisien for his many years of dedication and exceptional level of service to the journal as an associate editor.

Parisien is a research scientist at the Canadian Forest Service, Northern Forestry Centre, in Edmonton, Alberta, where he has worked with the fire research group since 2000.

Parisien was trained as a forest ecologist and holds a B.Sc. from McGill University, an M.Sc. from l'Universite' du Quebec a' Rimouski, and a PhD from the University of California, Berkeley. His research on wildland fire is focused on understanding biophysical controls on fire regimes, mostly within the boreal biome of North America.

He specialises in quantitative analysis methods, including process-based simulation modelling, a tool he uses for mapping wildfire likelihood.

Parisien has been an associate editor of the IJWF since 2010. IJWF is pleased to add the 2021 IJWF Outstanding Editor Award to Parisien's impressive list of achievements, and thank him for his exceptional service.

WORLD GRAPPLES WITH WILDFIRE CRISIS

UN REPORT CALLS FOR INVESTMENT IN PREVENTION AND PREPAREDNESS

BY DAVID BRUCE

Climate change and land-use change are projected to make wildfires more frequent and intense, with a global increase of extreme fires of up to 14 per cent by 2030, 30 per cent by the end of 2050 and 50 per cent by the end of the century, according to a report by the UN Environment Programme (UNEP) and GRID-Arendal.

The paper, which was released Feb. 23, calls for a radical change in government spending on wildfires, from reaction and response to prevention and preparedness.

The report, *Spreading like Wildfire: The Rising Threat of Extraordinary Landscape Fires*, finds an elevated risk even for the Arctic and other regions previously unaffected by wildfires.

The publication calls on governments to adopt a new fire ready formula, with two-thirds of spending devoted to planning, prevention, preparedness, and recovery, and one-third for response. Currently, direct responses to wildfires typically receive more than half of related expenditures, while planning receives less than one per cent.

To prevent fires, the authors call for a combination of data and science-based monitoring systems with Indigenous knowledge and for a stronger regional and international cooperation.

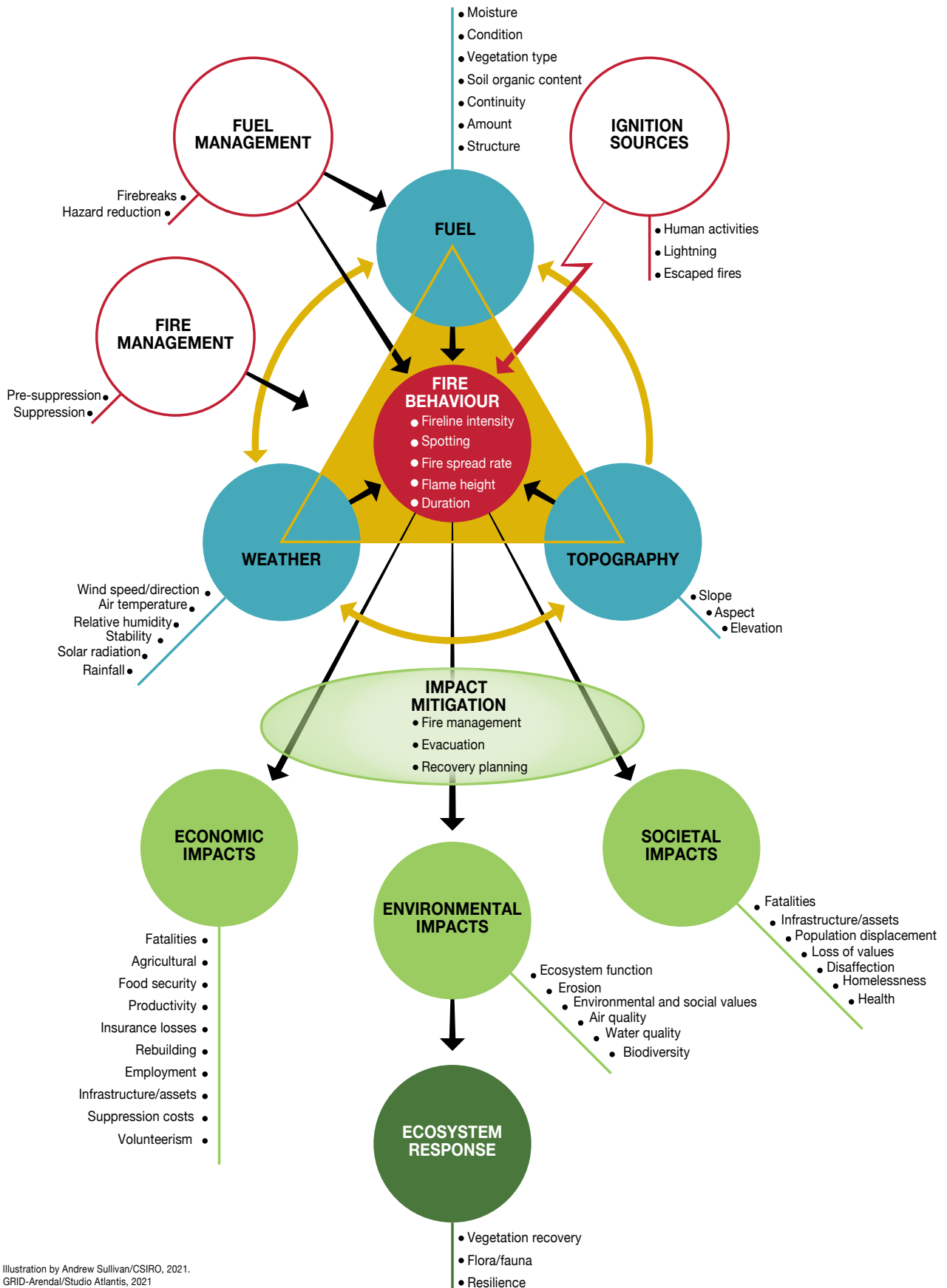


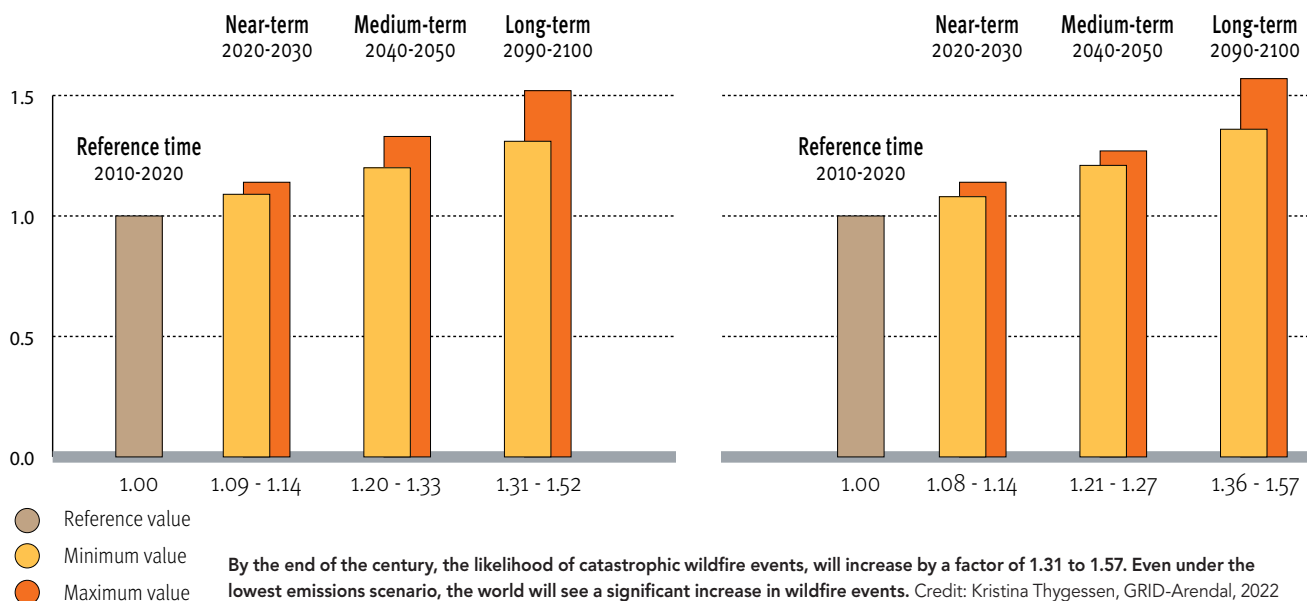
"Current government responses to wildfires are often putting money in the wrong place. Those emergency service workers and firefighters on the frontlines who are risking their lives to fight forest wildfires need to be supported," said Inger Andersen, UNEP executive director. "We have to minimize the risk of extreme wildfires by being better prepared: invest more in fire risk reduction, work with local communities, and strengthen global commitment to fight climate change."

Wildfires disproportionately affect the world's poorest nations. With an impact that extends for days, weeks and even years after the flames subside, wildfires impede progress towards the UN sustainable development goals and deepen social inequalities:

People's health is directly affected by inhaling wildfire smoke, causing respiratory and cardiovascular impacts and increased health effects

Factors influencing wildfire outcomes and management actions





for the most vulnerable;

The economic costs of rebuilding after areas are struck by wildfires can be beyond the means of low-income countries;

Watersheds are degraded by wildfires' pollutants; they also can lead to soil erosion causing more problems for waterways;

Wastes left behind are often highly contaminated and require appropriate disposal.

Wildfires and climate change are mutually exacerbating. Wildfires are made worse by climate change through increased drought, high air temperatures, low relative humidity, lightning, and strong winds resulting in hotter, drier, and longer fire seasons. At the same time, climate change is made worse by wildfires, mostly by ravaging sensitive and carbon-rich ecosystems such as peatlands and rainforests. This turns landscapes into tinderboxes, making it harder to halt rising temperatures.

Wildlife and its natural habitats are rarely spared from wildfires, pushing some animal and plant species closer to extinction. A recent example is the Australian 2020 bushfires, which are estimated to have wiped out billions of domesticated and wild animals.

There is a critical need to better understand the behaviour of wildfires. Achieving and sustaining adaptive land and fire management requires a combination of policies, a legal framework and incentives that encourage appropriate land and fire use.

The restoration of ecosystems is an important avenue to

mitigate the risk of wildfires before they occur and to build back better in their aftermath. Wetlands restoration and the reintroduction of species such as beavers, peatlands restoration, building at a distance from vegetation and preserving open space buffers are some examples of the essential investments into prevention, preparedness and recovery.

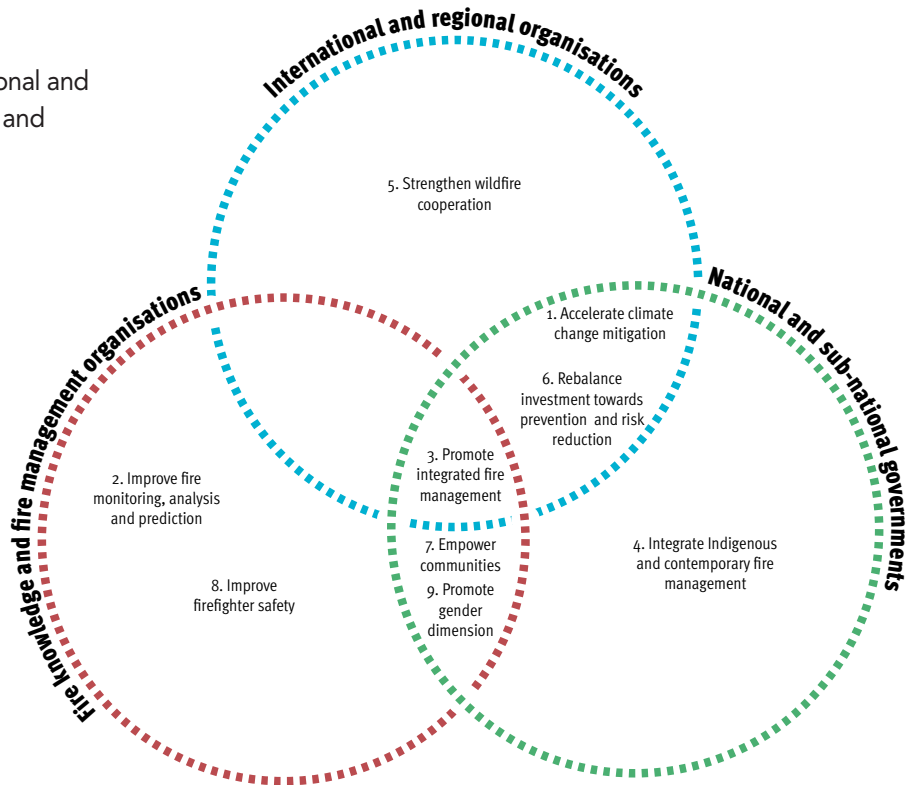
The report concludes with a call for stronger international standards for the safety and health of firefighters and for minimising the risks that they face before, during and after operations. This includes raising awareness of the risks of smoke inhalation, minimising the potential for life-threatening entrapments, and providing firefighters with access to adequate hydration, nutrition, rest, and recovery between shifts.

"We need to better understand the nature of the threat in each locality and develop more effective wildfire risk reduction strategies and policies," says Andrew Sullivan, co-editor of the report and research team leader of the Commonwealth Scientific and Industrial Research Organization.

"We also need to accept that, regardless of what we do, there will always be a residual risk that we have to learn to live with."

The report was commissioned in support of UNREDD and the UN Decade on Ecosystem Restoration. UNEP will explore how further investments can be made to reduce fire risks in critical ecosystems around the world.

