"Uniting Our Global Wildfire Community"
APRIL 2019 - VOLUME 28.2

WILDFIRE®

THE FIRE GLOBE

GREECE | JULY 2018
CALIFORNIA | NOVEMBER 2018
TASMANIA | JANUARY/FEBRUARY 2019

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

FIRE GLOBE - GREECE. *In the aftermath of the East Attica fire, the narrow roads continued to clog traffic. During the fire, Demokratias Street was one of many that became death traps. Learn more about this and other factors that led to this disaster in the first of three articles on the Fire Globe.*

Fire is a global phenomenon – a topic of study, concern, action and advocacy. In this issue we expand our coverage with a new, regular focus on global fire, with articles this issue on extreme fires from Greece, California and Tasmania.

These articles support another new feature as we launch a series of IAWF Issue Papers. The first topic on 'Extreme Fires' is anchored in our Fire Globe coverage in this issue and in the experience and expertise of our IAWF members.

ON THE COVER: Burning out on the Western Hills Fire on February 5, 2019 near Zeehan, Tasmania.

Photo: Michael Scott Hill

April 2019 *Volume 28, Number 2*

COLUMNS & NEWS

THE FIRE GLOBE

FIRE ISSUES

TAKING CARE OF US

"Uniting the Global Wildland Fire Community"

WILDFIRE

A PUBLICATION OF THE International Association of Wildland Fire
www.iawfonline.org

EDITORIAL
Ron Steffens - Executive Editor
editor@wildfiremagazine.org
Marjie Brown - Managing Editor
wildfirewriter@gmail.com

BUSINESS
Mikel Robinson - Administration
execdir@iawfonline.org
Kim Skufca - Advertising Associate
kim@iawfonline.org
Century Publishing
Post Falls, Idaho (Printing)

WILDFIRE/COMMUNICATIONS COMMITTEE (IAWF)
David Bruce - CHAIR.
Michael Gollner
Richard McCrea
Mikel Robinson
Michele Steinberg
Ron Steffens

ASSOCIATE & CONTRIBUTING EDITORS
Bill Arsenault (USA)
Zev Balsen - Medical Editor (USA)
G. Matt Davies (Scotland)
Michael Scott Hill (USA)
Donato La Mela Veca (Italy)
Adam Leavesley (Australia)
Mark Masters (USA)
Guillermo Rein (UK)
Albert Simeoni (USA)
Cathelijne Stoof (Netherlands)

International Association of Wildland Fire
UNITING THE GLOBAL WILDLAND FIRE COMMUNITY

BOARD OF DIRECTORS
Alen Slijepcevic (Australia) - **President**
Toddi Steelman (USA) - **Vice President**
Albert Simeoni (USA) - **Treasurer**
Steve Miller (USA) - **Secretary**
Mikel Robinson (USA) - **Executive Director**
Tim Brown (USA)
David Bruce (AU)
Murray Carter (AU)
Euan Ferguson (AU)
Michael Gollner (USA)
Tom Harbour (USA)
Sara McAllister (USA)
Kelly Martin (USA)
Amber Soja (USA)
Michele Steinberg (USA)
Cathelijne Stoof (Netherlands)
Johnny Stowe (USA)
Gavriil Xanthopoulos (Greece)

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

Address: International Association of Wildland Fire.
1418 Washburn, Missoula, MT, 59801 USA.
Phone: (406) 625-7059 •
Email: execdir@iawfonline.org.
Editorial Email: editor@wildfiremagazine.org.

Postmaster: Send address change to Mikel Robinson, Executive Director, International Association of Wildland Fire, 1418 Washburn, Missoula MT, 59801 USA.

WELCOME TO OUR GLOBAL FIRE CONFERENCES

Fuels of Today – Fire Behaviour (Behavior) of Tomorrow

The 6th International Fire Behavior and Fuels Conference offers a multi-continent conference to address critical aspects of global fuel and vegetation complexes, interactions and influences, and current and future fire behavior.

The International Association of Wildland Fire (IAWF), Bushfire and Natural Hazards CRC of Australia, and the French National Research Institute of Science and Technology for Environment and Agriculture (Irstea) are extremely proud to present the 6th International Fire Behavior and Fuels Conference.

This conference will be held concurrently in three locations on three continents around the world. Locations include Albuquerque, New Mexico, USA; Sydney, Australia; and Marseille, France. The conference is being presented to bring focus to the many issues associated with fuels, fire behavior, large wildfires, and the future of fire management.

Wildland fire management is frequently categorized as the most complex and highest risk component of natural resource management. In recent years, it has often been talked about in terms of what the future holds, courses to the future, escalating challenges, being at a crossroads, and the pervasiveness of constant change. But what has remained constant is the steady progression toward a program having increasing complexity and capricious risk.

An in-depth analysis of wildland fire management from a global perspective is not necessary to recognize that the fire situation of today now constitutes a year-round activity. Wildland fires are burning in altered vegetation and fuel complexes, exhibiting higher levels of intensity, generally impacting larger areas, persisting for longer durations of time, and more frequently occurring in the wildland urban interface (WUI). In addition, climate change may magnify these issues and bring additional concerns. Overall fire complexity is increasing at a rate that is possibly faster than at any other time in the past several centuries. Future challenges appear formidable.

We know that the future of wildland fire management will necessitate escalated and diverse actions. Significant issues abound. New solutions are needed and, in some cases, will prove hard to define and achieve. Vital components for our success include:

- management of fuel complexes;
- accelerated fuel treatments;
- preparation of communities to withstand wildfire;
- incorporation of learning and experience;
- increasing awareness and use of emerging science and technology;
- as well as ensuring sustainable funding for wildfire suppression and fuel treatments.

IAWF, Bushfire and Natural Hazards CRC, and Irstea recognize these needs. We are committed to promote increased involvement, improved communication, escalated research, focused education and training, and active management support to help mitigate future outcomes, promote success, and advance wildland fire management.

The 2019 6t^{h} International Fire Behavior and Fuels Conference has been designed to be innovative, revolutionary, and provocative. It will provide a forum to facilitate discussion of the latest relevant research findings, disseminate information about management treatments, stimulate policy discussions, and inspire global fire management interaction.

All three venues will offer a stage, with:

- hundreds of oral and poster presentations of new research information, practical experience lessons, and case studies;
- numerous knowledge and skill building workshops;
- on-the-ground learning field trips and tours;
- keynote and plenary presentations; and
- panel discussions by leading experts in wildland fire management and those with firsthand experience of problems, solutions, and outcomes.

Conference participants will be able to share what is known, what needs to be learned, how to advance knowledge, and how to use this knowledge to effectively respond to increasing concerns.

Conferences such as these represent the single best source of up-to-date focused learning, continuing education for fire professionals, program currency, and presentation of research and new knowledge information.

Collectively, we at IAWF, Bushfire and Natural Hazards CRC, and Irstea are excited about the opportunity to partner together to sponsor this conference. We hope that everyone in the field of wildland fire management shares the enthusiasm for a conference on this subject area and agrees that it is timely, relevant, and necessary to provide up-to-date information and better prepare professionals to respond to challenges ahead.

We encourage and welcome anyone involved in or having an interest in wildland fire management to attend one of these conference venues and hope that they will meet, and even exceed expectations of increasing awareness, knowledge, and capability in this important field in addition to affording unparalleled networking opportunities with peers to establish future avenues of discovery. We anticipate that this conference promises to be the most informative, enlightening, and powerful event to date on fire behavior and fuels in wildland fire management.

Authors-coordinators | Auteurs-coordinateurs

Tom Zimmerman,
Past-President, International Association of Wildland Fire

Alen Slijepcevic,
President, International Association of Wildland Fire

Anne Ganteaume,
Research Institute of Science and Technology for Environment and Agriculture | IRSTEA (Institut national de Recherche En Science et Technologie pour l'Environnement et l'Agriculture)

Combustible d'aujourd'hui - comportement des feux de demain

La 6ème conférence internationale "Comportement du Feu et Combustibles" présente une vision multi-continentale pour traiter globalement des aspects essentiels des complexes d'incendies et combustibles, de leurs interactions et influences, et des comportements actuels et futurs des incendies.

L'association américaine IAWF (International Association of Wildland Fire), le centre de ressources Bushfire and Natural Hazards d'Australie et IRSTEA sont très heureux de vous inviter à la 6ème conférence internationale "Comportement du Feu et Combustibles" Cette conférence se tiendra simultanément sur 3 continents : à Albuquerque (Nouveau Mexique, USA), à Sydney (Australie) et à Marseille (France). Elle a pour but de faire le point sur les nombreuses questions associées aux combustibles, au comportement du feux, aux grands feux et à la gestion future de ces incendies.

La gestion des incendies est fréquemment considérée comme la composante la plus complexe et la plus à risque de la gestion des ressources naturelles. On s'interroge depuis quelques années sur ce que nous réserve le futur et comment s'y préparer, sur les défis croissants nous amenant à faire des choix cruciaux devant l'omniprésence de changements permanents. Ce qui n'a pas changé, c'est la complexité toujours croissante du problème et le côté aléatoire du risque.

Il n'y a pas besoin d'analyses poussées sur la gestion du feu pour savoir qu'il est maintenant présent toute l'année. Les incendies ravagent des végétations dégradées et des complexes de combustibles avec plus d'intensité et sur de plus longues durées, en impactant généralement de plus grandes surfaces, et de plus en plus fréquemment dans les interfaces habitat-forêt. De plus, le changement climatique devrait aggraver ce problème et nous confronter à de nouvelles préoccupations. Enfin, la complexité des phénomènes d'incendie croît à un rythme jamais atteint au cours des siècles passés et les défis pour le futur semblent extraordinaires.

La gestion du risque d'incendie demandera à l'avenir des actions plus nombreuses et diversifiées. Les défis sont divers. Ils réclament des solutions originales et innovantes, qui se révèleront parfois difficiles à concevoir et à mettre en œuvre. Les points essentiels pour y parvenir sont la gestion des complexes de combustibles, le traitement accéléré de ces combustibles, la préparation des populations au risque, l'intégration des apprentissages et de l'expérience, la prise en compte et l'utilisation de technologies émergentes, un financement durable pour la lutte et la prévention.

L'IAWF (International Association of Wildland Fire), le Bushfire and Natural Hazards et IRSTEA reconnaissent ces besoins. Nous sommes attachés à promouvoir une implication accrue, une communication optimisée, une recherche intensifiée, une éducation et formation ciblée et un support actif à la gestion pour aider à atténuer les conséquences futures des feux, promouvoir le succès et améliorer la gestion du feu.

La 6ème conférence internationale "Comportement du Feu et Combustibles" en 2019 a été conçue pour être innovante, révolutionnaire et provocante. Elle servira de forum pour faciliter la discussion sur les dernières recherches les plus significatives, disséminer l'information sur les traitements de gestion, stimuler les discussions sur les politiques et inspirer une interaction globale de la gestion du feu.

Les trois lieux de conférence offriront une plateforme pour :
- -des centaines de présentations orales et posters avec les dernières informations en matière de recherche, des enseignements pratiques issus des expériences de terrain et des études de cas,
- -de nombreux ateliers pour la connaissance et la formation,
- -des sorties sur le terrain,
- -des séances plénières et des exposés thématiques,
- -des panels de discussion par des experts reconnus dans la gestion du risque incendie possédant une expérience directe des problèmes rencontrés, des résultats obtenus et des solutions à apporter.

Les participants à la conférence pourront débattre des résultats obtenus, des avancées qui restent à faire et comment les connaissances acquises peuvent répondre aux problèmes posés.

Les conférences qui sont proposées représentent une opportunité unique pour acquérir une information spécialisée, pour aider à la formation continue des professionnels du feu, pour définir des programmes et connaître les résultats issus de la recherche. Collectivement, l'IAWF, le Bushfire and Natural Hazards CRC, et IRSTEA se sont engagés pour proposer cette conférence. Nous espérons que tous ceux impliqués dans le domaine de la gestion du feu seront enthousiasmés par cette conférence, apprécieront la pertinence des thématiques et y trouveront une information précise et utile pour les préparer aux défis futurs.

Nous encourageons et invitons quiconque est intéressé dans la gestion du feu à assister à la conférence dans l'un de ses sites. Nous espérons que les attentes de chacun seront comblées et même dépassées en matière de connaissance, de sensibilisation et de renforcement des compétences dans ce domaine. Cette conférence offrira aussi des possibilités inégalées de mise en réseau et de partenariat pour explorer de nouvelles voies. Nous sommes confiants dans le fait que cette conférence saura être l'évènement le plus informatif, enrichissant et marquant sur le comportement du feu et les combustibles dans la gestion du feu.

OUR FIRE GLOBE

And introducing Marjie Brown, our new managing editor

While we've been covering global fire news and issues for a good amount of time (the magazine is entering our 28th year), this month we're expanding by adding two new features (plus a new editor too).

First, we're helping launch an IAWF "Issues Paper" initiative - to examine key issues and spark a dialogue and action. The first topic is "Extreme Fires" - which leads into our second new feature: a series of articles examining "The Fire Globe." With articles on Greece, California and Tasmania we follow the chronology of an extreme-fire year across the globe. And will continue to do so. Also in this issue: an invitation to a tri-nationally hosted Fuels and Fire Behavior Conference, two columns on leadership, and a two-part analysis of how we might build a "Wildfire Science for Success" tradition.

With this expansion, it was time to grow our staff. Meet our new Managing Editor, Marjie Brown, though with her years of work as a wildfire writer, it's only natural to let her introduce herself:

"After writing about wildland fire for nearly fifteen years, I am thrilled to join IAWF as Managing Editor of Wildfire Magazine. Many of you in the US and abroad have known me as a regular face at conferences, workshops and field tours for over a decade. I can reliably spotted sitting in the second row for presentations, snapping photos, birthing hashtags and tweeting away. I've also been known to irritatingly weasel up to the front of the group with my camera on conference field trips (Sorry!). You may know me through my many years as a wildland fire science writer for the Joint Fire Science Program. I may have even pestered you for an interview for a Fire Science Brief. Over time I've developed a valued crew of perpetually inspiring friends and colleagues from across the spectrum of wildfire professionals whom I consider family.

"As I integrate myself into the global community of IAWF, I look forward to expanding that family by meeting as many of you as possible, hearing and sharing your stories, learning from you, and generally being in awe of your experience and knowledge. I believe the more connected we are - in person, through the stories in this magazine, digital pathways, or all of the above, the stronger our wildfire work and community will be as we face our shared future on this warming planet. Would you like to contribute an article or photos to Wildfire Magazine? Do you have feedback for us as we expand our content? Find me on Twitter @wildfirewriter_, message me on Linkedin, say hello through email (wildfirewriter@gmail.com), or flag me down in Albuquerque. Be safe and hope to see you soon - Marjie."

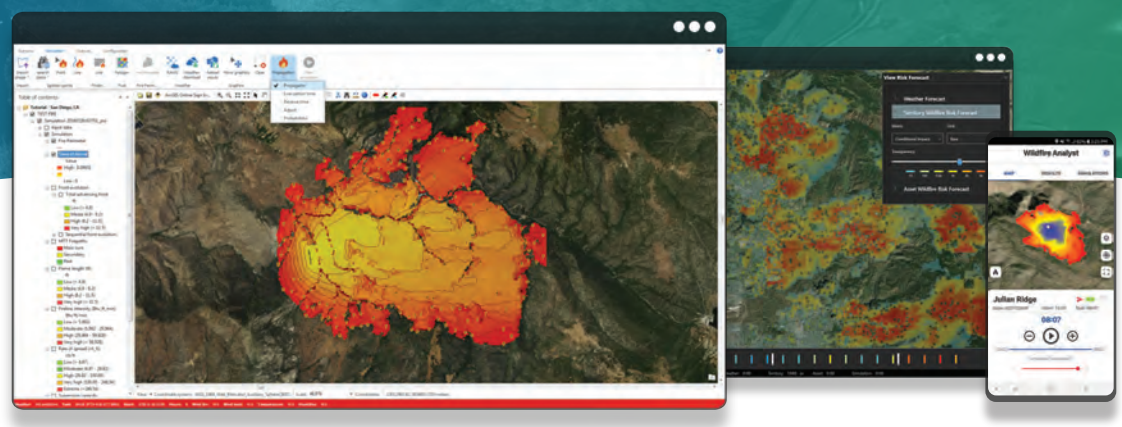
With Marjie as managing editor, I'll continue in an editing role as executive editor while also looking for publishing strategies to promote our communities and conversations. I join with Marjie and ask for your guidance, input and help in covering the Fire Globe.

Wildfire ANALYST

Real-Time Wildfire Modeling

Solutions for Fire Behavior Simulation Analysis & Wildfire Risk Forecasting

www.wildfireanalyst.com • www.technosylva.com



Wildfire Analyst is software that provides real-time analysis of wildfire behavior and simulates the spread of wildfires. Wildfire Analyst is available as a standalone Desktop software program and an Enterprise wide subscription service. Both offerings utilize the same Wildfire Analyst modeling engine that provides **advanced fire behavior analysis in seconds**. Enhanced modeling capabilities support deterministic, probabilistic, real-time adjustments based on field observations, and values-at-risk exposure analysis.

Wildfire Analyst Desktop for Analysts & Planners

The Desktop version is designed to meet the needs of fire planners and operational fire behavior analysts, FBANs and LTANs. Time is of the essence, and Wildfire Analyst was specifically architected to support initial attack situations, giving the Fire Chief and Incident Commander the critical intelligence needed to support suppression and resource allocation decisions.

Wildfire Risk Forecasting Subscription Service – FireCast

The Enterprise version is available as a cloud-based subscription service. Millions of simulations are undertaken daily through integration with advanced weather forecasting models to derive a wildfire risk forecast for a 72-hour horizon. The hourly risk forecast is accessible from desktop, web and mobile applications for subscribers.

Contact us for a demo!

contact@technosylva.com

TACTICAL ANALYST

technosylva

fiRESPONSE

Boundary-Crossing and Leadership

Working across boundaries to reduce fire risk will present challenges that may bewilder even normally nimble fire organizations

by Michael DeGrosky

These days, here in the western U.S., we're all about shared stewardship and cross-boundary management among good neighbors - each doing our part to implement the National Cohesive Wildland Fire Management Strategy at the landscape scale. In other words, we've acknowledged that fire and forest health issues do not conform to geopolitical boundaries and agency jurisdictions. We seem ready to reflect this fact not only in our natural resource policy but also in our management.

Without a doubt our work represents magnificent aspirations -- coordinating efforts across ownerships and jurisdictions, sharing burdens, working collaboratively, and targeting our work into the most fire-prone landscapes. Yet these aspirations are also a tremendously practical philosophy for responding to our most pressing natural resource issues. It's an exciting and challenging time to be working in fire and natural resources with a newfound sense of purpose.

However, those of us who've engaged in collaborative work know that it can be tough. Having observed efforts to increase the pace and scale of restoration forestry both up-close and from afar for many years, I must say that achieving the promise of cross-boundary collaboration is a challenging game-changer for most agencies and organizations in this arena. Whether boundaries are geographic, organizational or both, this approach often requires new thinking, new organizational structures, new resources, and a changed mindset, all of which can confound the most agile of organizations.

Useful cross-boundary work can also require intense cooperation between different parts of the same organization, and between people whose previous partnership with one another has been limited or nonexistent. The speed bumps can be many, and to the surprise of many a leader aiming to foster this model, internal hurdles can prove as high as those between agencies. That's why, since the inception of the National Cohesive Wildland Fire Management Strategy in 2009 I've observed (and this has become a mantra for me), that organizations cannot be cohesive externally without first being cohesive internally. With new and turbulent challenges comes the need for adaptive, enabling leadership -- an emerging paradigm that I've written about in these pages before. As I reflect on my experience working with leaders in pursuit of useful cross-boundary work at a meaningful scale, I see the following challenges and offer some leadership advice.

> "Organizations cannot be cohesive externally without first being cohesive internally. With new and turbulent challenges comes the need for adaptive, enabling leadership – an emerging paradigm."

We resist change.

Writing in the Harvard Business Review in 2012, Rosabeth Moss Kanter chair and director of the Harvard Advanced Leadership Initiative, identified ten common and predictable reasons why change catalyzes resistance. Moss Kanter contends that "….the best tool for leaders of change is to understand the predictable, universal sources of resistance in each situation and then strategize around them." While I briefly touch on some of Kanter's observations and proposed solutions in this column I strongly encourage Wildfire readers to read her excellent article at https://hbr.org/2012/09/ten-reasons-people-resist-chang. In which she explores how we fear losing autonomy and control over our work. We crave free will and self-determination. So allow those who are affected by a change to make choices. Give them ownership by inviting them into the planning.

We fear uncertainty.

When we can't see what's coming or where we're going, we resist. Even people who want something different don't want things to be too much different. If a leader is sending signals that too much (or everything) is going to change people naturally resist. Both management science and practical experience supports the idea that visionary leadership builds support for, and blunts resistance to, organizational change by describing a better and more appealing future. However, I recently read a fascinating research article by Merlijn Venus, Daan Stam, and Daan van Knippenberg. They suggest that to get people to embrace change, leaders must emphasize what will stay the same. This information helps overcome fears that the organization will no longer be the organization they value and with which they identify. Wildfire readers can also read this excellent article at https://hbr.org/2018/08/research-to-get-people-to-embrace-change-emphasize-what-will-stay-the-same.

Those involved in crafting the previous course become defensive.

I feel safe in saying that everyone fears the perception that they worked hard, applied their knowledge and skills and came up short. Effective leaders help people in this situation let go, maintain their dignity, and move on by acknowledging and commending past efforts and achievements. Leaders make clear that additional change is needed not because the previous strategy was inadequate, but because the operating environment has changed.

Change can cause us to feel inadequate.