Recommendations for international and regional organizations, national and sub-national governments, and fire-management organizations are applicable to all wildfire management contexts across the globe.



READ THE REPORT AT
unep.org/resources/report/spreading-wildfire-rising-threat-extraordinary-landscape-fires



Dauntless Air is an aerial firefighting company that exists to protect people, land and property. We fly to win the war against wildfires.



To learn more, visit our website at dauntlessair.com and download our vision paper, Transforming Aerial Firefighting for a Changing Environment, or reach out to us at [320-297-9088](tel:320-297-9088) to find out how you can strengthen your rapid initial attack capabilities.

FIRE MANAGEMENT

SUPPORTING PRESCRIBED BURN ASSOCIATIONS

BY DYLAN BRUCE

As an essential part of the modern fire-management toolkit, prescribed burning needs community involvement and co-ordination to achieve its best results.

One initiative working to organize community efforts and resources for prescribed burning is Prescribed Burn Associations (PBAs), which are Jennifer Fawcett's field of expertise.

Fawcett is an extension associate at North Carolina State University and works closely with PBAs.

PBAs are community organizations led by private landowners to share knowledge, equipment, and resources with each other; they are then able to co-ordinate and co-operate to carry out prescribed burns on each other's land.

"PBAs are rapidly increasing across the U.S., especially in the south-east and in states such as California," says Fawcett.

"PBAs have successfully increased prescribed fire use by landowners and land managers, mainly by making it easier and safer to use.

In 2020 alone, Fawcett says, one PBA in North Carolina safely conducted 48 burns on 4,600 acres and has a membership of more than 300 people.

"Much of my research in 2022 will be focused on identifying educational needs and opportunities for members of PBAs."

Fawcett lives in Raleigh, which faces the unique challenge of having the highest Wildland Urban Interface (WUI) number in the United States. WUI measures areas where the landscape transitions between wilderness and human-developed land.

North Carolina's high WUI number presents a challenge to fire managers, as any prescribed burn may impact homes, roads, farms, and other developments.

Fawcett discovered her interest in fire management while completing her master's degree in forest resources at Clemson University in South Carolina.

"When I started my master's degree I had never been on a wildfire or seen a prescribed burn" says Fawcett.

After being invited to join some prescribed burns early in this degree, Fawcett developed an interest in the area.

"All of the planning and thought that went into each burn, combined with the effects of the fire on the landscape was

fascinating to me."

Fawcett is also the co-ordinator of the Southeast Regional Partnership for Planning and Sustainability (SERPPAS) Prescribed Fire Work Group, a six-state partnership of state and federal agencies that promotes collaboration in making resource-use decisions.

Supporting national defence, conservation of natural resources, and sustainable working lands and communities, SERPPAS functions to build relationships among a range of partners.

Fawcett's responsibility is to co-ordinate the prescribed fire working group and ensure members meet the prescribed fire-related needs of the region.

"I also get to conduct education and outreach programs with private landowners and others on topics related to prescribed fire," says Fawcett.

She began her career as an ecologist with a degree in animal science, conducting wildlife surveys in southwest Florida.

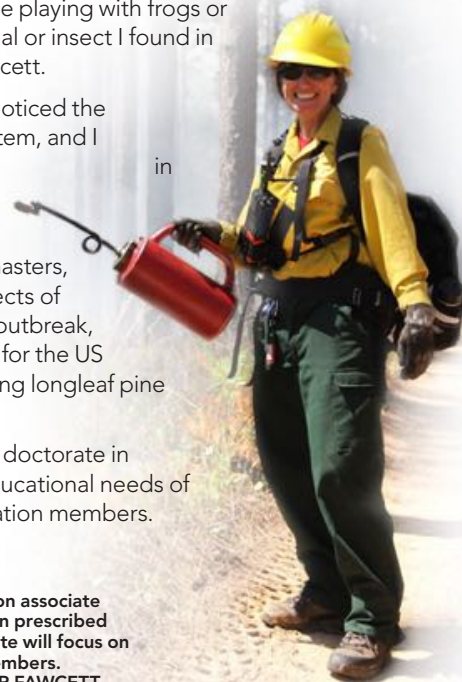
"Growing up, I always had an interest in the outdoors. My mom would catch me playing with frogs or turtles or whatever animal or insect I found in our backyard," says Fawcett.

"In this ecologist role I noticed the role of fire in the ecosystem, and I became very interested in learning more about disturbance ecology."

While completing her masters, Fawcett studied the effects of a Southern Pine Beetle outbreak, and then worked briefly for the US Forest Service researching longleaf pine ecosystems.

Fawcett is completing a doctorate in education, exploring educational needs of Prescribed Burn Association members.

North Carolina State extension associate Jennifer Fawcett specializes in prescribed burn associations; her doctorate will focus on educational needs of PBA members.
PHOTO COURTESY JENNIFER FAWCETT.



YOUR WILDLAND AND FIRE EQUIPMENT EXPERTS

VISIT OR CALL FOR INFO: NATIONALFIREFIGHTER.COM 800-423-8347



NATIONAL
FIRE FIGHTER CORP.



CALL TODAY TO REQUEST YOUR FREE CATALOG!

WILDLAND GEAR & PPE

Fire & Climate

An international approach to wildfire



PASADENA
CALIFORNIA
MAY 23-27, 2022



MELBOURNE
AUSTRALIA
JUNE 7-9, 2022

Fire & Climate 2022 will concentrate attention on the most significant forces shaping wildland fire today and better prepare us to focus and respond to the formidable challenges of tomorrow. One conference, in two locations, will feature insights, case studies, innovations and opinions from around the world to begin to form a collective, global approach to the wildfire challenge.

fireandclimateconference.com

PASADENA

KEYNOTES



Climate change impacts on wildfire and solutions for management and policy

Patrick Gonzalez, PhD, assistant director for climate and biodiversity, White House Office of Science and Technology Policy

The rise of wildfire disasters in the 21st century: What have we learned?

Crystal A. Kolden, PhD, assistant professor of fire science management of complex systems, College of Engineering, University of California, Merced

A NASA perspective: Global to local connections between fire, weather and climate

Amber J. Soja PhD, research fellow, IAWF board of directors, National Institute of Aerospace (NIA), NASA Langley Research Centre

Indigenous carbon

Brenden Mercer, First Nations Emergency Services Forest Management liaison

Our Firey Future – Situational Awareness for systemic change

Dr. Natasha Stavros, director Earth Lab Analytics Hub, CIRES, University of Colorado Boulder

Kate Dargan, founder, Intterra; former assistant director for natural disasters, OSTP

Trends in fire research and publications; the last 50 years

Susan Conrad, PhD, co-editor in chief, IJWF, affiliate faculty position at George Mason University, USFS ret.

Emerging leaders

Lindon Pronto, senior expert, European Forest Institute, Germany

Kylie Paul, crew leader, divisional/group supervisor and firefighter, South Africa

Martha Sample, research associate, Centre for Adaptable Western Landscapes, Northern Arizona University

PANELS – PASADENA

Climate policy

Moderator: Toddi Steelman, PhD, Stanback Dean of the Nicholas School of the Environment at Duke University

Kelly Martin, cofounder/president, Grassroots Wildland Firefighters; chief, Fire and Aviation (ret.) Yosemite National Park

Bryan Petit, senior professional staff member, U.S. Senate committee on energy and natural resources

Carol Baldwin, PhD, PI and project co-ordinator, Great Plains Fire Science Exchange and Extension professional, Kansas State University

Partnerships in fire management: Supporting Indigenous Leadership in Cultural Burning

TBA

Communications / media

Moderator: **Marjie Brown**

Amanda Monthei, freelance writer, creator of the Life with Fire podcast

Nathan Rott, NPR

Elizabeth Weil, writer, New York Magazine

Trip Jennings, freelance writer

MELBOURNE

KEYNOTES

Joe Buffone, director general, Emergency Management Australia

Amy Christianson, PhD, fire research scientist, Canadian Forest Service

Dr. Sidney Dekker, director, Safety Science Innovation Lab, Griffith University

Michael-Shawn Fletcher, associate professor, University of Melbourne

Dr. Sophie Lewis, ACT commissioner for sustainability and the environment

Greg Mullins, climate councillor, former commissioner of fire & rescue, NSW

Stephen Oliver, manager, documentaries, Australian Broadcasting Commission

Dr. Amber Soja, research fellow, National Institute of Aerospace

Vicki Woodburn, group executive, Australian Climate Service/Bureau of Meteorology

PANELS – MELBOURNE

Working together

Oliver Costello, Firesticks Alliance

Amy Christianson, Canadian Forest Service

Michael-Shawn Fletcher, University of Melbourne

Communicating the complexity of fire and climate science

Stephen Oliver, ABC

Allie Gallant, Monash University

Anthony Clark, NSW RFS

Fiona Dunston, BoM

Fire leaders

Rob Webb, AFAC

Naomi Stephens, NPNSW

Murray Carter, DFES

Christ Hardman, FFMV

Ruth Ryan, HVP

Fiona Gill, DEW

Rob Robers, NSW RFS

To register for Fire & Climate 2022 Melbourne, visit

fireandclimateconference.com/melbourne

SUPPRESSION —VERSUS— PREVENTION

BY GAVRIIL XANTHOPOULOS, MILTIADIS ATHANASIOU, AND KONSTANTINOS KAOUKIS

THE DISASTROUS FOREST FIRE
SEASON OF 2021 IN GREECE



The forest fire season of 2021 in Greece was exceptional; the volume of hectares burned, and the fire-caused damages, led to heated debate in parliament and the media about the country's fire-management organization. The season was characterized by an early start of significant fires that continued throughout the summer, with increasing firefighting problems as time progressed, resulting in serious devastation. In the aftermath, besieged by intense criticism from media, opposition parties, and residents of fire-affected communities, the government promised changes and the elimination of such disasters. In the subsequent months, there was a lot of talk and even some action toward change; unfortunately, yet again, the focus is on more firefighting capacity rather than holistic forest fire management.

TIMELINE

The official forest fire season in Greece extends from May 1 to Oct. 30. A fire on the island of Andros in the Aegean Sea on April 4, 2001, burned about 500 hectares of low shrubs and agricultural cultivations under strong winds and was stopped the next morning with the help of rain.

This fire made the news because it was early in the year, and because the General Secretariat of Civil Protection and the fire service demonstrated the policy they were to follow for the rest of the year – evacuating many villages in the vicinity of the fire.

The purpose of the policy was to avoid fatalities at any expense. The emphasis on evacuation was the result of heated political clashes in the aftermath of the East Attica fire of July 23, 2018, in the settlements of Neos Voutzas and Mati, which had caused 102 fatalities.

Following that disaster, the opposition had accused the government of failing to evacuate people in an orderly and timely manner. In 2019, the main opposition became the new government, and avoidance of firefighter and civilian fatalities became a central objective.

Contracted aerial resources, especially in the fire season of 2021, were strengthened impressively, to try to reduce the chance of devastating fires, while ordering evacuations during early stages of a potentially serious fire became the norm.

On May 19, 2001, at a time of the year when grasses are still largely green, a fire started under very strong wind near the Schinos settlement in Corinthia, 60 kilometres west of Athens. The vegetation was mainly pine forest. First responders focused on evacuation of people and the protection of homes. The fire spread through the night and, given the delayed response on the ground and limited aerial support next morning, became large, burning both forest and agricultural cultivations.

Fire of Aug. 4, 2021 in Messinia. The obvious impact of an agroforestry landscape to mitigate fire spread and leave unburned patches.
PHOTO BY Gavriil Xanthopoulos

FIRE DANGER PREDICTION MAP VALID FOR TUESDAY AUGUST 3, 2021

Date of issue: Aug. 2, 2021 Time: 12:30
Foivos Theodorou, Forester, General Director
Chair of the issuing team



Ministry of Citizen Protection
General Secretariat for Citizen Protection
Directorate General of Coordination

FIRE DANGER CLASSES

- LOW (LIGHT GREEN)
- MEDIUM (LIGHT BLUE)
- HIGH (YELLOW)
- VERY HIGH (ORANGE)
- ALARM STATUS (RED)
- BOUNDARIES OF FOREST SERVICES OFFICES

Figure 1: The fire danger prediction map for Greece for Aug. 3, 2021, with most of the country rated in the Very High danger class.

Source: General Secretariat for Civil Protection; translation Gavriil Xanthopoulos.

The emphasis, once more, was on citizen evacuation, using among other tools, alert/evacuation messages to mobile phones transmitted through the 112 Civil Protection emergency number.

After four days, the burned area reached 6,964 hectares. There was considerable debate in the media about the reasons, with some local authorities calling for more aerial resources to be available year-round.

Currently, only a small portion of national aerial firefighting resources are available outside of the fire season; the bulk of the contracted resources arrive in June and operate until the end of September. The use of 112 for early warning over a broad area, the emphasis on early evacuation of villages (even when they were not threatened by the fire), aiming to eliminate the risk of fatalities, and a defensive stance by firefighters for the same reason, became apparent as policy cornerstones for the rest of the fire season.

As the fire season advanced, the pattern described above was repeated over and over. However, as the larger-than-ever aerial fleet of national and contracted resources built up by the middle of June, massive initial attacks from the air managed to offset any weaknesses on the ground. The contracted aerial resources included 10 contracted S-64 AirCrane helicopters. By the end of July, however, as the fire danger grew with a heatwave that brought increasing temperature and dropping relative humidity, the first signs that the situation could not be kept under control became evident. Two significant fires in Achaia that resulted in serious damages, and a large fire on Rhodes Island, presented serious challenges to the firefighting system.