When impacted by a significant change in the workplace we worry that our skill set may no longer be needed, and can become concerned about our ability to achieve what's expected of us. In my experience, smart leaders invest time and effort in providing information, education, training, mentoring, support, and reassurance. They help people understand the desired outcome, the process, and the timetable for completion. They don't expect too much, too soon, recognizing that people will naturally move toward the desired future state at variable speeds and by different routes reflecting individual readiness and personality.

Empathy forms the basis of trusting relationships.

Leaders who face resistance to change help their people, their organization and themselves by employing empathy and compassion. Let's face it, no leader likes opposition. Unfortunately, it's human nature to divide people into cooperative and uncooperative camps. However, we need to understand that people are stressed when faced with uncertainty. In my experience, the most effective leaders avoid the impulse to isolate and control those who resist. They keep them focused on accomplishing the desired future state while serving and benefitting all employees. They ask people what they need, talk with them one-on-one, let them say what's on their mind, and put themselves in their shoes. Leading with understanding and compassion also means providing extra guidance, fostering flexibility, focusing on priorities, and reducing distractions.

Bureaucratic organizations rely on rules and hierarchy that can stifle important innovation and creative problem-solving.

I've said it before, and I'll repeat it: in today's turbulent environment, leaders must get over the idea that they can direct complex organizations or control future outcomes in complex situations in traditional ways. Instead, I recommend focusing on fostering conditions that allow new organizational structures to emerge and people to innovate on the fly. According to the best and most current research I've seen, enabling individuals and groups to work adaptably requires a leader to foster network development and to role-model the value of networks that catalyze innovation -- to encouraging others to innovate rather than doing all the innovating themselves, to interpret emerging events rather than trying to direct them, and to manage peoples' communication rather than the people themselves.

Leaders who succeed in chaotic environments know that they can produce remarkably effective solutions when they involve people in crafting direction and solutions to challenges. I'm influenced by research conducted by Mary Uhl-Bien and Russ Marion who posit that in bureaucratic organizations, leaders provide the highest value when they engage in "enabling leadership." I think of this as the leader serving as the linking pin between the organization's formal, administrative leadership and its informal, emergent leadership. Uhl-Bien and Marion contend that when leaders provide this interface, new, innovative, adaptive concepts and ideas arise from the organization.

The promise of collaborative, cross-boundary work makes this an exciting time to be working in fire and natural resources. Many of us find ourselves animated with a new sense of purpose. Successful leaders will be those who strive to understand the universal reasons people resist change, involve others in crafting direction and solutions rather than trying to solve problems alone, and lead with empathy and compassion.

Mike DeGrosky is Chief of the Fire and Aviation Management Bureau for the Montana Department of Natural Resources and Conservation, Division of Forestry.

He taught for the Department of Leadership Studies at Fort Hays State University for 10 years. Follow Mike on Twitter @guidegroup or via LinkedIn.

IAWF News

SCHOLARSHIPS, DIVERSITY AND INCLUSION, PRINCIPLES OF CONDUCT

Now Accepting Applications for our 2019 IAWF Student Scholarships

In an effort to promote scholarly pursuits and graduate level training within the global wildland fire community, we will again be awarding two graduate-level scholarships, each valued at $3,000 USD to IAWF members who are Master of Science/Arts (MSc/MA) or Doctoral (PhD) students studying wildland fire or wildland fire-related topics. We encourage applications from students studying any aspect of wildland fire, be it from the perspective of physical, ecological or social science or less traditional subject areas. The application period will be open from 6 March 2019 to 19 April 2019. Scholarship recipients will be announced by mid-June 2019. The scholarships will be awarded to the top MSc and PhD applicants based on the student's submitted essay.

Learn more and apply:
https://www.iawfonline.org/scholarships/

Embracing Diversity and Inclusion

Being a diverse and inclusive organization enables the International Association of Wildland Fire to learn from others, grow our understanding, and find new ways to address, understand and implement solutions to complex problems. We maintain a positive, empowering, inclusive, and innovative culture that enables all members of the fire community to feel safe and valued when contributing to the IAWF. We operate in a flexible and open manner to help members achieve their fullest potential.

See our Full Diversity and Inclusion Policy:
https://www.iawfonline.org/diversity-inclusion/

Principles of Conduct – Living Our Values – Leading by Example

In the conduct of personal and professional matters, IAWF places high importance on the values of integrity, responsibility, and reputation. We are committed to maintaining high standards both within the organization and in our dealings with others in our daily lives. Our leadership has developed Principles of Conduct to define acceptable and unacceptable ethical behaviors. It's important that our standards are readily available, clear, and understandable. We've established these guidelines to be followed by all members at all times, and non-members who may be participating in any IAWF activities. This helps ensure that IAWF promotes, achieves, and maintains high standards of practice and provides a benchmark for members and non-members participating in IAWF activities to use for self-evaluation. Compliance with these standards demonstrates our individual and collective respect for our profession, our professional and personal relationships with others, and our respect and commitment to the long-term vision, goals, and values of IAWF.


International Association of Wildland Fire
Principles of Conduct
Living Our Values – Leading by Example

In an additional effort to ensure the safety and comfort of all members and participants at all times at IAWF events, we have recently joined with the Spot company to utilize their AI reporting tool.

This tool provides a mechanism for members and others to safely speak up, report, and document any incidents of inappropriate behavior and violations of the IAWF Principles of Conduct. It provides safety and security. Reporting can remain anonymous. We're very excited to add this capability to our efforts to improve diversity, inclusivity, and reduce inappropriate behavior in our activities. Additional information about this reporting tool will be coming very soon. We plan to have Spot available by the 6th International Fire Behavior and Fuels Conference.

Read our Principles of Conduct:
https://www.iawfonline.org/diversity-inclusion/

YOU ASKED FOR IT...

PACER

PACER PUMPS DELIVERED!

POTABLE DRINKING WATER PUMP

- SELF-PRIMING AFTER INITIAL PRIME
- CORROSION RESISTANT
- HIGH VOLUME – 180 GPM MAXIMUM
- NSF-ANSI 61 & 372 CERTIFIED
- EASY CLEAN-OUT
- LIGHTWEIGHT
- MULTIPLE DRIVE UNITS AVAILABLE

MODEL IPW2WL

NSF
Certified to NSF/ANSI 61 & 372

Call 800-233-3861 or visit pacerpumps.com for more information

Complete Wireless Technologies

Independent experts in pager and radio service for public safety, governmental entities and commercial companies

- 27+ years of technical experience in the wireless industry
- Business and manufacturer warranty service center
- Sales and Service for Motorola, Bendix King, Harris, Hytera, Vertex Standard, Unication, Apollo, David Clark, Firecom and many more!
- Complete Wireless Technologies is your one-stop-shop for sales, service, repair, maintenance and technical expertise

$120 Flat Rate BK Portable Repairs

Specializing in BK Technologies
All Legacy Series Radios!
No hidden costs or fees
No charge for non-repairs!

$85 Flat Rate Minitor Repairs

Tuning & Alignment of Receiver
Full Functionality Testing
Fast Turnaround
Internal Components Replaced
Housing/Casing Parts Replaced at No Charge

Nationwide Sales & Service

CALL TODAY!

(866) 747-8324 **www.compwiretech.com**

sales@compwiretech.com 621-C Innovation Circle Windsor, Co 80550

IAWF ISSUE PAPER: EXTREME FIRES

This is the first of a range of Issue Papers that the board of the International Association of Wildland Fire is preparing to develop an engaged discussion of the key issues facing our profession today. Future topics include Fire Suppression (June), Competing Resources (August) and International Cooperation (October).

BACKGROUND

During the 21st Century wildfires globally are becoming increasingly deadly and destructive. It is not just an increase in the size of fires that is being observed, but a steep increase in impacts encompassing a high number of human fatalities, homes and structures destroyed by the thousands, and an upward trend in smoke exposure related to human health.

In recent decades, beginning in the late 1990s, we have seen an increase of difficult fire seasons -- more frequently overall, and in landscapes and seasons where such difficult fires were rare. Signals of the impact of climate change on fires started in 1997,starting with more than a decade long drought in SE part of Victoria,and with significant peat fires in Indonesia that same year.

The United States started to experience frequent significant fire seasons starting in 2000 when large number of resources came from Canada, Mexico, Australia,and New Zealand. These large movements of resources have become a norm since 2000 as fire seasons have become more severe compared to previous decades.

By 2002, "mega-fires"became a norm in southern Australia. Unfortunate examples of recent very high impact events include Portugal(twice in 2017), California(in 2017 and 2018), and Greece in 2018. Swiss Re reports that 2017 was the costliest year on record for wildfire insured losses($14B USD). Three of the top 20 costliest world insurance losses in 2017 were related to wildfire.

WHY THE TRANSITION TO EXTREME FIRES

This transition to extreme fires appears correlated with three primary trends.

1. Climate change is often cited as a cause of this increase in wildfire activity. Increased temperature (and subsequently drier atmosphere) relates to a reduction of dead fuel moisture via the equilibrium moisture content. Warmer temperatures increase plant evapotranspiration and reduces soil water uptake, thus reducing live fuel moisture. While weather drives fire behavior, climate enables fire, particularly when regional climates experience more erratic phases -- with longer periods of wet for fuel growth and dry for fuel flammability.
2. Abundant vegetation is climate related, but for many places heavy fuel loads are also a function of past and current land management practices. Fire exclusion over long periods allows for increased fuel density, provides for a ladder of fuels, and during extreme environmental conditions enables extreme fire behavior. Yet with both climate change and land management practices in mind, "global area burned appears to have overall declined over past decades, and there is increasing evidence that there is less fire in the global landscape today than centuries ago" (Doerr and Santín, 2016).
3. The rising trend in destructive fires has a third component in addition to climate and fuels – people are moving into fire and fire is coming to people. In many places,there is a shifting increase of population density into areas that are naturally fire prone – places where fire is known to have occurred for centuries and thousands of years. In other places, people are abandoning land that was managed and thus allowing it to go wild, with subsequent impact on fuels management. These locations are often referred to as a "wildland-urban interface" or a "rural-urban interface," and "interface" is sometimes referred to as "intermix." Areas where impacts of extreme fire may occur include: building next to or in a forested region;housing abutting grass and shrubland; communities near abandoned farmland; and firestorms entering deep into urban developments.

Based on this analysis of factors, it is suggested that there is not a single cause to today's extreme,deadly and destructive wildfires, but rather a triangle of three factors – climate, fuels, and people. These are not mutually exclusive,though in fact all three are human-driven when considering a warming climate, fire exclusion, and population densities that not only live in fire prone areas but are the primary cause of ignitions.

A DIALOGUE ON EXTREME FIRES

We propose a number of key questions related to climate, fuels, and people. One or more answers are provided,based on input from IAWF review of this issue and its related topics,but we recognize that there are varying viewpoints and perspectives.

We invite additional responses, and hope to engage ideas and insights as part of a broader discussion among the international wildfire community.

Wildfires in the Mendocino National Forest (iss056e126709 - Aug. 4, 2018). Examples of extreme wildfires are seen in northern California and near the San Francisco Bay Area as the International Space Station orbited 252 miles above the United States.

KEY QUESTIONS FOR IAWF MEMBERSHIP

CLIMATE

Q 1. What are the geographic climate trends that are potentially associated with changes in wildfire activity?

Response: There are more frequent periods of unstable atmospheric conditions resulting in high winds, rapid fire growth, extreme fire behavior, and convective storms that provide lightning for ignitions.

Response: There has been a significant decrease of winter rainfall in SE Australia which leads to earlier onset of fire seasons.

Response: An increase of night-time warming temperature has been observed globally.

Q 2. What is being observed in terms of changes in the fire environment? In particular, how are weather and climate extremes being manifested in wildfire?

Response: Fuels in many geographic locations are drier in relation to temperature warming, and thus more flammable.

Q 3. What can be said about the extent of 21st Century fire extremes compared to the 20th Century?

Response: While extreme fires and seasons have occurred in the past, they now occur more frequently.

Response: The frequency and severity of heat events has increased which has a major impact on population(heat-related deaths) and dryness (availability) of fuel.

FUELS

Q 1. How are fuels different today than a century ago, and if different, what are the likely reasons?

Response: In Australia, vegetation that grows back after large, severe fires has a different structure to the original vegetation. It becomes very grassy and shrubby with more open canopy which leads to quicker drying and also fires burn quicker to it. That is especially noticeable in wet forests.

Response: In some regions there has been observed an increase in vegetation mortality related to hotter drought conditions.

Q 2. Given a changing climate and potential human health impacts(e.g., from smoke), what strategies can be employed to manage fuels?

Response: Mechanical treatment will need to be explored, especially closer to communities.

Response: The current debate about smoke impacts are based on comparing prescribed fire smoke with no smoke. As 'no smoke' is not a real option (we will have more wildland fires in the future), the debate needs to be shifted to find the right balance of treatments to minimise risks to life, health and other values from fires and also from prolonged smoke events.

Crown fire on the Valley Complex Fire in Montana in the summer of 2000 – a fire season that many identify as a benchmark of the extreme fire era. Photo: USDA Forest Service-Northern Region (CC BY 2.0).

PEOPLE

Q 1. What are viable actions that can be undertaken to help mitigate against home loss and public safety?

Response: The current design for expansion of cities and towns transfers the risk onto land and fire managers. The only proactive lever that land and fire managers have is land use planning. The changes to use of land should include a significant consideration of hazards that may impact on those new settlements/suburbs that happen due to population growth. Smarter design of those suburbs, ex-urbs, villages and related community growth need to incorporate green buffers such as golf courses and other sport fields, and agricultural and/or managed fuel breaks that will provide a better protection to developments than the current building of houses right against and within the vegetation.

Response: Building standards and codes need to be improved to make houses more fire resistant,including potential inclusion of roof sprinkler systems.

Q 2. How does management communication to the public need to change to reflect the new paradigm of fire on the landscape?

Response: The public needs to learn to live with fires in a similar way it accepted reality of other hazards such as floods, storm surges, tornadoes, hurricanes, etc. Our communication needs to reflect this and consider that the community is not homogenous, but a group that is diverse in education, social capital, age and racial/cultural background;therefore,in order to have impact,our communication activities and messaging need to consider these differences.

Response: Currently we are constantly reporting on fires that we are successfully suppressing that do not cause any damage (which is around 98%in the United States). That has built community expectations that we could do the same for the remaining 2% if we can just get better, have more resources, have access to larger aircraft, etc. We need to educate the community and governments on how fires at the extreme end require not just more resources but vastly different resources, skills,and approaches to planning and education.

REGIONAL EXTREMES

Q 1. What is the regional extent of extreme fire and what are the primary driving and/or enabling factors?

Response: The geographical extent of every year. More and more people are moving into areas that are fire prone. Most of these people have no experience living in such environments,which creates an increased risk.

Q 2. How do today's extreme events compare to known historical fire?

Response: They are more frequent, and because of housing and other values at risk and increased flammable vegetation,these extreme events require changes in suppression tactics and in strategic planning.

REFERENCES

Doerr SH, Santín C. 2016. Global trends in wildfire and its impacts: perceptions versus realities in a changing world. Phil. Trans. R. Soc. B 371: 20150345. http://dx.doi.org/10.1098/rstb.2015.0345

Werth, Paul A.; Potter, Brian E.; Clements, Craig B.; Finney, Mark A.; Goodrick, Scott L.; Alexander, Martin E.; Cruz, Miguel G.; Forthofer, Jason A.; McAllister, Sara S. 2011. Synthesis of knowledge of extreme fire behavior: volume I for fire managers. Gen. Tech. Rep. PNW-GTR-854. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 144 p.

BACKGROUND - PRIOR POLICY PAPER

"Reduce wildfire risks or pay more for fire disasters." Policy Paper. 2015. International Association of Wildland Fire, Association for Fire Ecology, The Nature Conservancy.

Wildfire Magazine. Fall 2015. https://www.iawfonline.org/article/reduce-wildfire-risks-or-pay-more-for-fire-disasters/

Full Paper, April 16, 2015: https://fireecology.org/Reduce-Wildfire-Risks-or-Well-Pay-More-for-Fire-Disasters/

Talk to us at the conferences and online...

At each of three Fire Behavior and Fuels conference sites we will include opportunities for you to share your thoughts on this and other issue papers.

In addition to opportunities at the conferences, you can contribute your response at any time via our IAWF Twitter and/or Facebook feeds. Visit IAWFonline.org for more on the Issue Papers and submitting comments.

PLEASE USE THE HASHTAG

#ExtremeFires

SO WE DON'T MISS YOUR VOICE!

twitter.com/IAWF
facebook.com/IAWFire
email: **issuepapers@iawfonline.org**

ATTICA REGION, GREECE JULY 2018

By Gavriil Xanthopoulos and Miltiadis Athanasiou
(Photos by the authors)

The 2018 fire season in Greece started out quietly. The weather was quite favorable, with above average precipitation and lack of strong winds and/or heat waves. But on July 23rd - things changed dramatically. On that tragic day, a wildfire in Northeastern Attica set a new record for fire fatalities in Greece, and became the second deadliest fire in the world for this century. One hundred people were killed and 150 more injured. More than 1,650 homes burned along with 1,431 hectares (5.5 square miles) of agro-forestry vegetation and urbanized land. We provide a synoptic overview of what happened that day and identify the major factors contributing to the disaster in the hope of helping Greece and other countries to avoid similar tragedies in the future.

The information is sourced from:

- Video footage and photographic material of numerous citizens uploaded on social media. Most people were located, contacted, and in many cases interviewed in person.
- Interviews with professional and volunteer firefighters who worked on the fire perimeter.
- Interviews with locals during numerous visits in the area immediately after the fire, including residents who chose to leave and many who decided to stay, accepting the risk of entrapment.
- Data and information reported in the mass media, by public agencies, and in photos.

July 23rd was the first day of the 2018 season for which a "very high" fire danger rating (class 4 in the 1-5 range) had been assigned in the region of Attica, and to a large part of southeastern continental Greece, in the Fire Danger Prediction map issued daily by the General Secretariat for Civil Protection. This rating was due to a forecast of strong to extreme westerly winds.

At 12:03 that day, the first fire erupted on Mount Geraneia in western Attica, about 50 kilometers (31 miles) west of Athens near the town of Kineta, which is surrounded by forest. Fanned by the strong wind, it grew rapidly and swept through Kineta destroying many houses. It then spotted over the six-lane national road that connects Athens with Peloponnese, reaching the sea

A TALE OF TWO FIRES *and* A SEASIDE TRAGEDY

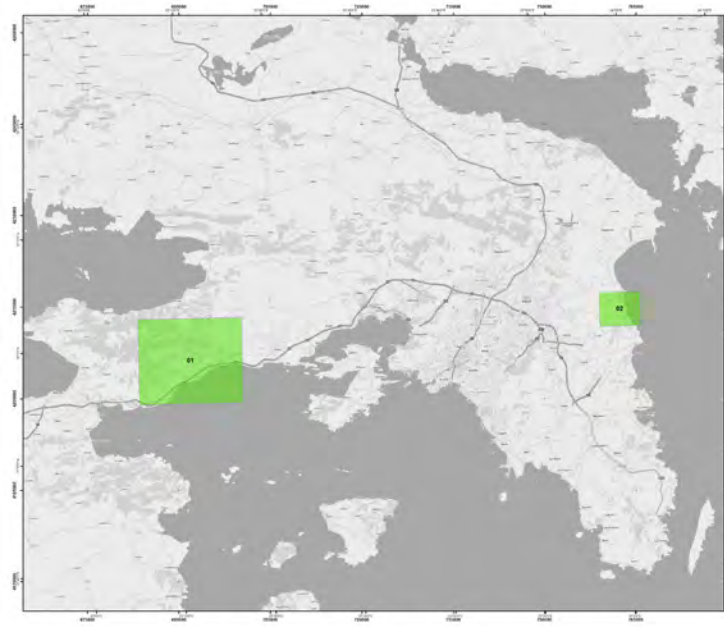
Above: Where the fire burned, moving from left to right.

where it threatened a large oil refinery. It was the high risk to people and property in the Kineta wildland-urban interface (WUI), to the travelers on the national road (where traffic had to be stopped for hours), and to the oil refinery, that forced the Fire Service to dispatch a very large portion of ground and aerial firefighting resources in Attica to the affected area.

While attention and resources were concentrated in western Attica, a second wildfire erupted on Mount Penteli at 16:41 in the northeastern part of the Attica region (Figure 1). The start was within the perimeter of an August 2009 wildfire in the settlement of Daou Pentelis, roughly 5.2 km west of the coast. According to weather measurements at the National Observatory of Athens on Mt. Penteli, the prevailing wind was WNW with speeds ranging from 32 to 56 km/h for the first two hours after the fire start, with gusts of 50 to 89 km/h. Temperature didn't exceed 31^{o} C and relative humidity varied between 34% and 43% making the probability of spotting relatively low. Until that day, the season had been much wetter than usual and the vegetation was not water stressed.

In eastern Attica on the 20th of July, the older needles of the

Figure 1. Fire areas in western and northeastern Attica (in green).