The heatwave, with temperatures exceeding 40 C in most of the country and reaching 47 C in some locations, started July 28 and had an unprecedented duration of 10 days, according to the National Observatory of Athens. This was reflected in the fire danger prediction map for the country



The fire in Northern Evia only stopped at the Aegean Sea.
PHOTO BY GAVRIIL XANTHOPOULOS

that is issued daily by the General Secretariat for Civil Projection (Figure 1).

On Aug. 3, around 13:20, a fire started 18 kilometres north of the center of Athens, near a settlement called Varympompi, which is one of the wildland-urban interface (WUI) areas that exist around the city. At the time, temperature had reached 42 C and relative humidity had dropped close to 10 per cent while the wind blew at about 8 km/h an hour with gusts exceeding 15 km/h. The fire grew, mainly through radiation and profuse short-distance spotting as the wind was not strong.

The ground resources focused on saving property, leaving fire control to the aerial resources. However, at such low relative humidity, the fire kept restarting after the aerial drops. Since aerial fire fighting was not followed by effective work on the ground by hand crews and dozers, and the suppression efforts consisted of sporadic and sparse attempts, there was no gradual (stepwise) containment of the wildfires, and the overall fire fighting was ineffective. Varympompi and all other neighboring settlements were evacuated with a concerted effort by police. About 80 buildings, mainly homes but also some businesses, were destroyed.

With a fleet of helicopters and fixed-wing aircraft waterbombers fighting the fire, it was put under control

by the middle of next day, with estimates of burned area ranging between 1,300 and 3,000 hectares. However, this fire fight came at a heavy cost. Another fire that had started near the town of Limni, located by the east coast of the forest-rich north part of Evia Island, 95 kilometres north of Athens, did not receive the necessary attention and aerial support. This was confirmed by various sources including the elected head of the prefecture of Evia and the two local mayors. Exhibiting very high fire intensity and after threatening Limni, the fire started growing inland. Simultaneously, four other aggressive fires had started in Peloponnese, the most threatening being the one in the prefecture of Ilia, which expanded in the direction of the archaeological site of Ancient Olympia. At that point, on Aug. 4, there were serious doubts about the capacity of the Greek firefighting mechanism to handle the situation, and the government requested the support of the European Union Civil Protection Mechanism (UCPM). Over the next three to four days, other non-EU countries mobilized and sent resources and firefighters as well.

On Aug. 5, in the middle of the day, the situation became much worse, when the Varympompi fire, which had been controlled and was passively guarded, restarted. This fire soon crossed the eight-lanes wide Athens-to-Thessaloniki National Road at three different points. In the next two



Figure 2: An image acquired by one of the Copernicus Sentinel-2 satellites on Aug.8, 2021, shows the wildfire of northern Evia with a towering convection column (Source: <https://www.copernicus.eu/en/media/image-day-gallery/evia-wildfire-greece>)

days the fire burned through more settlements, destroyed the Tatoí estate where the summer palace of the ex-king is located, and was finally stopped after reaching the core of the Parnis National Park to the west and the shores of Marathon Lake to the east. The final burned area was 8,377 hectares. Two volunteers died fighting the fire and a third succumbed to his burns six months later.

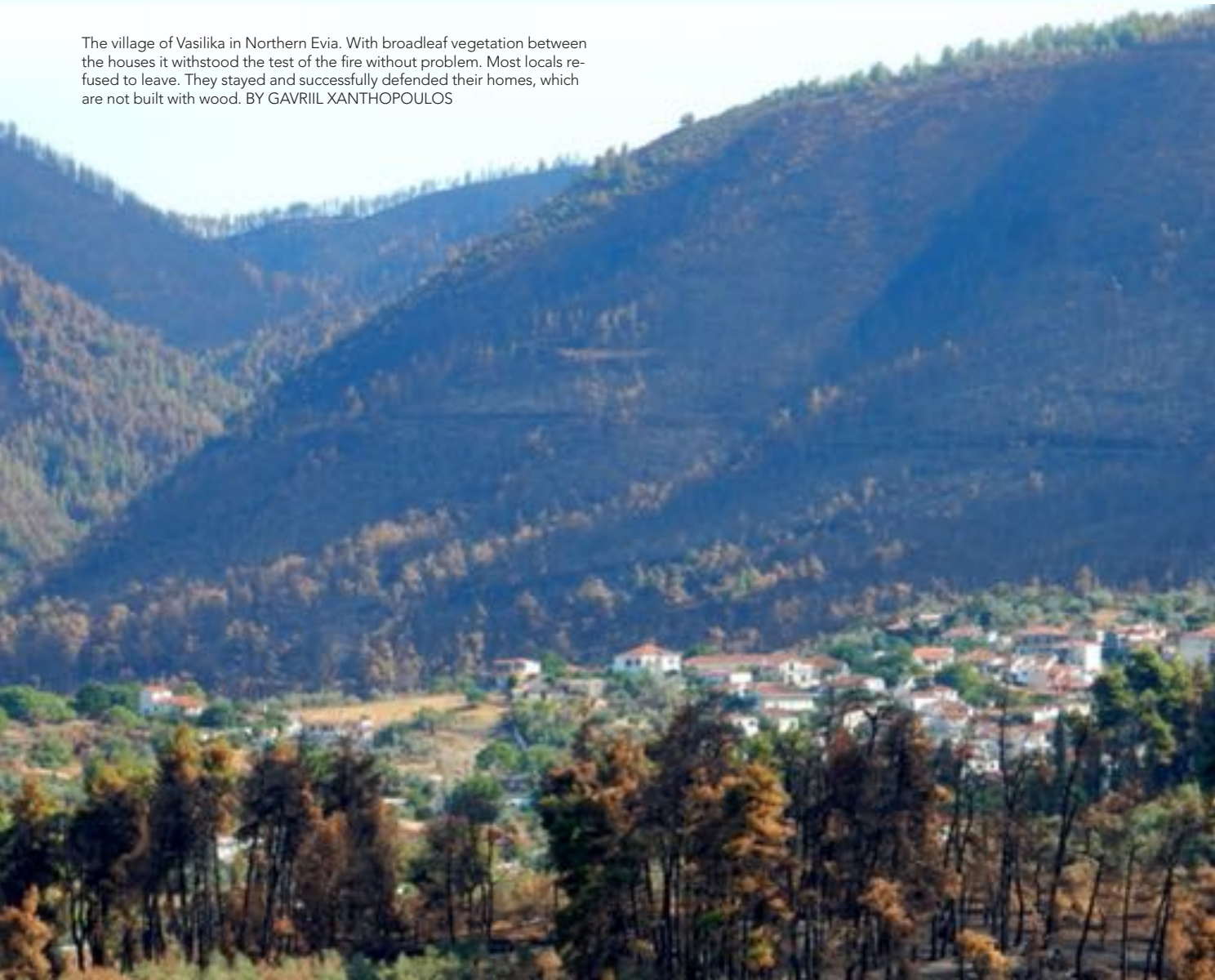
In the next days, without fierce winds but with intense fire behavior due to heat and dryness, the other fires kept growing. In northern Evia, the fire, spreading in many cases against the wind, developed towering convection columns (Figure 2) finally stopping at the sea. At 50,000 hectares, the Evia fire became the largest fire in modern Greek history, in a year during which the country had the strongest firefighting capacity. According to fire service statements, the co-ordination center had to manage up to 102 aerial resources. Simultaneously, the fires in Peloponnese also became very large: the fire in Ilia-Gortynia reached 15,000 hectares; the fire in Messinia 5,100 hectares; and the fire in

Lakonia (Mani) 10,100 hectares, devastating both forest and agricultural lands.

By Aug. 11 the situation started being brought under control. However, as discussions about what went wrong were hot in the media and the political arena, two more destructive fires in Attica, on Aug. 16, burned about 9,800 hectares.

The final burned area in 2021 exceeded 130,000 hectares, in addition to extensive damages to houses and infrastructure, despite unprecedented international help that came to aid Greece with fire fighting in August, comprising both aerial resources and ground firefighters. Aid included help from Austria, Croatia, Cyprus, Czech Republic, France, Germany, Poland, Romania, Slovakia, Spain, and Sweden, which was provided in the frame of the European Union Civil Protection Mechanism (UCPM), as well as bilaterally provided (or offered) help from Egypt, Israel, Kuwait, Moldova, Qatar, Serbia, Switzerland, Ukraine, United Arab Emirates, and the United Kingdom.

The village of Vasilika in Northern Evia. With broadleaf vegetation between the houses it withstood the test of the fire without problem. Most locals refused to leave. They stayed and successfully defended their homes, which are not built with wood. BY GAVRIIL XANTHOPOULOS



DISCUSSION

The memory of the 2018 disaster in Eastern Attica, with 102 fatalities, played a major role regarding the selected, quite naïve, fire-management approach. As those deaths had become a central issue in the political arena, the government wanted to avoid fire fatalities at any cost. This was stressed on multiple occasions. Thus, rather than maximizing initial attack efforts from both air and ground, the selected approach was to mainly use aerial resources for this task, with firefighters mostly working on the protection of homes, often remaining on roads and avoiding entering the forest until the flames were subdued by the aerial water drops.

This policy was supported by a steep increase in the contracted aerial resources: added to the national resources, the total reached 71 planes and helicopters, before the arrival of international aid. Simultaneously, and in addition to the messages for evacuation from the 112 emergency number (76 messages, of which 66 were for evacuation), strong police forces were deployed to actively push people to evacuate.

Whereas in some cases fire behavior, topography, accessibility and building characteristics justified the order for evacuation, in most cases such criteria were not considered. Thus, pushing indiscriminately for evacuation, the firefighters had to try to defend the abandoned homes rather than trying to control the fire perimeter.

In a difficult fire season, such as 2021, this approach failed, as the aerial resources were not able to achieve fire control without serious support on the ground.

The excessive use of 112 for warning and evacuation messages – especially in cases when it is not really needed, or with directions that are rather vague (which was the case on some occasions) – may result in loss of importance and effectiveness; Aesop's fable about the boy who cried wolf should always be kept in mind.

As for what could be done differently, it is necessary to point out the need to strengthen fire prevention, regarding education and preparation of the population and proper management of the landscape. With a barely functional Forest Service due to aging personnel, reduced funding and poor morale, forest management is quite poor and fuel accumulation high, and this needs to be corrected; this had been pointed out two years earlier, in a report by an independent commission, chaired by Prof. Johann Goldammer, who was appointed by the government after the 2018 fire disaster in Eastern Attica, and was tasked "to Analyze the Underlying Causes and Explore the Perspectives for the Future Management of Landscape Fires."



Figure 3: Low and medium intensity surface fire consumed the understory (mostly grass and sparse *Phlomis fruticosa* shrubs) of an oak (*Quercus frainetto*) forest in Arcadia, Peloponnese, without scorching or killing the mature trees. Photos captured at 19:36:09 and 19:58:31 (EEST time) in the evening of Aug. 8, 2021, while the wildfire was still active. PHOTOS BY MILTIADIS ATHANASIOU



The over-reliance on aerial resources and the unorthodox approach to ground fire fighting must change. This has been pointed out numerous times, not only in the report of the independent commission, but also by many researchers and writers, mainly from the domain of forestry but also and even the former minister of Agricultural Development and Food.

Effective initial attack and efficient management of large fires should become absolute priorities. Limiting the cost of aerial resources and improving their contribution through better co-ordination with ground forces will not only improve effectiveness but also efficiency. Thus, there could be more funding available for prevention.

High quality pre-suppression planning, especially in wildland-urban interface areas, is necessary to improve efficiency and safety; it should include identification of locations where populations may be at high risk in case of fire, and specification of criteria and priorities for evacuation. The local authorities and the population should be informed and prepared accordingly, in advance of the fire season.

Furthermore, some other important changes should be introduced, following fire management examples elsewhere, namely:

Formal introduction of the use of fire in fire suppression – a time-honored technique, necessary in indirect attack, which has been forgotten in Greece in the last few decades. As of

March 2022, the government introduced a law recognizing that fire can be used as a firefighting tool when considered necessary by the fire service, leaving drafting of the technical aspects of how to use it as a next step.

Creation of a legal framework for the use of prescribed burning for fuel reduction and for other forest land management objectives.

Recognition that all forest fires are not bad, thus ceasing to use burned area reduction as the only criterion for fire management success. Even under the extreme conditions of 2021, within some portions of the burned areas, fire severity was relatively low either due to the presence of less flammable species (Figure 3) or because of the resilient agroforestry landscape.

A host of other issues and changes can be identified and discussed. Actually, the government has already tried to introduce improvements, mainly in the direction of fire suppression, such as hiring 500 young firefighters to create heli-crews and contracting even more aerial resources; it has also indicated its willingness to support fire prevention. However, in many cases, a lot has to do with how changes are conceived, designed, and applied. Serious input from modern forest fire science is needed. Without well-planned changes, if Greece continues only to pile up resources, the problems will become evident again in the first difficult fire season. With current weather trends under climate change, it is more than likely that this will happen quite soon.

ABOUT THE AUTHOR



Gavriil Xanthopoulos is an associate researcher specializing in forest fires at the Institute of Mediterranean Forest Ecosystems of the Hellenic Agricultural Organization "Demeter". He holds a B.Sc. in forestry from

the Aristotelian University of Thessaloniki, Greece and M.Sc. and PhD degrees in forestry with specialization in forest fires from the University of Montana. He has been active in European forest fire research for more than 25 years, with a parallel involvement in many aspects of operational fire management, post-graduate teaching and forest fire management training. He is a member of the board of directors of the IAWF and as an associate editor for the International Journal of Wildland Fire. His research interests include forest fire policy, fire prevention, fire danger rating, fire behavior, fuel management, firefighting, post-fire rehabilitation, forest fires and climate change, and new technologies in fire management.



The large fires burning on August 6, 2021 in Greece. (Image source: NASA WorldView, annotation: Gavriil Xanthopoulos).

WATERAX

WE MOVE
WATER

GET EVERYTHING WATERAX AT YOUR LOCAL DEALER



For specialized expertise and fast delivery on in-stock pumps, parts and water-handling accessories, visit the authorized WATERAX dealer near you.

waterax.com

STEWARDSHIP PLAN
SAVES PROPERTY
FROM BOOTLEG FIRE

PRE-FIRE

BY GENE ROGERS

The past two decades of wildland fires have intensified the political and scientific debate about wildfire spread and wildland fuels treatments. Do pre-fire treatments result in changes to the spread and intensity of wildfires? To really answer this question the details of fire behavior – weather, fuels and topography – must be evaluated on a case-by-case basis. The best fuels treatments can be negated by the worst fire-behavior conditions. One fact is clear: under similar conditions, a treated area will survive even moderate fire behavior when a similar area untreated may not.

The South 40, affectionately named by its owners, is a 40-acre parcel of private forest land adjacent to Fremont-Winema National Forest land in southcentral Oregon; the parcel is in a dry Ponderosa pine forest historically prone to fire. The forest property and log cabin survived the Bootleg Fire of 2021. Previous

fuels treatments enabled fire suppression personnel to be successful in the point protection of the cabin and adjacent forest stands. This fire burned out of control for nearly two months and for a time was the largest wildfire in the United States in 2021.

The owners purchased the property in 1997. The assorted stumps on the property indicate three or four separate individual tree selection harvests, with the oldest stumps well-rotted. Slash piles are scattered throughout the property from the previous harvests. I confirmed harvest dates back to 1918 in the vicinity.

In 2011, after contact with a local stewardship forester from the Oregon Department of Forestry, the owners became interested in developing a stewardship plan for their property. The stewardship forester explained the process and suggested some local



The road into a 40-acre parcel of private forest land adjacent to Fremont-Winema National Forest land in southcentral Oregon is affectionately named The South 40, and is shown prior to fuels treatments. ALL PHOTOS BY GENE ROGERS

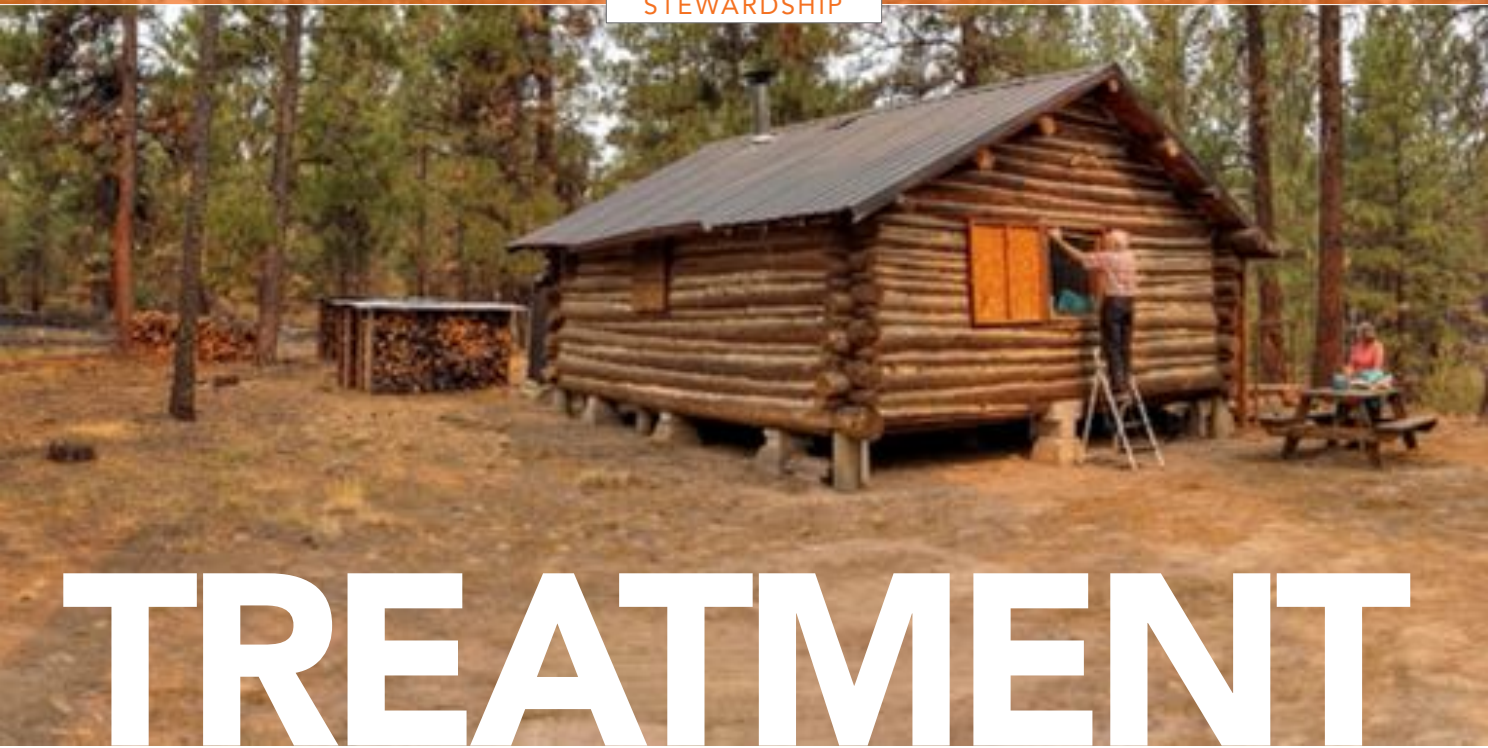


Photo of the cabin about three weeks after the fire; fire intensity was low in the vicinity of the cabin as a result of previous fuels treatments.

TREATMENT

forestry consultants; the owners contacted me and arranged a site visit to discuss objectives and possible mitigation treatments.

The owners explained their plans to make the property and log cabin a legacy for their children and grandchildren; they were interested in forest health, wildlife habitat, excluding free range cattle from the riparian zone on the property, and significantly reducing the potential for high intensity wildfire. I was contracted to develop the plan.

The completed stewardship plan listed:

GOALS

1. Improve forest health.
2. Restore the riparian area.
3. Enhance wildlife habitat.
4. Reduce wildland fire hazard.
5. Pass this legacy forested property to heirs in better ecological condition than when it was acquired.

OBJECTIVES

1. Identify overstocked stands. Implement thinning with fuels treatments to increase vigor for resistance to insects, disease and wildfire.
2. Seek assistance with riparian restoration to repair streambed damaged by cattle and prevent future impacts. Identify and protect any artesian flows.

3. Improve wildlife habitat by culturing existing, or planting additional trees/shrubs, to increase the carrying capacity and diversity of the property.

In February 2012 the stewardship plan was completed, signed, and approved by the Oregon Department of Forestry. By July 2012 the owners had secured grant and cost-share money for fencing the riparian area and thinning of prioritized areas identified in the plan. In September 2013, the 32 acres of forest on the South 40 had been thinned by a crew from the Klamath Tribes, arranged by the Lomakatsi Restoration Project. Much of the downed wood was donated as firewood and some to small milling operations. Additionally, 30 per cent of the brush from the creek to powerline fence was removed, the remaining brush height was reduced 30 per cent and 30 per cent of the small, fresh brush growth was left. The slash was hand piled. In September 2014 a crew from the Lomakatsi Restoration Project burned more than 100 piles of slash remaining from the thinning operation in 2013.

By 2019, plans were being made for a co-operative prescribed fire project. Local US Fire Service personnel were including the owners in the planning process. The goal was to conduct a prescribed underburn through the forest stands previously thinned on federal and private land; this would be the final step in the fuels-treatment plan. Weather conditions were not favorable in 2020 and the COVID-19 pandemic further complicated options. The spring of 2021



A view of the forest stands east of the cabin following the passage of the Bootleg fire, July 2021.

was dry, precluding prescribed fire. In April 2021, the Ponina Fire covered 1,641 acres near the South 40, coming within one-half mile of the property. The spread rate and intensity of this pre-season wildfire foretold the coming summer. On July 6, the Bootleg fire was detected and quickly became the largest current wildfire in the United States. It covered 413,717 acres before containment in late August.

The Bootleg fire crossed the South 40 in the first few days of spread. On July 24, I met the landowners on the property. The owners were anxious to see the fire effects, having previously verified the cabin had been protected. Fire personnel had obviously assisted in the protection of the cabin as evidenced by a hand line constructed around the cabin area.

The thinned stands for the most part appeared to have had light to moderate mortality. Certain areas would have experienced significant mortality in the pre-treatment condition of overstocked trees and high loadings of dead and down wood from beetle kill.

Below the cabin is the riparian area and more thinned pine stands. Some individual trees and small groups of trees did torch out, but the majority of the trees

appeared to have had enough canopy to survive.

We agreed that the objectives of the planned prescribed fire had been met by the wildfire firing operations. We are optimistic that additional stocking level control will only increase the vigor and health of the surviving trees. Watching the response of the vegetation in the next few years will be telling. All agreed that the South 40 surviving the Bootleg fire was the result of the stewardship plan developed a decade earlier and the implementation of treatments recommended in the plan.

Following our site visit on July 24, the owners sent me photos taken by a game camera near the cabin. The photos clearly show firefighting resources visiting the property as the Bootleg fire approached. Local US Fire Service personnel were familiar with the property and informed the incident management team of the property location. Incident fire personnel visited the site in advance of the Bootleg fire to begin



Piling burning near the cabin in September 2014; this work proved essential for the successful firing operation around the cabin during the Bootleg fire in July 2021.



planning point protection operations.

Overhead and engine personnel arrived at the cabin site and began structure and property triage in preparation for a defensive firing operation. A fireline was constructed with hand tools around the cabin prior to the firing operation.

Wildland engines from the Bureau of Land Management assigned to the Bootleg Fire are seen supporting the firing operation and providing structure protection for the cabin. Time stamps on the images indicated that the operation took several hours.

The BLM engines moved out after the fire behavior diminished. The property was frequently visited by several agency and contract engine crews plus law enforcement personnel through the next two days including a California Office of Emergency Services unit (CA-OES). Personnel from the engines were seen patrolling on foot around the cabin and the fireline. No

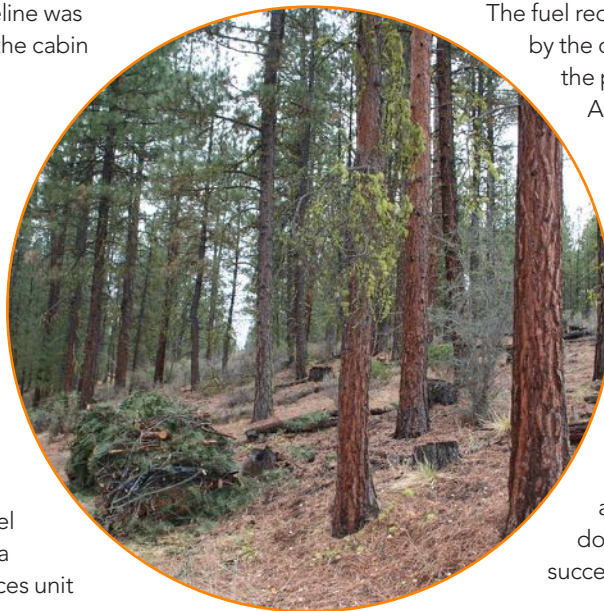
holding or structure protection challenges were presented.

The firing operation was successful in removing surface fuels prior to the arrival of the Bootleg fire.

The fuel reduction work accomplished by the owners played a key role in the protection of their property.

An on-site review in October 2021 with the owners and local US Fire Service fire personnel concluded that the firing operation done in advance of the approaching Bootleg fire was a good surrogate for the prescribed fire that had not been able to be implemented.

A spring follow-up site visit and future monitoring will be done to evaluate the apparent success story of The South 40.



A stand after thinning, pruning and hand piling.

ABOUT THE AUTHOR



Gene Rogers is the president and consulting forester for Wildland Fire Technologies, Inc. based in Klamath Falls, Oregon. He served in a variety of fire management positions with the U.S. Forest Service, Bureau of Land Management and the National Park Service. He retired in 2003, in his thirty-fourth fire season. Rogers is a fire behavior analyst, a qualification he has maintained since 1987. He served two terms on the IAWF board of directors, has chaired and co-chaired conferences and served on numerous committees. His bachelor of science degree in natural resources is from Humboldt State University, with forestry graduate work there and at the University of Washington.

SHIFTING RESPONSIBILITY

A COMMUNITY-BASED APPROACH TO WILDFIRE OUTBREAK PREVENTION

BY ROSA DIEMONT AND TIEME WANDERS

Forests in Ghana are increasingly being influenced by human-induced fires. Until the 1980s, uncontrolled wildfires were relatively uncommon in Ghana, especially in the forest zone in the southern regions of the country.