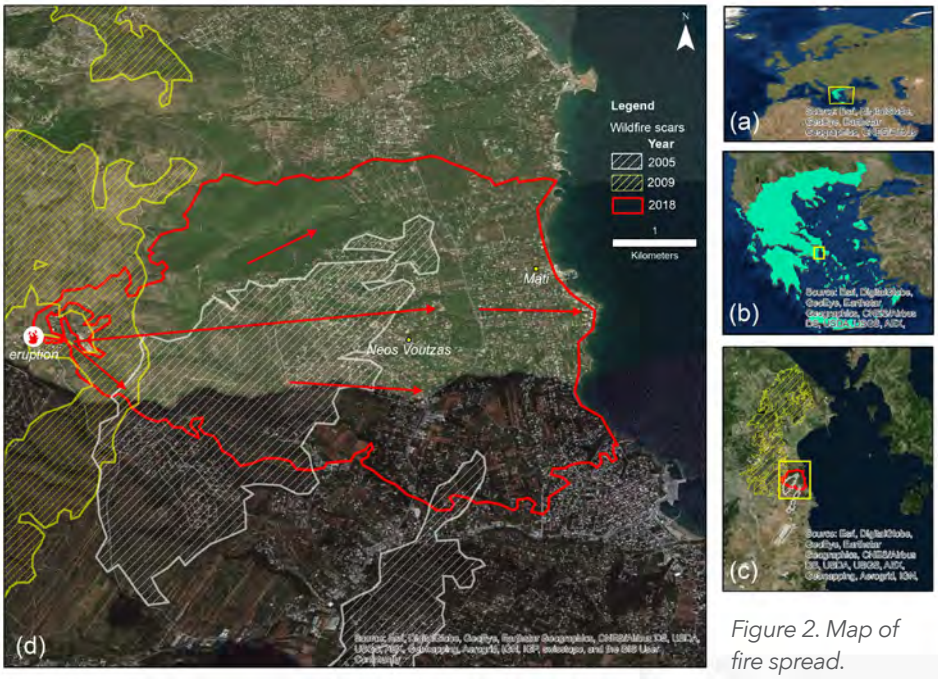


Figure 2. Map of fire spread.

primary tree species, Aleppo pine, had a moisture content of 100% while new needles registered 133%. The leaves of the Eastern Mediterranean evergreen shrubs, Kermes oak and lentisk, were at 83% and 97% respectively. The dwarf, spiny, Pink Rock-Rose shrubs were at 112%, with Thyme at 80%. Even with this unusually high moisture content, and with relatively limited spotting, the intense winds were able to generate a high rate of spread (ROS) via surface or passive crown fire. Much of the initial run of this second fire took place in an area that had burned 13 years earlier on July 28, 2005. Moving eastwards towards the settlement of Neos Voutzas, the fire spread through jumbled ravines and gorges and up several leeward, steep slopes. Fuels consisted of Mediterranean shrubs, a few scattered olive groves, and stands of Aleppo pine.

As the catabatic wind (named from the Greek word κατάβασις or katabasis - https://en.wikipedia.org/wiki/Katabasis%22%20%5Co%20%22Katabasis), meaning "descending") blew towards the sea through rough topography, meteorological conditions in the draws were affected by higher wind velocities, higher temperatures, and lower relative humidity. At the Hellenic National Meteorological Service station at Rafina, near the sea, temperature reached 38oC and RH dropped to 17% at 16:45. Gale force winds resulted in high ROS from the first stages of the fire. It's estimated that five minutes after its eruption, the wildfire perimeter length was about 400 meters and the first house was already in flames. Within the next 35 minutes the perimeter length was more than 3,500 m, having formed two fingers - one spreading southeast and the other to the east (Fig. 2).

Twenty minutes later the perimeter was at least 6,000 m as it approached the western boundary of the settlement of Neos Voutzas. After reaching Neos Voutzas, the fire spread faster eastward through the central and southern part of the settlement, and approached Marathon Avenue with an impressively rapid downslope run. The left flank of the fire spread northeastward along a narrow, deep gorge that forms the north boundary of the settlement. It traveled through mature, dense pine forest that had not seen fire recently, spreading more slowly but with higher intensity while making quick, topography-driven, upslope runs. Reaching Marathon avenue, the length of the perimeter had exceeded 11 km.

At the foot of Neos Voutzas Hill the fire became a high intensity passive crown fire, then quickly transformed into a high intensity, wind-driven, active crown fire. With flame lengths exceeding 20-30 meters it crossed Marathon Avenue, heading towards the coast through a mixture of homes and pines in the settlement of Mati, having morphed into a rapidly advancing active, and at times even independent crown fire. Many witnesses reported that the fire arrived with random, intermittent ignition of crowns above their heads, as hot gases were pushed forward by the extreme wind.

After crossing Marathon avenue, the faster fire finger, roared through Mati at a ROS of approximately 4 km/h, followed by many other fire fingers that advanced rapidly, almost concurrently, towards the coast. The head of the faster finger reached the sea in less than two hours after fire eruption. Given that the distance (straight line) between the eruption site and the coast is roughly 5.2 km, the mean ROS was 2.6 km h-1. Such ROS is not very rare, but the erratic fire behavior with bursts of ROS exceeding even 5 km/h for short periods of time explains the difficulty of the situation.

The high growth rate of the fire perimeter, the delayed arrival of fire trucks because of the focus on Kineta, and the difficulty of employing aerial resources due to wind, can explain, among other factors, why suppression efforts were not successful.

Panic and Loss: Unprepared. Uninformed.

As the fire was approaching there was no warning or direction from local authorities or other community leaders. This, along with the lack of any preparatory measures for fire protection (settlement fire plan, citizen education or home preparation) increased the risk and damage. The fast rate of spread surprised residents, motorists, and visitors who happened to be in the area. The smoke and hot gases being pushed ahead of the fire by the strong wind made it difficult to see and breathe, causing panic.

While many people made quick decisions, either moving out of the fire's path in time or sheltering in their homes (which in Greece are generally built with non-flammable materials), many others tried to escape at the last moment in their cars where they were immediately caught in the traffic jam that formed in the narrow streets near the sea. Some perished near their cars while others continued to try to reach the water. Some could not find a passage and found themselves at the crest of a sea cliff, trapped, with the fire behind them. Others managed to get into the water but were exposed to heat and smoke for hours as rescue boats came hours later. Others did not survive, including victims who drowned trying to swim away from the coast to escape the unbearable conditions.

Aftermath: Seeking Knowledge and Solutions

The specialized teams that meticulously investigated the site after the fire were able to locate the bodies of 83 victims. An additional seventeen people died in the hospital during the

following days, while a few more are still hospitalized as of this writing. The total death toll currently stands at 100 fatalities. In addition to the unimaginable suffering and loss, this catastrophe left a very strong impression to the public, created extensive finger-pointing between agencies, and generated intense political conflict. The lack of knowledge or guidance among residents regarding fire preparation and response became the major issue.

In September 2018, the government appointed an Independent Committee of wildfire experts to shed light on the deeper causes of the worsening wildfire problem in Greece and propose solutions, while scientists continued to identify lessons to be learned from this tragic event. The Committee completed and delivered its report to the Prime Minister in February 2019. In March, twenty current and former Greek officials were charged for their alleged failures to respond to the situation. Some lessons learned bear a strong resemblance to those identified in similar disasters around the world. Others are necessarily attributed to the Greek reality regarding fire policies, organization and cooperation of relevant agencies, and public education, along with ongoing development and expansion of settlements. Efforts must focus on medium to long-term improvements that will mitigate fire management problems and risk in order to prevent future disasters like this.

Above: Winds pushed fire through oak lanes to the sea (at far edge). Below: the steep slopes where people sought escape from the flames.

REFERENCES

Athanasiou, M. and G. Xanthopoulos (2018), Observations on wildfire spotting occurrence and characteristics in Greece. In proceedings of the 8th International Conference on Forest Fire Research: Advances in Forest Fire Research, 9-16 November 2018, Coimbra, Portugal. D. G. Viegas, Editor. ADAI/CEIF, University of Coimbra, Portugal. Abstract p. 113, full text on CD (p. 588-597), (https://doi.org/10.14195/978-989-26-16-506_65)

Van Wagner, C. E. (1977), Conditions for the start and spread of crown fire. Canadian Journal of Forest Research. 7: 23–34.

Xanthopoulos, G. 2008. Parallel lines. Wildfire. 17(1):8-20.

Xanthopoulos, G., and M. Athanasiou. 2013. The evolution of the fire of August 21, 2009 in NE Attica and its suppression. pp. 73-83. In proceedings of the 16th Panhellenic Forestry Conference on the "Protection and Management of the Greek Forests in a Period of Economic Crisis and the Challenge of Natural Forestry", October 6-9, 2013, Thessaloniki, Greece. Hellenic Forestry Society, Thessaloniki, Greece. 1144 p. (in Greek with English abstract).

ABOUT THE **AUTHORS**

Gavriil Xanthopoulos is an IAWF board member and works with the Hellenic Agricultural Organization "Demeter", Institute of Mediterranean Forest Ecosystems, Athens, Greece. gxnrtc@fria.gr.

Miltiadis Athanasiou works in wildfire management consulting and training, based in Acharnes, Attica, Greece. He was awarded a 2014 IAWF scholarship for his graduate studies and wrote a background on fires in Greece for Wildfire Magazine in April 2018 (https://www.iawfonline.org/article/greece-to-measure-and-document-wildfire-behavior-and-share-the-research-findings-with-those-who-can-apply-the-lessons/). info@m-athanasiou.gr.

EDITOR'S NOTE:
This commentary is expanded from a blog post originally published on the NFPA Xchange on January 28, 2019.

by Michele Steinberg

It was clear that the destroyed homes we saw were more flammable than the vegetation around them. On a tour of the devastation wrought by the Camp Fire in Butte County, my NFPA colleagues Ray Bizal and Tom Welle and I saw textbook cases of the impacts of embers, structure-to-structure ignition and wind-driven wildfire all through the communities of Paradise and Magalia.

We were part of a group invited by the Western Fire Chiefs Association, who coordinated a learning tour of the area along with CAL FIRE and the local fire chief on January 22. The goal was to include not only fire service professionals but also researchers, insurance industry representatives, and those involved in safety outreach and advocacy such as NFPA. We welcomed the rare opportunity to gain a first-hand local perspective on the event from CAL FIRE and local officials.

On the evening before the tour, we heard from CAL FIRE Deputy Chief of Wildland Fire Prevention Engineering Steven Hawks about his parents' harrowing experience in evacuating Paradise, where Steven and his brother David were born and raised. Both escaped safely, though it took their mother three hours to reach her destination. On meeting Butte County Fire Chief and CAL FIRE unit chief David Hawks the next morning, he filled in more of the story, including the heartbreak of the loss of his parents' home to the fire.

It's important to note that this tour was not an attempt to seek out causes or lay blame but to understand more fully what had happened and the magnitude of the damage. Chief Hawks provided more details about the impact on the fire on the community, noting that Feather River Hospital, which lost the entire building housing its cardiology unit, is the area's largest employer. In terms of challenges to evacuating people and fighting the fire, while cameras are in place to aid in fire detection, they were not in the area of fire origin. In terms of fuel reduction efforts, Hawks deemed forest thinning and other treatments as good but inadequate in terms of slowing the fire, likening the effort to "dipping water out of Lake Oroville with a five-gallon bucket". Too little too late.

CALIFORNIA. THE BUTTE COUNTY "CAMP FIRE" NOVEMBER 2018

OBSERVATIONS OF CALIFORNIA'S DEADLIEST WILDFIRE. AN ON-SCENE REFLECTION ON THE IMPACTS OF A FIRESTORM, AND LESSONS FOR OUR MEGAFIRE ERA.