When talking to the older farmers, many recall 1983 as a tipping point. In that extremely dry year, the country experienced devastating wildfires that destroyed forests, villages and even people's lives. Ever since, wildfires have been an annual phenomenon in Ghana's landscapes, and decision makers have been puzzling over how to keep Ghana safe during the dry season.

A community-based approach reduced wildfires outbreaks by 78 per cent between 2018 and 2021. From a situation in which wildfires were frequent annual occurrences that nobody could stop, for which no one felt responsible, and from which everyone suffered, change has occurred to a situation in which people feel responsible for managing the fire risk and are able to prevent wildfire outbreaks.

In 2017, Form International and Form Ghana developed the Forest Landscape Restoration Program for Tain II Forest

Reserve. Form Ghana is a forest plantation management company based in central Ghana that produces timber and carbon credits for local and international markets. One of Form Ghana's concessions is located within Tain II Forest Reserve in the Bono Region in Ghana. The donor-funded Forest Landscape Restoration Programme was set up to collaborate with the neighbouring farmer community to develop improved livelihood activities in the Tain II Forest Reserve.

The land of the neighbouring community is mostly customary land under the traditional authority of chiefs and their families. The area around Tain II Forest Reserve is a rural area and most people living around it are subsistence or smallholder farmers. Most people rely only on farming as their sole source of income.

The Tain II Forest Reserve lies within the Eastern Guinean lowland forest zone, a dry semi-deciduous forest type. The Forest Reserve was once completely covered with this forest type and played a vital role in the lives of people living near it. Today however, very little of the original forest remains



and vast areas of the reserve are covered with savannah-like farm bush, resulting from human-induced degradation. Intensive farming and annually occurring wildfires promoted the growth of elephant grass (*Cenchrus purpureus*), a tall and fast-growing tropical grass species that prohibits natural regeneration of forest and makes a high, very dry and flammable fuel load during the dry season.

The removal of the trees, in combination with the environmental conditions and poor infrastructure of the area, worsens the situation. During the dry season (from December until March), the humidity drops below 10 per cent during midday. The Harmattan winds dry out the vegetation and dust in the air can severely limit visibility. The poor road network prohibits rapid response to fires and remote areas are difficult to reach. All elements that can contribute to severe uncontrollable fires are thus combined. The frequent fires further degrade the already degraded, unmanaged areas within and around the Tain Il Forest Reserve.

A TABOO ON THE USE OF FIRE AS A TOOL

In this zone of Ghana, fire is not a natural phenomenon; it is almost always human-induced. And the wildfires that run through the Forest Reserve annually do not come from within the Forest Reserve; they come from the communities around it. In Ghana, the use of fire as a tool is a longstanding practice: it is used in agriculture by farmers as a cheap way to clear a piece of land for cultivation, but also by other groups, such as hunters, herdsman, and beekeepers. These groups are often blamed for the fire outbreaks. In addition, it is often mentioned that farmers have limited knowledge of fire management and therefore cannot manage farming-related fires properly. This is why the bylaws of many Ghanaian districts prohibit the use of fire during the dry season, making a traditional practice taboo. Ironically, the outlawing of burning does not have the desired result. Throughout Ghana, fires keep getting out of control, threatening farms, properties and lives. And, as a side effect, these occurrences of out-of-control fires strips farmers of control over their

situations. Even worse, the situation creates conflict between farmers and other occupational groups, who blame each other for setting fire to avoid punishment.

A major consequence of the many wildfire outbreaks is that farmers became demotivated and discouraged from investing in perennial crops such as fruit and nut trees. When an area burns every year, farmers will plant only annual crops and to harvest before the dry season. As a consequence, the farmlands are left unmanaged after the harvest, giving way for wildfires to run freely through the landscape. This is a situation that farmers are very unhappy with but cannot change individually.

A GRASSROOTS-LEVEL SOLUTION FOR A LANDSCAPE-LEVEL CHALLENGE

While working together with key stakeholders such as the traditional authorities, the fire service, and the Forestry Commission Ghana on the implementation of the Forest Landscape Restoration Programme, the project team soon realised that outlawing burning in the dry season was not the way forward. One cannot tell farmers to stop using fire, because it is part of a way of life. To counter the accelerating degradation and to stimulate forest restoration, the incidence of fire in the area had to decrease, by drastically changing the roles of people in wildfire management.

Since the Control and Prevention of Bushfires Act came into practice in 1990, the regional fire offices in Ghana have operated through a system of community fire volunteers. The volunteers are responsible to execute daily patrols during the dry season, and they have the right to arrest offenders and report them to the police. Unfortunately, Ghana National Fire Service does not have the means to organise annual education programs or assist the fire volunteers with their organisation, the execution of pre-fire season prevention programs, or with the fighting of wildfires. All the responsibility for mobilisation, organisation and fire fighting has been left completely to the volunteers.

Community fire volunteers of Akrokrom, equipped with hand tools, make a fuel low zone to slow down a fire.

PHOTO BY MELLE MEIVOGEL

The project team found that traditional leaders were mostly left out of fire-related decision-making processes. The Ghana National Fire Service is responsible for fire management and the appointment of community fire volunteers. In this set-up, traditional leaders, who in Ghana are the stewards of the land, were not involved with the appointment and operations of the community fire volunteer squads. This resulted in conflict of interests and therefore friction and unproductive fire volunteer squads at village level.

As such, the first step of the program was the engagement with the traditional authorities and community leaders. Together with them, the fire service and the community fire volunteers, an Integrated Community Fire Management Project was developed. The proposed structural changes were endorsed by all. One of the largest structural changes was the revision of the local fire bylaws. The revised bylaw now states that farmers can be allowed to use fire as a farming tool, also in the dry season. The condition to this is that a community must be under a supportive program and has operational, trained and equipped

community fire volunteers who work according to a set of operating procedures.

This caused a great change in how everybody perceives fire. Instead of fire being taboo and focusing on punishment for using it, the project could now focus on making people capable and responsible for taking preventive measures to reduce the fire risk and to use fire responsibly.

IMPROVED OPERATIONAL STRUCTURE

Together with all stakeholders, an improved operational structure was developed by dusting off good traditional working practices and adding new ones, such as the use of the Fire Danger Index, and allowing controlled burns that are regulated through a permission system.

In each squad, a leader and a leader-assistant were appointed who made a community fire management plan for the community. In this plan, community activities to limit fire outbreaks are formulated for the coming dry season. The squad leaders then present this plan to the village chief. The chief has to formally agree with this management plan as a sign of support and to give the mandate to the squad leaders to call people to action. The leaders are responsible for mobilising the fire volunteer squad and to train them. The squad leaders also mobilise farmers to prepare farms before the dry season and to undertake other collective actions such as the weeding of fire breaks as presented in the community fire management plan.

The squad leaders were trained, and they in turn trained the entire volunteer squad and community members, on topics such as being fire wise, and the consequences of the use of fire. Key to the training was raising awareness in the communities on the new rules and regulation system and the permission system to do controlled burns. In the new system, the fire squad can give permission to farmers to burn their land based on whether it is safe according to the Fire Danger Index. The Fire Danger Index is adapted to the Ghanaian environment and is called Egya K k b in Twi, the language mostly spoken in the area.

Through a WhatsApp communication group, the Fire Danger Index and weather conditions are communicated on a two-hour basis to the leaders of the squads by the Form Ghana's operations centre. In turn, the leaders communicate the FDI to the community using the fire notice signboard and the community's central broadcasting system. This way, the whole community is kept aware of the climatic circumstances, how these affect fire behaviour and the fire risk. When the farmer is granted permission to burn his field, the fire volunteer squad provides assistance to keep it a controlled burn.

The community has taken back control over the use of fire. With the renewed skills and strengthened organisation, people are in control again.

Squad leaders communicate the Fire Danger Index to the community using the fire notice signboard and the community's central broadcasting system. PHOTO BY ROSA DIEMONT.



PREVENTION INSTEAD OF SUPPRESSION

In Ghana, there is no high-tech firefighting equipment available for suppressing wildland fires in rural areas. The road network is also poor in many areas, which prohibits the use of large firefighting vehicles. Fire volunteers were trained to suppress small to medium-size wildfires with hand tools, such as beaters and rake-hoes. As water is scarce in the dry season, fire squads could not be made water-dependent to suppress fires. For these reasons, the whole project is focussed on prevention instead of suppression.

As mentioned, the squad leaders are responsible for developing a Community Fire Management Plan for their villages and surrounding farm areas. These plans are completely focussed on preventing fire outbreaks and limiting the spread in case a fire gets out of hand. Based upon these plans, the squads and farmers undertake the planned preventative measures, such as the creation of strategically located fire belts to protect the villages and the farms, clearing and widening roads so that they serve as fire breaks, and making fire breaks around farms and other community properties. Some community fire squads join up to do large early block burns in the vast unmanaged areas around the Forest Reserve to establish low fuel load zones or a large defensive fire break to protect several villages.

RESULTS

After four years of implementing the Community Fire Management Project, the area under community fire management is 6,150 hectares. This land surrounds 8,072 hectares of Forest Reserve. The indirect result is that part of the Forest Reserve is protected by this shield of community fire operations. The number of wildfires in the community area reduced by 78 per cent compared to the baseline year of 2018. The fire frequency maps show this reduction. The darker the colour of a compartment, the more uncontrolled fires occurred in the dry season: the 2018 map shows the fire outbreak frequency before the project started and representative for the normal situation. The other maps show the improved situations in 2019, 2020, and 2021.

The community has taken back control over the use of fire. With the renewed skills and strengthened organisation,



During the grand opening of the Forest Landscape Restoration Program for Tain II Forest Reserve project in Ghana, officials presented a jointly designed and aligned approach toward rural fire management for the first time. PHOTO BY ROSA DIEMONT

Kwasi Asare, farmer from Kotaa

"In the past, farmers of Kotaa used to plant a lot of cocoa trees, underneath the large forest trees. This has changed over the past 20 years. I also stopped planting cocoa, and instead I started with cultivating maize, because I did not want to run the risk that the trees got burnt during the dry season.



Because of the community fire project, I now dare to plant fruit trees again. This time I plant cashew trees. Now that the fire squad of my village is active again, I do not need to worry. I can count on their assistance. Our village has had much less uncontrolled fires than in previous years.

Nowadays I always help other farmers when their farms are in danger. I now realize that when my neighbor's farm burns, mine is in danger too! We can only have flourishing farms when we work together."

- interview with writer Rosa Diemont

people are in control again. This control gives the community members confidence and new opportunities in farming as well. One result of the community fire project is that farmers have started developing agroforestry farms and tree-based farms, such as cashew and mango farms, intercropped with subsistence annual or perennial crops. About 3,000 farmers who have their farms in an area of 6,150 hectares experienced the change in the landscape. The fruit and nut cash-trees that were planted during the project's period will provide additional income within four to five years. A positive side effect for the Forest Reserve is that the buffer zone around it is now under permanent farm management, as farmers now feel that it is worth the effort to protect the farms during the dry season.

Form Ghana sees that the robust company fire management organisation in the plantation is complemented with these community efforts. The strong and trusting relationship with the



Fire squad members are trained on rules and regulations. The number of wildfires in the area reduced by 78 per cent between 2018 and 2021. PHOTO BY MELLE MEIVOGEL

communities has been strengthened, further embedding the forestry company in the landscape. The renewed control over fire is a co-creation of the communities and the company.

The previously vast unmanaged areas of farm bush, dominated by elephant grass, are turned into diverse, productive and healthy farms with increased tree-cover and perennial crops. Farmers say it is now feasible to protect farms from fire in these areas. The well-functioning community system makes possible what in the past was not worth the risk. In fire-prone areas, community fire management is a critical base for joint landscape restoration initiatives that wish to stimulate tree planting, nature conservation and development of agroforestry farms.

The most significant impact has been that people took back responsibility and control. In principle, all land users have wildfires as a common enemy. Whereas prior to the program community fire volunteers felt powerless, they are now proud and confident, feeling part of the solution to protect the lives and livelihoods of their neighbours. People now know that they are capable of making a large impact on a large scale.

ABOUT THE AUTHORS

Rosa Diemont is managing the Landscape Restoration Programme for Tain II Forest Reserve. Under this program, she developed and implemented the Community Fire Management Project together with Form Ghana Ltd. and CMO. CMO delivered fire management consultation for this project.

Tieme Wanders is senior forestry expert specializing in reforestation and forest certification. He has been responsible for several forestry research and development programs throughout Africa.

The Integrated Community Fire Management project is part of the Landscape Restoration Programme for the Tain II Forest Reserve, which was funded by DOB Ecology and DFID's Partnerships for Forests programme.

"Cut Line in Less Time!"



U.R. FIRE TOOLS

Designed by Professional Wildland Fire Captain.

Proprietary Steel Formation Holds Sharpened Edge Longer and Resists Chipping.
Universal Neck Allows for all Parts of Tool to be Fully Replaceable and Interchangeable.