We observed that the wildfire was an equal opportunity destroyer, leveling high-end homes and more modest manufactured homes across the communities of Paradise and Magalia. According to the incident synopsis provided by the Western Fire Chiefs Association, one of the major considerations was, "Ember ignition, ember ignition, ember ignition. The Camp Fire was all about ember ignition. Paradise and surrounding area are in a Pine forest. The ground was littered with pine needles. Ponderosa Pines drop about 1/3 of their needles each year…even those who had 'raked' their yards had a new fuel bed due to the wind." The synopsis also indicated that there were areas where urban conflagration took place – when one structure ignited, providing enough radiant heat and embers to ignite the next structure, and so on. During the tour, Chief Hawks said while no homes in Paradise had flammable wood roofing, the pine needle deposition on and around homes was the primary fuel bed for embers that finally ignited homes. He even described a home saved by firefighters who put out the smoldering pine needles in a gutter.

We received materials on the tour including wildfire preparedness brochures and guides developed by the Butte County Fire Safe Council, a long-active group that has promoted safety guidance including NFPA's Firewise USA® program. While wildfire preparedness was embraced among many residents, the age, condition, and proximity of homes to brush, trees, and debris as well as to one another made home destruction in this intense, fast-moving, wind-driven wildfire inevitable.

Paradise officials and residents had planned and practiced evacuations, but according to the fire chief, they had never contemplated having to evacuate the entire town simultaneously. Chief Hawks was careful to tell us the specifics of the deaths of the 85 people who perished, with only one person dying on the main evacuation route after hitting a tree. He said most died in their homes, immediately outside their homes, or in their vehicles in areas far from the main road. This pattern speaks to the challenges of adequate warning time during a fast-moving fire, and to the fact that most of the people who died were elderly, disabled or both. Even if they heeded the warning, in many cases they were simply not physically able to escape.

The fire's destruction was typical in terms of unprepared homes that were more flammable than the vegetation surrounding them and often close enough to one another to cause an urban conflagration – both elements hallmarks of American wildland/

urban interface fires. What stood out for me was the sheer size of the damage footprint. We drove miles and miles to encounter the same terrible story at every stop – unconsumed large trees and completely destroyed homes and vehicles.

Enormous trees some six- to eight-feet in diameter lay along nearly every roadside, toppled post-fire by the utility company because they were on the main roadway and viewed as additional risks to the fragile power lines in the area. As our group got in and out of vehicles time and again, it was shocking to see the mass destruction against the backdrop of natural beauty in the forests, ridges, and mountains all around us. One insurance professional told me she hadn't realized that firefighters wouldn't have had anything close to an adequate water supply to help protect structures during such an extreme event.

The region has enormous challenges ahead in recovery. Even residents whose homes survived are still out of their homes due to benzene in the drinking water. Small business owners whose physical locations survived have few customers left in the area. The wholesale destruction of thousands of residences in a region where the housing market is already squeezed and contractors are in short supply predict a long and difficult road ahead. There are a number of positive efforts occurring locally to support those made homeless

by the event and related recovery needs, and insurers are busy providing claims services to help people back on their feet financially. But everyone should understand the magnitude of the destruction and the huge challenges that the whole community faces for the future.

The Paradise Chamber of Commerce (http://www.paradisechamber.com/), the town mayor, Butte County Recovers https://buttecountyrecovers.org/paradise/ and more are coming together to try to encourage safer rebuilding and help connect volunteers and donations with people in need while trying to boost the business community by listing the status of open or reopening businesses. Sadly, some businesses will never reopen, while some are struggling and realizing they cannot survive. (See this link for background: http://www.paradisechamber.com/events/details/mendon-s-nursery-closing-sale-03-21-2019-12129].

An article from ABC 10 in Sacramento in early February documented the diaspora of evacuees using a map created by a family member of Camp Fire survivors. It is updated via a Facebook page as survivors enter the current addresses and shows nearly 300 people spread across 31 states. [https://www.abc10.com/article/news/local/paradise/map-shows-where-camp-fire-survivors-have-relocated-since-the-disaster/103-16fa6184-aacd-4a59-8d66-520f59941e4d]

Former FEMA Administrator Craig Fugate was recently quoted talking about our society's failure to plan for the worst case scenario. A quick Google search shows that he's been talking about this for at least a decade, imploring not only emergency managers and government agencies to start a shift in thinking, but also calling on residents to recognize and acknowledge that government alone cannot avert the destruction and suffering from the next flood, hurricane or wildfire to come along. If nothing else, I hope the Camp Fire is the motivation for communities all over the country facing natural hazard risks to engage, plan and act to address the situation long before the next deadly event occurs.

Photos taken by Michele Steinberg in Magalia, California, January 22, 2019. Middle Right: *Chief David Hawks with Ray Bizal and Tom Welle of NFPA.* ***Lower right:*** *Members of the Camp Fire assessment tour included NFPA's Tom, Bizal and Michele Steinberg (l-r).*

ABOUT THE AUTHOR: *Michele Steinberg manages the Wildfire Division of the National Fire Protection Association and is an IAWF board member.*

TASMANIA,

AFTER TWO EXTREME FIRE SEASONS IN THE PAST FOUR YEARS,

By Michael Scott Hill

A CHANGING CLIMATE

The Australian island state of Tasmania is located between 40 and 43.3 degrees south, surrounded by the Southern Ocean (to the south and west), the Tasman Sea (to the east) and Bass Strait (to the north). Tasmania is one of the world's last accessible wilderness frontiers, with no landmass west until South America, nothing south until Antarctica, and nothing to the east until New Zealand. The island became separated from the Australian mainland approximately 12,000 to 15,000 years ago when the ice caps melted and sea levels rose to flood a land bridge that once connected the island to the mainland, after the breakup of the super continent, Gondwanaland.

Tasmania is essentially a mountainous island with a generally moist climate, except in the south-west and south-east, which can suffer from drought. It has maritime and mountain climates with rainforest thrown into the mix. Rainfall varies dramatically across the island. Hobart, the capital has an average of 626 millimeters making it Australia's second-driest capital city (after Adelaide), while on the west coast, an annual average of 2,400 mm ensures the rainforest thrives.

The recent big fire seasons experienced, such as in 2016 and 2019, will become more common -- as found by climate scientists at the University of Tasmania's Antarctic Climate and Ecosystems Cooperative Research Centre working on its Climate Futures for Tasmania project. They discovered a relatively uniform rise in the mean temperature has been occurring across Tasmania, and with this rise has come an annual downward trend in rainfall. They also found the surface water temperatures off the east coast

Burning out on the Western Hills Fire on February 5, 2019 near Zeehan, Tasmania. Photo: Michael Scott Hill.

AUSTRALIA

JANUARY-FEBRUARY 2019

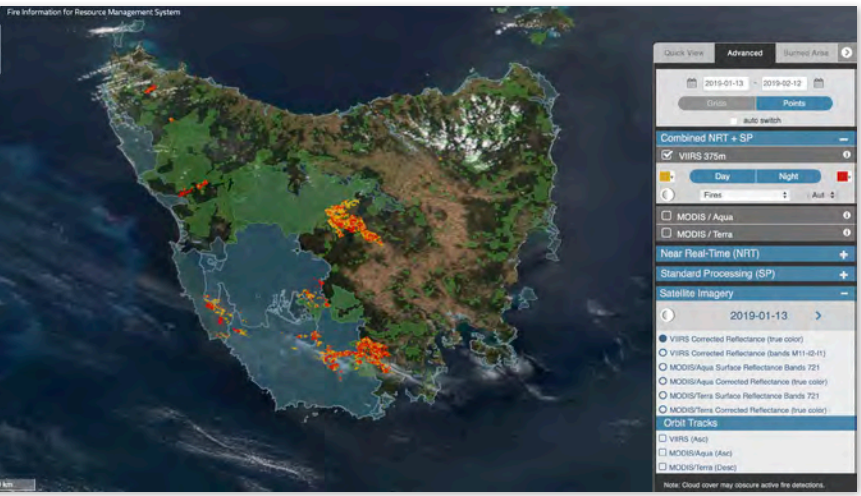
AN ISLAND STATE COPES WITH CLIMATE CHANGE AND FIRE.

have warmed approximately 2°C over the past 60 years, and project this to increase, as the warm East Australian Current to the north is expected to extend southward along the Tasmanian coast. The changing temperatures are believed to be creating a destabilization in the historic weather patterns of Tasmania and are predicted to bring into play an increase in the frequency and severity of extreme weather events for Tasmania's future. Across the state rainfall intensity and associated flooding have been recorded to be increasing and between these heavy downpours are coming more and longer heat waves and summer dry periods.

AN EXTREME FIRE SEASON

This season Tasmania's fire experience began with the Gell River blaze started in late December 2018 by a dry lightning storm in the state's south-west. In Tasmania's dry conditions fires are known to make large spectacular wind-driven runs then to lie down deceptively quiet until they start off again intensively. The Gell River Fire burning just north of Gordon Lake followed the pattern in early January 2019, growing rapidly in size in remote backcountry. During a period of its fire growth, the dilapidated structure of Churchill's Hut was consumed by its flames. This hut was famous as the historic trapper's shed of Elias Churchill, who captured the last Tasmanian tiger. Tasmanian fire managers took this loss as signal to begin wrapping other important structures lying in the Gell River Fire's path.

January proved to be the driest month on record in Tasmania, as the Gell River's flames continued to spread outwardly moving up into rugged inaccessible terrain. In the middle of the month another series of lightning storms ignited new fire starts around the state, several of which also made spectacular runs across Tasmania's vegetation. Professor David Bowman of Pyrogeography and Fire Service at the University of Tasmania, as reported in ABC News



"At its peak the fire displaced hundreds of residents and its flames badly twisted one of Tasmania's most popular tourist attractions, the Tahune Airwalk."

at the time, described what was taking place by saying, "Usually dry lightning isn't a significant factor in starting bushfires because the vegetation was traditionally too moist." And adding, "But certainly the coupling of dry lightning with dry vegetation has created an increase in both the number and the area burned."

New fires from the dry vegetation being lit by more dry lightning bolts, added to complexity of dealing with the large Gell River Fire burning on Tasmania's remote forested Central Plateau region to the south-west of Hobart, the state's Capital City. Here during an annual summer season fire managers typically face only one large bushfire at time, yet now they had a number spreading out independently. The multiplying fire spreads and starts, impacted fire managers who were overseeing so many fires in January, as their resources were being divided. An Interstate relief effort was put in place to provide more fire fighters and specialists, but due to multiple fire-staffing requirements these resources were spread out across the island and it became difficult for fire managers to be able to prioritize their focus.

On January 22 the Skittle Ball Plains Homestead, a fishing retreat was burned by the Central Plateau fire out near the Great Lake, and in the days after, by January 30, the Tahune fire, near the Tahune forest, had grown to 56,000 hectares. It threatened a large urban interface area to the south of Hobart known as the Huon Valley. At its peak the fire displaced hundreds of residents and its flames badly twisted one of Tasmania's most popular tourist attractions, the Tahune Airwalk, a steel canopy walkway which gets about 80,00 visitors a year.

INTO FEBRUARY, WITH FIRE IN THOUSAND-YEAR-OLD PINES

By early February 187,00 hectares of Tasmania had been exposed to fire, and the Wilderness Society -- fearing for the protection of the world's largest remaining forest of irreplaceable thousand year-old King Billy pines made famous by a photographer in the 1980s and 90s -- made the following statement as they began lobbying Australia's top politicians to request international fire assistance: "The scale of the fires, with over 2.5 per cent of Tasmania burnt or burning, has overwhelmed firefighting capacity to the extent that little is available to combat remote fires in the Tasmania Wilderness World Heritage Area." Tasmania Parks and Wildlife Service are also concerned for the survival of the King Billy and the equally endangered Pencil pines as well as other relic Antarctic species, and they have been refining and drilling on their tactics using mobile sprinkler kits, to protect these very sensitive rare plant communities from wildfire since the tragedies of the 2016 fire season.

AND THEN THE RAINS CAME

The 2019 peak fire season roughly came to an end in mid-February when rain and a small amount of snow finally pushed in by a couple of cold fronts reducing the severe threats. Only three summers before, the 2016 Tasmania fire season had been considered unprecedented. When that fire season of 2016 wrapped up in February of that year, an official Tasmania Government press release declared, "Not a single life or properly was lost, and only about 1.3 per cent of our Wilderness World Heritage Area was affected. This is despite more than 300 fires, more than 120,000 hectares burned and a record 15 total fire ban days, five more than any previous year."

WHAT WE LEARN – AS FIREFIGHTERS AND CLIMATE CHANGE MANAGERS

I joined the Tasmania fire-fighting effort in 2019, like I had in 2016, this time operating with a team of remote area firefighters in the island's rugged west coastal region as part of two important efforts. One was a large burn out along a road system to protect a powerline that carried one half of Tasmania's electricity, carried cross the rough Bass Straits in an undersea cable from the Australian mainland. I spent much of this deployment, however, as part of another effort, being carried into remote river systems by boat or chopper. We used water here to mop up smoky pockets of organic soil deposits smoldering in deep gullies of dried out rainforest where earlier fire runs had been slowed when encountering its thick vegetation in prevention of future large fire runs occurring from that fire perimeter.

As one of the world's frontiers of climate change with its unique fire environment, Tasmania is a remarkable and diverse place to be able to fight fires in -- from its western rolling-hill-covered button grass moorlands, onto its rainforest, and high country groves of massive gum and fern trees, even further to its even higher, scrubby alpine plant communities and timber plantations.

NATIONAL
FIRE FIGHTER CORP.

NEW IN 2019

SAME TRUSTED BRAND...
GREAT NEW PRODUCTS!

CALL TODAY TO LEARN MORE.

COAXSHER

CREW BOSS™
ALWAYS MADE IN THE USA

★PROPPER

800-423-8347
NATIONALFIREFIGHTER.COM

With temperatures rising and rainfall decreasing, the story of fire is one that will continue to be transforming as climatic change takes place across the world. In Australia, its landscape in many places was historically managed using the fire of thousands of generations, under the guardianship of Indigenous Australians elders who understood the various sensitivities of plant and animal communities, and their fire and land management regimes ensured abundant wildlife, plants, and foods were available while they also decreased fuel loads.

Aboriginals were very skilled fire managers as custodians of the land. They shaped much of the fire dependant ecosystems of Tasmania, just like in the mainland of Australia using seasonal knowledge, and the knowledge of animals and vegetation types passed down by the generations. Now, here in Tasmania, we are looking at a situation where a change of the climate is taking place alongside a long period of growth and corresponding fuel build ups that have developed since that pattern of burning ceased.

Tasmania's wildfires, due to the influences of future predicted extreme weather patterns are only set to become more and more frequent. And this pattern in itself is not very far out of step with the past, from that distant time, when Aboriginals historically over tens of thousands of generations shaped much of Tasmania's historic vegetation mosaic with skillful applications and withholdings of fire.

Today, however, the selective and careful fires that they once carefully managed are gone from this island ecosystem -- replaced by fire protection efforts and a few small scale burn programs. The unique landscape of plant and animal communities the Aboriginals nurtured still largely exist here, some which are fire dependent and others unable to tolerate fire. Fortunately, Tasmania's annual wet climate has been assisting in fire protection, but in some areas this vegetation has been allowed to build up into unprecedented levels.

Change is here for Tasmania with these more extreme weather patterns becoming normalized, and for fire, as in much of Australia, it is once again coming home as an ecological regulating force, and we as humans, must once more adapt and use fire as a tool.

ABOUT THE **AUTHOR**

Michael Scott Hill (at right cooling down a hot spot) manages fire and aviation with a global perspective from a home base in Virginia in the United States. He is a contributing editor of Wildfire Magazine and wrote about the 2016 fires in Tasmania -- see https://www.iawfonline.org/article/the-tasmanian-fires-of-2016/ for his report.

DAUNTLESS AIR

WE FLY TO WIN

formerly Aero Spray

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 new vision paper, Transforming Aerial Firefighting for a Changing Environment, or reach out to us at **320-297-9088** to find out how you can strengthen your initial response and direct air attack capabilities.

THE SUPPLY CACHE®
EST. 1991

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 —

Colorado USA

NICKS CUSTOM BOOTS · WHITE'S BOOTS · COSMAS · HAIX Shoes for Professionals · LA SPORTIVA · SCARPA · Danner

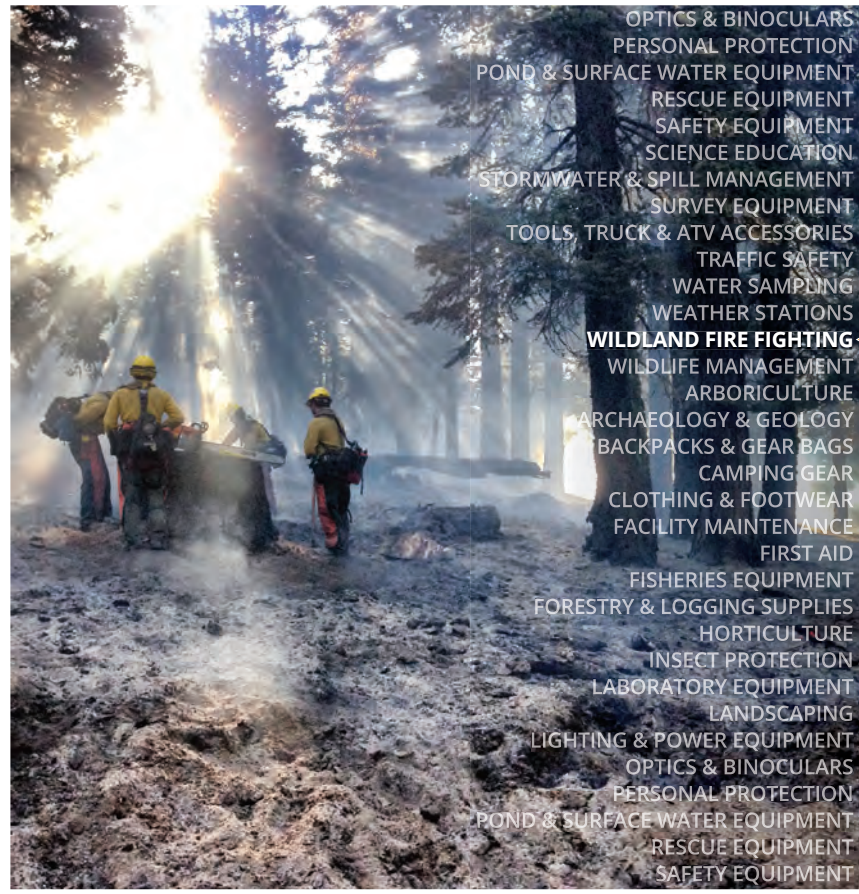
MEASURING UP TO EVERY TASK SINCE 1949.

Whatever your discipline, whatever your skill... We've been there, and know what it takes to get the job done right. It's just what you'll find in our catalog and on our website—thousands of professional quality products, each backed with our world class customer service.

Go online, or call 800-360-7788 to order your **FREE** catalog today.

FORESTRY SUPPLIERS

Sales 800-647-5368
www.forestry-suppliers.com



Third Annual
NATIONAL COHESIVE WILDLAND FIRE MANAGEMENT STRATEGY
workshop

OCTOBER 21-24, 2019
HOTEL 1620 PLYMOUTH, MASSACHUSETTS

International Association of Wildland Fire

The International Association of Wildland Fire is presenting this workshop in partnership with the Wildland Fire Leadership Council (WFLC) and the Western, Southeast and Northeast Regional Strategy Committees.

SmokeD
by IT for Nature

SmokeD Wildfire Detector

Early automatic detection and alerting

- System uses **Infrared** and **visible light cameras**
- The average wildfire detection time is **5 minutes**
- Wildfires are detected up to a **10 miles** distance
- **24/7** monitoring of large areas based on Artificial Intelligence
- Software for private residents and professional dispatch centers
- **Low monitoring costs** of remote areas
- Low rate of false alerts
- **Automatic notification** of Fire teams and local communities about an occurence of a wildfire

There is no need to build expensive infrastructure to use the SmokeD detectors. With a 3G mobile router, you may install it wherever you want!

IT for NATURE

www.smokedsystem.com

phone: +1 (714) 351-5000
email: office@itfornature.com

IT for Nature LLC
303 North Glenoaks Blvd. Burbank
CA 91502, USA

Smoldering emissions study during a research prescribed fire in Alaska. Photo: Roger Ottmar.

WILDFIRE SCIENCE FOR SUCCESS

PART 1 IN A SERIES

A healthy fire-science ecosystem is essential – but not a magic bullet – for managing our wildfire and bushfire challenges. In this series, fire researcher Eric Kennedy begins by looking at how we might improve the practices for funding, focusing, and implementing wildfire science by first suggesting we look at the implementation challenges facing fire scientists.

This series was inspired and inaugurated in part by a panel from the IAWF's Human Dimensions of Wildland Fire conference in December 2018.

By Eric B. Kennedy

Fighting fire is a massively expensive operation. Recent fires around the globe have continued to remind us of the fiscal impact of fire management. Totals for the Camp Fire (including insured and uninsured losses) exceeded $16 billion USD in late 2018 and continue to climb, while CalFire had burnt through over $600 million by November 2018. This sum exceeded its $443 million allocation with much of the fiscal year (which runs until June 2019) still ahead. Experiences in Canada, Australia, and elsewhere have followed similar patterns of high spending on suppression and extensive costs in impact. Wildfire managers and policy makers alike face difficult decisions as these costs continue to mount.