MORE PRODUCTS AVAILABLE AT:

URFireTools.com

P.O. Box 1617 • Cedar Ridge, CA. 95924 • (530) 272-1444





Super P Pro 40



Hoe 40



Chingadara 40



Bigfoot 40



Pounder II 40



Scalper 48



McLeod 48



Wire Fire Broom 52

BASQUE-ING IN FIRE KNOWLEDGE

PAU COSTA FOUNDATION INTRODUCES PRESCRIBED FIRE AND TACTICAL BURNS TO ÁLAVA FIREFIGHTERS

BY KATHLEEN UYTTEWAAL

COLLABORATING IN RESEARCH,
SCIENCE AND JOURNALISM



International
Association
of Wildland Fire



PAU
COSTA
FOUNDATION

After more than a year without leaving our regions in Spain, COVID-19 measures finally eased in May 2021. The Pau Costa Foundation pounced, sending two seasoned experts and former firefighters (now fire lighters!) to cross the peninsula to Álava in the Basque Country. Juan Caamaño plowed through the west from Ávila, while Jordi Pagès skirted the Pyrenees from Lleida with a novice PhD student in tow – me! I had yet to leave the confines of my online research world; this is what happens when you start a PhD in May 2020. I was long overdue to witness fire knowledge in action.

Álava isn't high on the radar yet for forest fire risk: the vegetation is almost offensively green year round. But the Álava suhiltzaileak (that's Basque for firefighters) still enthusiastically invited the Pau Costa experts for a three-day introduction to fire management course, training local fire managers on prescribed burns and tactical uses of fire. (Note: a prescribed burn aims to achieve certain habitat/fuel management goals under predetermined conditions; a tactical burn is used during a fire event as a method to redirect or contain it.)

Instructors and firefighters get ready for a straw pile burn experiment; the miniature versions of crests, slopes and valleys help firefighters understand how topographical characteristics, and weather, can affect fire behavior. PHOTO BY KATHLEEN UYTTEWAAL



Fire energizes our ecosystems

Pagès and Caamaño set the backdrop by drawing on many of their own international experiences and lessons. They delved into essential context on local fire ecologies and cultures in Spain, the myth of achieving zero fires on the landscape, and encouraged the suhiltzaileak to consider fire as another tool in the management toolbox. “After all,” shared Caamaño, “every year we are better equipped to extinguish fires, but it is not a long-term solution to current and future forest fire problems.” To this, the 20 participants from Álava nodded in unison.

While some aspects of fire remain out of human control, Caamaño emphasized that “in prescribed fires, I choose the conditions of the fire, not the other way around.” The trick is in reframing our concerns as fire managers: it is not about if our landscapes will burn, but how we want them to burn, he said. For this, the instructors shared their knowledge on technical parameters of controlled burning.

Within the prescribed-burn toolbox, Pagès and Caamaño developed exercises on the controlled burn patterns fire managers can use under various conditions of topography and vegetation: lines, points, flanks, and head fires among others. “Careful,” Pagès warned. Another tool can either help or hurt fire managers: the weather. The meteorology will always be dynamic, and conditions will change

throughout the day. “No matter what, we need to adapt to it,” Pagès said.

Shifting to tactical burns, Pagès asked: “What does the fire want to burn? Everything! But even a small discontinuity can have a big impact in how we manage it.” Just like fire managers, he said, the fire also reads the wind and counterwinds looking for opportunities to expand. It is necessary to find the opportunity to control the fire with the least amount of risk, smoke and irradiation. How can we use tactical fires, then, Pagès asked. To generate “black zones,” avoid secondary foci, reduce fire perimeter length, and redirect/narrow/close a front.

Pearls of wisdom when conducting prescribed or tactical burns:

- Ask yourself, “What is the worst situation possible?” and start to work from there.
- Never think in the present while working a fire – think of the future conditions.
- There is no concrete recipe for combining all fire-management tools, but think about the convenient and inconvenient aspects of every tool available.
- If there is no natural line to help control a fire, then make one.



There must always be at least one factor in your favor (slope, wind or suction) and a certain proximity to the fire front.

It's important to understand the physics of fire, such as the dynamics that will move the fire column, to play in favor of management decisions.

Take a step back: instead of thinking about fire trucks, think about objectives. And then firefighters have sufficiently open minds to think about other tools.

In the window of prescribed burns, think of tools and techniques like gears on a vehicle, from slow to high intensity, depending on what needs to be managed in the territory.

In Caamaño's words: "I'm not going to play a game that I know I'm going to lose. I will always win if I know my limits well. So always place yourself in the winner's seat."

Miniature landscapes, big impacts

The suhiltzaileak put their newly acquired tools and axioms to the test. When the chirimiri (that's the word for fine, constant rain in Basque) permitted, the firefighters experimented burning straw pile mounds. These miniature versions of crests, slopes, and valleys helped them get a feel for how these topographical characteristics (along with weather) can radically change fire behavior. The firefighters split into groups and assigned a burn boss to decide the desired control burn pattern according to the topographic and wind conditions.

In another straw pile exercise, we observed how fire interacted with the crest and wind. This helped us think on our feet about the opportunities we have in a situation like this: Where can we place extinguishing tools? What are the (in)conveniences of each decision?



Pau Costa Foundation's Jordi Pagès provides an introductory lecture on fire management during training in Álava in the Basque Country in May 2021. PHOTO BY KATHLEEN UYTTEWAAL

NOT YOUR ORDINARY SANDBOX

Pagès and Caamaño crafted another exercise sure to hit close to home. Using a projector and a sand table, they generated a 3D topographical representation of a hillside right next to the Álava firefighter base. It was up to the firefighters to decide how to burn it in parcels.

What seemed like simple triangles and rectangles overlaid on the hillside suddenly became much more complex. So many decisions determine how to manage the territory under certain conditions. It took teamwork to organize, plan and execute the burn. The firefighters had to communicate quickly about principle objectives, the range of acceptable results, structural complexity, preparing the terrain, resource provisioning, security conditions, and communicating with the public. The groups split up for briefing which, the Pau Costa experts declared, is the most essential moment for fire crews. They then ran through the entire burn operation: assigning the ignition team; control team; the communication network; the contention plan; considering possible escape areas; base lines, patterns and point of ignition; subdividing the parcel; and a security plan.

As a fly on the wall, I was thoroughly impressed with the knowledge integration, co-operation and quick decision making throughout these days. The hierarchical command systems are clear among fire managers, and teamwork is so practiced that action seems to happen almost fluidly. While research has its own set of challenges for fire management, the weight of these fire managers' responsibilities was much more palpable as they place their minds and bodies forward daily. One fire manager joked, "Even when it rains, it's my fault!"

The suhiltzaileak felt equipped and motivated with their new toolbox, though they shared how difficult it would be to immediately implement prescribed burns in the area due to unfavorable policies and closed administrative mindsets. This is not news to the instructors: "It is much faster to change people's hearts than to change institutions," Caamaño said. Undoubtedly, the suhiltzaileak started on that journey during this training. It is up to organizations like the Pau Costa Foundation and a wide network of passionate allies, from fire managers, landowners, administrators, researchers and even foreign PhD students, to accompany that process and light more good fires along the way.

ABOUT THE AUTHOR

Kathleen Uyttewaal is a PhD candidate working at the Pau Costa Foundation, and she is affiliated with Wageningen University in the Netherlands through the PyroLife Innovative Training Network. Primarily raised in California, she has family roots in France and has lived in Catalonia nearly three years. Fire first sparked her interest when she witnessed its devastating and healing effects in rural California. She carries these lessons with her for current participatory research on how rural Mediterranean communities adapt to living with wildland fire.



Pau Costa instructor Juan Caamaño prepares a drip torch for a controlled burn exercise during a three-day introduction to fire management course, training local fire managers on prescribed burns and tactical use of fire.

PHOTO BY KATHLEEN UYTTEWAAL



GROUSE, GRASS AND GARGANTUAN FIRE

MEGAFIRE MAY BE A NEW THREAT TO IMPERILED LESSER-PRAIRIE CHICKEN

BY NICHOLAS PARKER AND DANIEL SULLINS

Spring mornings in southwestern Kansas often begin cool, dark, and quiet. Among the surrounding silence, the prairie slowly awakens. Sometime after the owls stop asking “who?” and before the liquid summer song of the meadowlark bubbles forth to greet the light, you hear lesser prairie-chickens; they yodel, boom, gobble, gurgle, moan, whine, cluck, and cackle, filling the cool spring dark with life.

The morning of March 6, 2017, in Clark County, dawned with the prairie muffled by a strong sustained south wind, bringing with it faint whiffs of smoke. The next morning the prairie was utterly dark and quiet, with charred and blackened ground for miles around.

The wind-driven Starbuck fire burned more than 250,000 hectares in Kansas and Oklahoma on March 6 and 7, breaking the record of largest wildfire in Kansas. The record had been set just the previous year, in 2016, by the 150,000-hectare Anderson Creek fire. Both wildfires were known as megafires for their massive size (> 40,000 hectares, or 100,000 acres) and lasting impacts to the rural communities affected. Separated by a year and roughly 50 miles, both megafires burned the sparsely populated Red Hills region of Kansas, an area of rolling grasslands dedicated to agriculture and cattle ranching. The Starbuck fire killed between 5,000 and 9,000 cattle and caused an estimated \$44

million in damage to fences and structures alone.

In addition to megafire impacts to rural communities in these areas, both megafires burned grasslands occupied by lesser prairie-chickens. The lesser prairie-chicken (*Tympanuchus pallidicinctus*) is a dull, brownish, football sized grouse found in the southern Great Plains of North America. While quiet and unnoticed for most of the year, in the spring male lesser prairie-chickens are scintillating stars of the prairie. They gather on communal mating grounds known as leks to sing, dance, and display for females. Males stamp their feet, inflate bright red air sacks on their necks, fan out brilliantly yellow

eyebrows, and gobble, cackle, and yodel to woo females. Female prairie-chickens remain quiet and cryptic, hesitantly darting around the leks, seemingly unimpressed by the strutting and dancing of puffed-up males. The age-old ritual repeats every spring, with lesser prairie-chickens returning to the same leks year after year, with some leks existing in the same spots for greater than 40 years.

Unfortunately, much like the North American prairie, once abundant lesser prairie-chicken



A male lesser prairie-chicken displays on a lek in Clark County, Kansas.

PHOTO BY ELLEN WHITTLE

populations have dwindled. Historical accounts speculated that millions of lesser prairie-chickens may have been on the prairie prior to 1900, and surveys that began in the 1960s estimated an overall population of around 175,000

individuals. Today, estimates suggest there are only around 30,000 individuals. Concern over reduced populations led to the lesser prairie-chicken being listed as threatened under the Endangered Species Act in 2014, but legal issues led to its delisting in 2016. In 2021, the US Fish and Wildlife service once again proposed to list the species, this time as threatened in the northern part of their range and endangered in the south. Lesser prairie-chicken declines are linked to loss of habitat, as native prairies throughout their range have been lost to farming, energy exploration (oil and gas wells, wind turbines), and other human activity. Many remaining grasslands have been further altered and degraded due to mismanaged grazing and the expansion of invasive trees.

The increase in megafires throughout the lesser prairie-chicken range poses yet another potential threat to the already declining species. Although prairie-chickens are adept at avoiding small fires, many may be killed in the path of fast moving and intense megafires. Following large megafires, hundreds of thousands of acres of grasslands are lost or altered, and lesser prairie-chickens may have few places to go, as they are already restricted to increasingly fragmented islands of intact grasslands.

Ironically, it was likely the removal of fire from grassland ecosystems that paved the way for record fire years in the southern Great Plains in 2016 and 2017. Fire was historically an essential part of grassland ecosystems as fires kept prairies as prairies, killing trees and structuring grasslands. These fires were sometimes naturally caused, but often were ignited by Indigenous peoples. This practice ended following European settlement, and fire has largely been suppressed and removed from Great Plains grasslands. Fire suppression has led to increased trees and grassland areas thick with dead vegetation and litter that provided the fuel for these blazes. When combined with changing climates and extreme droughts, much of the southern Great Plains is at high risk of extreme wildfires.

Unfortunately, it is only predicted to get worse. Trees are increasing exponentially, and climate predictions suggest increased occurrence of hotter and drier years that will promote larger, more frequent wildfires. The same factors leading to increased wildfire risk have degraded grassland quality and decreased lesser prairie-chicken habitat and populations. When such factors culminate in a megafire, what happens to grasslands and lesser prairie-chickens?

But perhaps by using fire as a tool, rather than allowing fire to evoke catastrophe, we can strengthen other lesser prairie-chicken populations and prevent future megafires.



Bison grazing (along with fire) was historically a driving force in shaping Great Plains grasslands and lesser prairie-chicken habitat. While bison have been replaced by cattle, recoupling cattle grazing with prescribed fire can mimic historic conditions to benefit grasslands and lesser prairie-chickens. These curious cows accompanied researchers measuring vegetation after megafire. PHOTOS BY DANIEL SULLINS AND NICHOLAS PARKER

Clark County was one of the hardest hit areas by the Starbuck fire, with an estimated 85 per cent of the county burned. One person died in the fire and many lost homes and livestock. The area was also home to a robust lesser prairie-chicken population that was the focus of a study by a team of wildlife researchers from Kansas State University prior to the 2017 Starbuck fire. Following the megafire, researchers returned to Clark County to see what happened to lesser prairie-chickens and the grasslands they inhabit.

Going to Clark County today, at first glance you may not find many signs of this megafire. The rolling green hills are lush and vibrant, dotted with hefty and healthy cattle. But look closer and the scars of the Starbuck fire are visible in the shiny, taut barb wire fences, built right over the remains of burned fenceposts, and in burned houses in the dwindling town of Englewood, population 58 as of the 2020 census. Towering white skeletons of trees, some planted more than 100 years ago by the first settlers in the area, stand sentinel over a changed landscape. And on cool April mornings, the air no longer reverberates with calling prairie-chickens, but in several areas a faint echo of their former glory remains.

After the Starbuck fire, researchers found that lesser prairie-chicken numbers decreased an estimated 67 per cent, and almost half of the leks that were active before the fire were abandoned post-fire. Nesting females after the fire experienced greater nest failure and predation; as a result, populations have remained low five years after the fire.

However, like many things in nature, lesser prairie-chickens and grasslands are resilient. Individual lesser prairie-chickens that remained in the area moved to unburned areas and exhibited survival and lifespans similar to those in the area before the fire. And while prairie-chickens largely selected unburned areas of grassland after the fire, burned grasslands also had a remarkable response to the intense fire disturbance. Two years after the fire, grasslands had largely returned to their pre-fire state in structure and plant composition, providing hope that lesser prairie-chickens will once again be abundant on this landscape.

Much of this recovery and persistence can be attributed to the fire-adapted nature of the grasslands in this region; it likely helped that the area was home to large swaths of healthy, well managed grasslands and a strong lesser prairie-chicken population before the fire. In the years post-fire, considerable rain was also received, helping to accelerate recovery. In some ways this study may represent a best-case scenario for lesser prairie-chickens following a megafire. However, continued loss and degradation of remaining grasslands could make megafires much more devastating for lesser prairie-chickens and other grassland wildlife. Without successful conservation of remaining large intact grassland landscapes, future megafire activity will almost certainly harm lesser prairie-chicken populations.

The story of the lesser prairie-chicken is reminiscent of that of its ill-fated cousin, the heath hen. Now extinct, the heath hen was a coastal subspecies of the greater prairie-chicken that was once abundant throughout the Northeast United States

during colonial times. European settlement brought increased hunting pressure, agriculture and removal of fire that destroyed heath hen habitat and decimated populations, causing the species to vanish from the mainland by 1870. A small number of heath hens persisted on Martha's Vineyard, an island refuge off the coast of Massachusetts. While the heath hen survived for a time, a catastrophic wildfire in 1916 wiped out most of the population, and the remaining individuals eventually succumbed to a combination of harsh winters, disease, and inbreeding. By 1929 only one male remained and after his disappearance in 1932 the species was declared extinct. This slow, well documented decline and our inability to prevent the extinction of the heath hen provides a stark example of what could come to pass for the lesser prairie-chicken. It is true that lesser prairie-chickens are not as geographically isolated as the heath hen, nor are populations so critically low. But if grasslands continue to be lost and populations grow smaller and more isolated, they will be increasingly vulnerable to catastrophic events such as megafire.

So how do we strengthen lesser prairie-chicken populations, improve their habitat, and prevent future megafires?

In remaining grasslands, the answer may be as simple as implementing prescribed fire at appropriate intervals. Alone, prescribed fire can remove extensive litter and invasive trees, eliminating fuels from the landscape. Lesser prairie-chickens strongly avoid trees (due to perceived predator risk from raptors), so removing trees opens up previously unusable areas for lesser prairie-chickens and improves overall grassland ecosystem health. To deal with trees, proactive burning is best as smaller fires cannot always kill large established trees. While the intensity of the Starbuck fire did kill a large number of trees, many snags remained standing post-fire, preventing lesser prairie-chickens from using these areas. However, success was noted when snags were removed by mechanical means such as chaining and highlights the potential for conservation opportunity following megafire.

When prescribed fire is used in conjunction with grazing in a patch burn grazing system, it is especially beneficial for lesser prairie-chickens. Patch burn grazing mimics historic grasslands that were estimated to burn every three to 10 years and grazed by bison that once ranged North America in the tens of millions. Fire and subsequent grazing in recently burned patches creates grasslands of varying heights, thickness, and plant make-up that provide habitat for many wildlife species, including lesser prairie-chickens. Recently burned and grazed areas provide short vegetation needed for leks so that the elaborate male prairie-chicken mating displays can be seen. However, unburned areas are needed in close proximity to leks. After they mate on leks, females nest relatively close by the lek in tall, dense vegetation that provides camouflage from predators. After nests hatch, the small chicks can't move through thick grass easily, so females move them to more open areas that are easier to navigate and rich in flowering plants. Such areas provide insects and other foods essential for growing lesser prairie-chicken chicks. Areas short in vegetation and rich in flowering plants are characteristic of one- or two-year post-fire grasslands in this system.

By combining fire and grazing in a patchy mosaic on the landscape, lesser prairie-chickens are provided with grasslands that support their habitat needs for reproduction and mimic historic grasslands. Practices such as patch burn grazing are also good for overall grassland health and do not impact gains for cattle producers in the region. Megafires do the opposite, burning huge areas of grassland all at once, with negative effects on both lesser prairie-chickens and the people making a living in these grasslands.

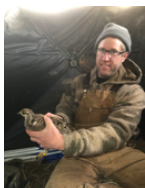
Unfortunately, prescribed fire is not a common practice in the grassland region occupied by the lesser prairie-chicken. Most grasslands are privately owned, and many ranchers and landowners are wary of fire, a feeling certainly justified following the catastrophic fires they have experienced. Fire suppression has long been the dominant practice in this area and changing this mindset is not easy. But local grazing groups and prescribed burn associations in some locales have made progress on this front and provide a wealth of information and assistance for landowners who are curious or interested in using prescribed fire.

Reintroducing fire at smaller scales is beneficial for lesser prairie-chickens, but large, intensive megafires are not. In Clark County, the Starbuck fire reduced lesser prairie-chicken populations and (temporarily) altered large swaths of grasslands. Even though grasslands are once again green, and the lesser prairie-chicken can still be heard in the area, the effects of the Starbuck fire are not erased. The reduced lesser prairie-chicken population makes it more susceptible to future extreme events (drought, wildfire, flooding) and it is still unknown if the population will recover to its former numbers. But perhaps by using fire as a tool, rather than allowing fire to evoke catastrophe, we can strengthen other lesser prairie-chicken populations and prevent future megafires.

ABOUT THE AUTHORS



Nicholas Parker is a wildlife biologist and recently completed his M.S. research at Kansas State University, focused on lesser prairie-chicken response to megafire.



Daniel Sullins is an assistant professor in the Wildlife and Outdoor Enterprise Management department at Kansas State University; his research focuses on conservation of grasslands and avian populations.



Two male lesser prairie-chickens fight for female attention.
PHOTO BY NELLIE HILL

TO ENJOY A LESSER PRAIRIE-CHICKEN LEKKING DISPLAY, VISIT
www.scientificamerican.com/video/lesser-prairie-chickens-show-greater-dance-moves-in-the-spring

PRESCRIBED FIRE

IMAGINING A BALANCED FUTURE

BY LENYA QUINN-DAVIDSON

Imagine this: it's 2050. Fire regimes are intact and flourishing across the United States. Coastal prairies and mountain meadows are teeming with grasses and flowers, and forests are open and healthy, with scattered clusters of old and young trees. Stream flows have increased, even during extreme drought, because frequent fire has released so much water from the clutches of dense, fire suppressed vegetation. The rivers are full of fish, the oak woodlands humming with birds, butterflies, and other wildlife.

Homes are hardened and communities are fluent in fire, and backyards, parks, and nearby forests are a patchwork of blacks and greens, depending on when they were last burned. More people are trained in prescribed fire than not, and states have fully assumed liability for their essential work.

Summers are smoky from wildfire, but not like they were earlier in the century when we were still selecting for all the worst fires by putting all the easy ones out.

After centuries of imbalance, both fire and people have restored their inherent roles as forces for good on the land.

RADICAL IMAGINATION

In their 2014 book *The Radical Imagination: Social Movement Research in the Age of Austerity*, Alex Khasnabish and Max Haiven describe radical imagination as the ability to imagine the world, life, and social institutions not as they are, but as they might otherwise be; it is the courage and the intelligence to recognize that the world can and should be changed, the authors say.

The concept of the radical imagination was introduced to me by my brilliant professor friend Sarah Ray, who in 2020 published a *A Field Guide to Climate Anxiety*. Ray describes a moment when she asked her college class to envision a climate-changed future where all their good work had come to pass, and they and others were thriving. Ray asked the students to describe, in that future scenario, what people would be thanking them for. This was meant to be a fun,

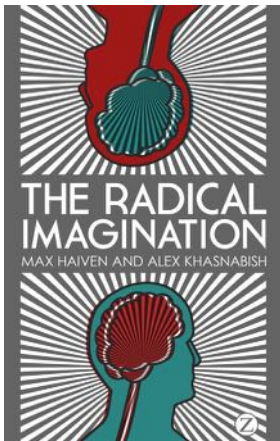
inspiring exercise, but instead the room fell silent. Ray soon realized that the group of 20-somethings could not envision this kind of future – they could not imagine effecting needed change or thriving. And they are not alone; as Ray describes in her book, feelings of futility are common in this “age of overwhelm,” during which climate change, fire, drought, disease – and now war – are deflating our hearts and minds.

An eternal optimist, I was intrigued by the idea of the radical imagination. And in reading more, I learned that the radical imagination is a common denominator of many social movements: you can't be the change you wish to see if you can't visualize the change in the first place.

It turns out radical imagination is also a common denominator of many of my favorite fire people. Last fall, my friend Zeke Lunder – a wildfire mapping guru who now runs the fire reporting website *The Lookout* – articulated his radical fire vision during an entertaining interview with a California-based bike parts company. His post-apocalyptic fire story starts out like something from a comic book: “Imagine a country ravaged by a century-long battle with wildfire. After this bloody siege, with rapidly escalating casualties, fire has unexpectedly joined forces with a new superhero named ‘Global Warming.’ I come to power at a time of unimaginable destruction, with our communities in smoking ruins, people shell-shocked, and forests on the brink . . .”

After setting the stage of this war-torn country, Zeke describes a necessarily evolved approach to fire management, with changed policies, investments, and tactics that allow fire and people to peacefully co-exist. The interview beautifully hit the nerve of many of our deepest fire problems: culture, capacity, connection.

Those same themes were fodder for another friend, Will Harling, who leads a community-based fire program on the Klamath River in one of the most remote parts of northern California. In 2020, Will wrote a poem that laid out his radical vision for fire on his landscape:



In ten years, the fire ceremonies on Offield Mountain will be restored,
And people will see that we made the wild in fire,

In ten years, an interconnected series of well-planned fuelbreaks,
Will allow us to share the inherent risk of managed wildfire and prescribed fire,
Everyone will know there is no solution that does not include fire on the land,

In ten years, Californians will think about fire like Floridians,
Prescribed fire will still be more fun but about as stressful as mowing the lawn .

..
Ten years from now, we will manage landscapes for processes not species,
And what seem like conflicts and tradeoffs will be revealed as the balance,
The balance of life on the land,

Ten years from now or perhaps a hundred, we will learn to live with fire,
Because the lessons will keep coming,

Eventually every one of us will have lost a piece of what we love,
And will choose the uncertainty of embracing fire, even while it burns us . . .

In ten years, creeks that have been dry for decades will flow again,
Salmon will turn gravels that have long been out of reach,
The fruits of the land will be sweeter, the deer and elk fatter,
We will remember what it means to be stewards of place,
To give back what is owed to the land that feeds us.

- Excerpt from 2020 poem *A Future with Fire*

These stories are inspiring on their own, but they are also helping shape a larger collective vision for good fire in California – a community-led vision that is increasingly widespread and increasingly powerful.

PREScribed FIRE ASSOCIATIONS

As Khasnabish and Haiven said in their book, the radical imagination is not just about dreaming of different futures; it's about bringing those possibilities back from the future to work on the present, to inspire action and new forms of solidarity today.

In California, we are in the midst of a social movement around prescribed fire. Just five years ago, the bulk of prescribed fire in California was led by federal fire management agencies such as the USDA Forest Service, the National Park Service, and the US Fish and Wildlife Service, and community organizations, cultural practitioners, ranchers, and other private landowners were largely missing from the conversation.

In 2017, my colleagues and I borrowed inspiration from the Great Plains and imported the prescribed burn association (PBA) model to California. I work for the University of California Cooperative Extension as a fire advisor, and I traveled to Nebraska with my fellow extension advisor Jeff

Stackhouse, a local rancher named Dean Hunt, and our colleague Mathew Cocking from the Natural Resources Conservation Service to learn more about community-based prescribed fire programs. In the years that followed, Jeff and I traveled around California to host workshops and demonstration burns, and inspiring people to reclaim their right to good fire. Today there are more than 18 grassroots prescribed fire and cultural burning groups around California, training community members, implementing burns, and inspiring neighbors and agency partners. People like Will and Zeke are at the helm of this work, helping us understand what is possible.

There is a simple beauty to the movement: the right to burn, the connection to place, the power of fire to bring people together. California's prescribed fire movement finds ranchers burning alongside tribal members, timber companies burning with environmentalists, university students learning from crusty old fire dogs. The movement reminds us that we're all students of fire, and that sometimes those who think they know the most also have the most to learn.

Just recently, I did a quick survey of California's PBAs and other grassroots burning groups. I learned that since the beginning of 2019, the 13 groups that responded had implemented 356 broadcast burn projects – with no escapes and no damages. These practitioners, often just in

blue jeans and ball caps and burning with their children, grandparents, and neighbors, are reimagining prescribed fire in California.

COMMON GROUND

Khasbabish and Haiven say the radical imagination is about drawing on the past, telling different stories about how the world came to be the way it is, remembering the power and importance of yesterday's struggles, and honoring the way they live on in the present.

In many ways, California's prescribed fire movement centers on a shared understanding of the history of fire in California, and the various forms of political and social oppression that underpin current fire policy. The insights of cultural practitioners have been fundamental to our policy efforts in recent years. For example, the Karuk Tribe's recent Good Fire Report, which was based on interviews with California's prescribed and cultural fire leaders and summarized barriers and opportunities, informed several successes during California's 2021 legislative session. These included changes to California's prescribed fire liability standard via Senate Bill 332, the appropriation of \$20 million to develop a Prescribed Fire Claims Fund, and another bill (Assembly Bill 642) that focused on various aspects of cultural burning. Most of these efforts have also been informed and supported by members of California's ranching community, as they too have a deep but interrupted prescribed fire history. Recent policy work has found these often-disparate groups suddenly on common ground, recognizing their shared histories and the potential for a shared fire future.

A FUTURE WITH FIRE

According to Khasnabish and Haiven, social movements are animated by the radical imagination.

In California, and across the West, we are in a time of unprecedented challenge: widespread drought, extreme fire behavior, firefighter burnout and despair. And yet, it is during this time that the need for collective vision and action has become most clear. The leaders of California's prescribed fire movement – the community members, the cultural burners, the ranchers, the retired burn bosses – have come together to lay out a new fire future, and each tragedy and challenge only seems to further fuel our passion.

We can envision a future in which local and traditional knowledge are guiding this work. We can envision landowners and land managers having a deep comfort with fire and using it regularly. We can envision holding on to our remaining forests, woodlands, and prairies, threading the needle between too much and not enough fire. We can envision people from all backgrounds being trained and certified as burn bosses and effectively leading this work, with real incentives and protections from the state. We can imagine what future generations might thank us for, and we are trying our best to do it.



Burning in late June to control for the still-flowering, invasive medusahead grass. June 2019, Humboldt County. PHOTO COURTESY CALPBA.ORG



ABOUT THE AUTHOR

Lenya Quinn-Davidson is a fire advisor with the University of California Cooperative Extension in the North Coast of California. Lenya's primary focus is on the human connection with fire and increasing the use of prescribed fire for habitat restoration, invasive species control, and ecosystem and community resiliency. Lenya works on prescribed fire issues at various scales, including locally in

Humboldt County, where she works with private landowners to bring fire back as a land management tool; at the state level, where she collaborates on policy and research related to prescribed fire, and helps inspire and support prescribed burn associations; and nationally, through her work and leadership on prescribed fire training exchanges (TRES). Lenya is passionate about using prescribed fire to inspire and empower people, from rural ranchers to agency leaders to young women pursuing careers in fire management, and everyone in between.



INDUSTRY LEADING  INNOVATIVE SOLUTIONS

www.supplycache.com 800.839.0821

**Taking
your
boots off
should
NOT be
the best
part of
your day.**

**WE HAVE
BOOTS THAT FIT!**

SEE ALL OF OUR BRANDS ONLINE

— IN STOCK NOW —



INSTILLING *joy* THROUGH LEADERSHIP

BY MICHAEL DEGROSKY

In the last year, I started following the National Wildfire Coordinating Group Wildland Fire Leadership Development Program on Twitter (@WFLeaders.) I really like what the organization is doing in the Twittersphere, including regularly posting thought-provoking questions for followers. A few months ago, @WFLeaders posed a three-part question that caught my attention and got me thinking, in part because it was so different from conventional leadership fare. The post asked "What brought you joy today? This week? This month?"

Joy, by definition, is a feeling of great pleasure and happiness. These days I derive most of my joy on skis, in the river, on my bike, and hanging with good people. But what about work? The average person spends 90,000 hours, one-third of a lifetime for many folks, at work. If we are going to spend that much time at work, we better derive joy from it.

As I reflected on the post, I realized that in my last job, while much of what I did brought me satisfaction and a sense of accomplishment, just three things brought me joy: those moments when I thought I had been the best leader I could be; when I helped others become the best leaders they could be; and when I genuinely connected with people in ways that allowed us to exchange positive energy, build trust, and form lasting bonds.

That's me, but people derive joy from their work in many ways, and I encourage readers to engage in the thought exercise posed by @WFLeaders; it challenges you to focus for a little while on what is good about that one-third of your life that you spend away from family, pets, recreation, hobbies and other passions that bring you joy.

There is good evidence to suggest that when you know what brings you joy and can tap into it, you can shift your focus

and the way you think, making it more likely that you will bring a positive perspective to your work. As I pondered the three-part question, I realized that experiencing joy at work puts me at ease, improves my mood, and allows me to have a positive perception of happenings around me. Research also suggests that incorporating joy into your work life will help you recover from stress, solve problems, and maintain good health and well-being. When you put all those things together, when you take time to notice your own joy and draw strength from it, you contribute to a great foundation from which you can lead effectively.

Since the @WFLeaders post sparked my curiosity, I have been reading about the relationship between joy and leadership. I have concluded that by thinking about their own joy and tapping into their knowledge, leaders can show up ready to cultivate joy in others and use that to better energize peoples' motivation. I recommend that leaders take a quiet, private half-hour for self-reflection and ask "What brought me joy today? This week? This month?" Then take it a step further, and ask "What am I grateful for?" Write it all down. Think about how that knowledge can influence your leadership.

Why? Through this exercise, we can overcome that very human tendency to let our negative emotions roam free and, when stressed, to run things through the negativity filter, focusing on feelings of anger, resentment, disappointment, or frustration. By taking time to shift perspective, we can remind ourselves that we likely derive joy from our work, that we chose to do what we do for a reason, that we draw energy from it. That change in perspective can enable us to show up more at ease, more content with our lives, ready to recognize moments of joy, and feeling safe and secure – happier,

The average person spends 90,000 hours, one-third of a lifetime for many folks, at work. If we are going to spend that much time at work, we better derive joy from it.

healthier, more positive, more satisfied, more kind, ready to lead as effectively as we can.

Since joy and happiness are so closely linked, I want to offer some happiness related resources. A few years ago, a good friend and colleague introduced me to the work of happiness researcher and bestselling author Shawn Achor, whose presentation The happy secret to better work at TedX Bloomington remains one of the 25 most popular Ted Talks of all time. I recommend it. Also in the Ted Talk top 25 is Robert Waldinger's What makes a good life? Lessons from the longest study on happiness. Waldinger is a psychiatrist, psychoanalyst and the director of the Harvard Study of Adult Development, one of the most comprehensive longitudinal studies in history.

Indulge me in a bit of tough love. Happiness at work is important. Joy at work is important. Happy leaders are better leaders. If on reflection, you conclude that your work brings too little joy and you do not believe you can change that, find something else to do or somewhere else to do what you love. Life is too short to spend one-third of it doing something that does not, from time-to-time, bring you a feeling of great pleasure and happiness.

Happiness, joy and effective leadership are closely linked. Through the @WFLeaders exercise and my reading, I recently realized that when I feel as if I am leading as well as I can, I experience joy. But which is the chicken and which is the egg? I do not know, but I need to be open to the possibility that recognizing moments of joy and drawing on them for strength allows me to lead with courage, purpose and connection.



ABOUT THE AUTHOR

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

FEDS Protection for Wildland Firefighters

As A Wildland Firefighter You Could Face

MANSLAUGHTER CHARGES

**ADMINISTRATIVE &
CRIMINAL INVESTIGATIONS**

PERSONAL CAPACITY LAWSUITS

Professional Liability Insurance with FEDS costs less than \$300, and up to **half of the cost is covered by the USFS.**

CONTACT US TODAY TO GET PROTECTED

(866) 955-FEDS | feds@fedsprotection.com | fedsprotection.com



International Journal of

WILDLAND FIRE

The sum of small parts: changing landscape fire regimes across multiple small landholdings in north-western Australia with collaborative fire management

Michael Wysong, Sarah Legge, Alex Clark, Stefan Maier, Bardi Jawi Rangers, Nyul Nyul Rangers, Yawuru Country Managers, Stuart Cowell and Grey Mackay

Fire is a natural process in tropical savannas, but contemporary cycles of recurrent, extensive, severe fires threaten biodiversity and other values. In northern Australia, prescribed burning to reduce wildfire incidence is incentivised through a regulated emissions abatement program. However, only certain vegetation types are eligible; also, managers of small land parcels are disadvantaged by the program's transaction costs and interannual variability in management outcomes. Both impediments apply to landholders of the Dampier Peninsula, north-west Australia. Nevertheless, Indigenous rangers, pastoralists and other stakeholders have collaborated for 5 years to manage fire across their small holdings (300–2060 km²). We used remote sensing imagery to examine the project's performance against seven fire regime targets related to biodiversity, cultural and pastoral values. At the scale both of individual landholders and the entire Peninsula (18500 km²), the project significantly reduced the extent of annual fire, high-severity fire, mid-late dry season fire, fire frequency and severe fire frequency. The project significantly increased the graininess of burnt and unburnt areas and the extent unburnt for 3+ years more than tripled. The project demonstrates that cross-tenure collaboration can overcome the challenges of managing fire on small land parcels. However, this project's sustainability depends on securing ongoing funding.

www.publish.csiro.au/WF/WF21118

An evaluation of empirical and statistically based smoke plume injection height parametrisations used within air quality models

Joseph L. Wilkins, George Pouliot, Thomas Pierce, Amber Soja, Hyundeok Choi, Emily Gargulinski, Robert Gilliam, Jeffrey Vukovich and Matthew S. Landis

Air quality models are used to assess the impact of smoke from wildland fires, both prescribed and natural, on ambient air quality and human health. However, the accuracy of these models is limited by uncertainties in the parametrisation of smoke plume injection height (PIH) and its vertical distribution. We compared PIH estimates from the plume rise method (Briggs) in the Community Multiscale Air Quality (CMAQ) modelling system with observations from the 2013 California Rim Fire and 2017 prescribed burns in Kansas. We also examined PIHs estimated using alternative plume rise algorithms, model grid resolutions and temporal burn profiles. For the Rim Fire, the Briggs method performed as well or better than the alternatives evaluated (mean bias of less than ± 5 –20% and root mean square error lower than 1000 m compared with the alternatives). PIH estimates for the Kansas prescribed burns improved when the burn window was reduced from the standard default of 12 h to 3 h. This analysis suggests that meteorological inputs, temporal allocation and heat release are the primary drivers for accurately modelling PIH.

www.publish.csiro.au/WF/WF20140

Crown fuel consumption in Canadian boreal forest fires

William J. de Groot, Chelene C. Hanes and Yonghe Wang

Predictive crown fuel consumption models were developed using empirical data from experimental burning projects. Crown fuel load for foliage, bark, branchwood and stemwood were calculated for live overstorey and understorey trees in each plot using nationally derived tree biomass algorithms. Standing dead tree branchwood and stemwood biomass were similarly calculated. Crown bulk density values were calculated for all non-stemwood fuel components. Factors that affect the initiation and spread of crown fires (live crown base height, foliar moisture content, surface fuel consumption, critical surface fire spread rate, critical surface fire intensity) and components of the Canadian Forest Fire Weather Index System were not statistically significant variables. Crown bulk density was moderately correlated with crown fuel consumption but was not an influential factor. A new crown fuel consumption model was developed by regression analysis using fuel

load of overstorey tree foliage and standing dead tree branchwood, and fire rate of spread through crown fraction burned. A simpler model was developed using only overstorey tree foliage fuel load and fire rate of spread. Both models provide forest and fire management agencies with enhanced ability to determine crown fuel consumption, fire behaviour and carbon emissions in boreal fires using basic forest inventory or biomass/carbon datasets.

www.publish.csiro.au/WF/WF21049

Understanding fire regimes in Europe

Luiz Felipe Galizia, Thomas Curt, Renaud Barbero and Marcos Rodrigues

Wildland fire effects are strongly associated with fire regime characteristics. Here, we developed the first European pyrogeography based on different fire regime components to better understand fire regimes across the continent. We identified four large-scale pyroregions: a non-fire-prone (NFP) pyroregion featuring nominal fire activity across central and northern Europe; a cool-season fire (CSF) pyroregion scattered throughout Europe; a fire-prone (FP) pyroregion extending mostly across southern Europe; and a highly fire-prone (HFP) pyroregion spanning across northern Portugal, Sicily, and western Balkans. Land cover analysis indicates that pyroregions were first shaped by vegetation and then by anthropogenic factors. On interannual timescales the spatial extent of pyroregions was found to vary, with NFP showing more stability. Interannual correlations between climate and burned area, fire frequency, and the length of fire period exhibited distinct patterns, strengthening in fire-prone pyroregions (FP and HFP) and weakening in NFP and CSF. Proportion of cool-season fires and large fires were related to fuel accumulation in fire-prone pyroregions. Overall, our findings indicate that such a pyrogeography should allow a more accurate estimate of the effects of climate on fire regimes while providing an appropriate framework to better understand fire in Europe.

www.publish.csiro.au/WF/WF21081

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:

- Wildfires are going to happen.
- The fire service alone lacks the capacity to contain and extinguish these fires at their current pace.

OUTTHINK WILDFIRE CALLS FOR THE END OF COMMUNITY WILDFIRE DESTRUCTION BY 2050.

This comprehensive strategy lays out five key policy changes that need to be made at all levels of government to dramatically reduce the devastation caused by wildfire.

Through collaboration that begins with policy implementation, we can pursue a course of action that will better protect our communities, citizens, and first responders.

Visit nfpa.org/wildfirepolicy
for resources and information.



WATERAX



MOVING THE LEGEND FORWARD

WE MOVE
WATER



The next-gen MARK-3® Watson Edition. 30% lighter.
20% smaller. The evolution of the iconic MARK-3® series.

waterax.com