The money invested in suppression, however, vastly outstrips the funds put into two other important parts of the fire management enterprise: preparedness and research. Wise investments in preparation and mitigation – such as conducting fuel treatments nearby interface areas or investing in ember-based mitigation strategies for homes – have the potential to help to reduce skyrocketing suppression costs and property losses down the road. Likewise, investing in fire science provides improved tools for responders and allows for more effective deployment of resources (such as detection technologies or decision-aids for dispatch). Preparedness and science can also help us to achieve ambitions that are more important than economic costs alone: protecting personal property, ensuring responders come home safe, and minimizing disruption to communities as we learn to live with fire.

Science, research, and innovation are hot topics in wildfire management these days. On March 19th, for instance, the Cana-

dian government released the 2019 budget, earmarking $151 million for emergency management, including increasing the "ability to predict and respond to threats through the use of early warning systems, and enhance[ing the] understanding of the nature of the risks posed by floods, wildfires and earthquakes." And, the next day in Sacramento, California, the state held its first ever "Wildfire and Technology Innovation Summit," co-hosted by the California Office of Emergency Management, California Public Utilities Commission, UC San Diego, CSU Sacramento, and IBM. The Summit promised to explore "potential technological solutions" to wildfire including artificial intelligence, machine learning, and fire modeling.

Yet, as important as these things are, it's also easy for researchers, managers, policy makers, and the public to get seduced by the promise of fire science. In this series – this article and a follow up in the next issue – I explore these questions in detail, drawing on a background in the field of science policy to offer some lessons learned from other sectors.

Duff combustion research demonstration at the Missoula Fire Sciences Lab, Missoula, Montana, during the 2014 IAWF Large Fires Conference. Photo: Marjie Brown.

- Can more funding for fire science help to solve our wildfire woes?
- Are the existing funding strategies good enough and simply in need of more money, or do we need to explore new options?
- What are the best practices for making investments do more in fire science and fire research?

These questions were considered in a panel discussion at the Human Dimensions conference in December 2018 and are worth debating more broadly among the wildfire management community as a whole.

The Myth of More Money

Before we can explore how fire science is funded, we need to start by considering two common myths and misunderstandings about the topic. The first myth is relatively straightforward: just like in science, research, and innovation more broadly, it's easy to believe that 'more money' will directly translate into better science, better results, and better fire management. While it would be politically expedient for me to believe and advocate for this (I am, of course, an academic researcher who would love more grants to be available in the area!), the reality is a whole lot more complicated.

Much like we've learned the importance of understanding fire as one of the many interrelated components in a forest ecosystem, it's also worth understanding the 'research ecosystem' is similarly complex. In the research ecosystem, inputs include funding, but also personnel (researchers and the next generation of trainees), collaborative relationships (partnerships between researchers and practitioners), competing incentives (like pressure from superiors to publish to retain one's job in academia, or certain topics being 'sexy' for funding), and systematic biases (like which demographics have historically been underrepresented in academia, or which topics are considered important or unimportant). The research ecosystem also has a large number of 'species' that conduct studies and produce innovations, including universities, governments, and private companies, each of whom has different priorities, inclinations, and biases.

This is why simply injecting more money into the system doesn't guarantee better science. Additional funds can be squandered, for instance, in the accidental duplication of existing research, especially where there are disconnects between what is being done in different institutes, between the work of universities and private companies, and spread across different continents. There can be significant gaps between the topics that researchers want to pursue and the questions that are actually important to wildfire managers. Similarly, there can be a disconnect between what practitioners want (i.e. a decision-making aid that can help to reduce liability) and what scientists are actually able to provide. In addition, all too often research is metaphorically 'dropped off' for practitioners to use but is never actually taken up for a variety of reasons. In other words, how money is spent is just as important as how much money is injected in the first place.

Even if we can increase the production of good fire science, there's a second myth: that scientific and technological innovation will resolve the big challenges that we face in fire management. Of course, this can happen. The International Crown Fire Modelling Experiment and a multitude of other research projects have translated into a far more complete understanding of fire's potential and behavior on the

landscape. Similarly, technological innovations in aircraft, retardants, and communication technologies have resulted in more effective firefighting operations on the ground.

Improved computational models, for instance, can tell us how fire is likely to behave under certain conditions, whether a fuel treatment in a specific location might slow fire spread, or where fires have started relative to transmission lines. They cannot, however, inform the inherent values-based questions that lie beneath:

- How conservative or risk tolerant should we be when we deploy firefighters in light of predicted fire behavior?
- How much we should be willing to spend on that fuel treatment?
- Who ought to be held financially responsible for the new ignition?

These are questions of values, not of scientific fact.

It's critical to distinguish between science and values, even though the two are deeply intertwined. As scholars like Daniel Sarewitz and Roger Pielke Jr. often point out, it's tempting to try to use science to resolve values debates. Take, for instance, the calls we hear frequently to limit global warming to 1.5 or 2 degrees Celsius (lest we face the consequences). Science can help us to understand the consequences of 1.5 versus 2.0 versus 3.0 degrees of warming with respect to, say, sea level rise or wildfire season length. But, try as people might, it cannot tell us which of those values is an 'acceptable' level of warming. Should humanity be okay with 1.5 degrees? Or, is that too much or too little? Similarly, technological innovation produces the wind turbines and nuclear plants that might help to remake our energy system, but it cannot tell us which of those is ethical or legitimate or acceptable to deploy.

To offer an example that's closer to home, imagine that we invested money into wildfire science and created a near-perfect fire behavior model. With this model, we could test possible fuel treatments against simulated fires to determine what protective effects the treatments had for nearby communities. This model might be able to tell us whether a given treatment was likely to prevent a specific simulated fire from impacting a nearby community. But the model couldn't tell us anything about whether we ought to actually undertake that treatment, how much was worth spending to perform it, or what priority it ought to be given against other treatments.

"Wait," some readers might be saying. "We could just compare all the different possible treatments against this fire and rank them in terms of the size of their effect!" That's true – but it still wouldn't tell us where in that order we say 'enough is enough' given a limited amount of funding. And, more importantly, it's likely that most managers on the ground already know which of these treatments are a high priority for community protection. The model doesn't provide some objective, surprising truth about the world. Rather, the model simply provides evidence for the treatment we want to justify – evidence that can be tweaked by altering the simulation to attain our desired ends.

"I'm not arguing that fire science isn't important, or that we shouldn't increase our funding for research. I emphatically agree with both of those positions. But we need to be careful to inject funding in wise and effective ways and to understand what questions science can and cannot answer for us."

Not Bad News for Science

Lest this sound like an attack on science, research, and innovation in wildfire management, it's important to be clear about what I am – and am not – presenting for your consideration. First, I'm stating that we need to be careful about the allure of calls for more research funding alone. Injecting more money into wildfire research doesn't guarantee better outcomes, either in terms of data quality or relevance for fire managers. Second, I'm suggesting that we need to be careful to reflect on what science can and cannot provide for us. Science can help us better achieve our objectives (like putting out fires as quickly as possible whatever the cost, or restoring fire to the landscape for ecological purposes), but it cannot tell us what our objectives ought to be. Those are debates about values that must be brave enough to express explicitly: Just how much are we willing to spend to protect communities? Who is responsible for paying? How much risk is tolerable for firefighters, infrastructure, and ecosystems?

I'm not arguing that fire science isn't important, or that we shouldn't increase our funding for research. I emphatically agree with both of those positions. But we need to be careful to inject this funding in wise and effective ways and to understand what questions science can and cannot answer for us. A healthy research ecosystem is a critical part of being able to manage fires according to our desired strategies. Even though it can't answer what or why it can provide effective guidance in how we achieve those ends. This ecosystem is complicated – and current strategies may have significant limitations.

Some of these limitations were discussed at the recent International Association of Wildland Fire's fifth Human Dimensions of Wildland Fire conference in Asheville, North Carolina in December 2018. At the "Research Nexus Panel" hosted by Noreen Krusel from the Australasian Fire and Emergency Services Council, panelists Sarah McCaffery (US Forest Service), Richard Thornton and David Bruce (Bushfire & Natural Hazards CRC), and Stacey

Frederick (California Fire Consortium) provided experience-based insights into the funding challenges facing the wildfire science sector. The discussion was lively, provocative, and informative, with several different kinds of limitations coming up for discussion: the timing and length of funding, the social impacts of the money, the proposal and granting process, and coordination between different actors.

In the next issue of Wildfire, I'll discuss these additional challenges in detail and offer some ideas about how we can solve them to improve the fire research ecosystem. The answer isn't just 'more science' or 'more money,' but instead thinking critically and systematically about who we fund, what projects we undertake, and how we select between options. In the meantime, I'd encourage you to reach out via the contact information below to share your views on the topic so far.

ABOUT THE AUTHOR

Eric Kennedy is an Assistant Professor in the Disaster and Emergency Management program at York University in Toronto, Canada. With a Ph.D. in the Human and Social Dimensions of Science and Technology from the Consortium for Science, Policy & Outcomes at Arizona State University, his research focuses on how experts, agencies, and institutions manage wildfire – and deal with conflicting views on this contentious topic. He teaches courses in the ethics, sociology, and psychology of emergency management, working closely with practitioners in the field in Canada and beyond to train the next generation of emergency managers.

You can reach him at ebk@yorku.ca or on Twitter at @ericbkennedy.

This is the first in a series of articles by Eric Kennedy exploring wildfire science, research, and funding. In the next issue of Wildfire, Kennedy will discuss the challenges facing wildfire science, offering further analysis on the opportunities available for adapting and re-focusing fire-science funding models, and provide some suggestions on how long-term support of wildfire science can integrate with and support the application of science by practitioners in the field.

'Attributes of Leading' program shares tools for safer leadership

The 'Attributes of Leading'course, offered by the National Fallen Firefighter Foundation, shares a video-based training to support leadership training at the crew boss level.

Most of us can recall a bad leader or two in the course of our careers. Identifying traits of a less-than-perfect leader is easy: doesn't listen/hear well, lack of integrity, asks others to do tasks that leader will not do, comes to meetings and doesn't show up – even when present, constantly checks a cell phone, drops the ball on projects, does not follow up, never gives a positive shout-out when tasks are done well.

The examples seem endless of bad leadership. Yet if it is so easy to identify bad leadership, then why is good leadership so difficult to find?

I began my learning-leadership quest about four years ago when it became apparent that our Chief was on his road to retirement. How to prepare to become the Chief? Study leadership! I latched on to every leadership course, book, and pod cast I could digest. And even though I opted out of applying for the position when it opened, I continue my quest for leadership learning. When the train-the-trainer *Attributes of Leading* class presented by the National Fallen Firefighter Foundation (NFFF) came up on my email announcements, attending was a no-brainer. I signed up for the December 2018 class and hoped for good weather.

The five-hour drive from Jackson Hole to Boise landed me at the Wildland Firefighter Foundation Headquarters, across the street from the National Interagency Fire Center (NIFC). A giant wildland firefighter guarded the entrance as I entered through the red front door and was guided down a hallway covered with photographs of those who did not make it back home from their wildland fire. This visceral tribute emphasizes why classes like this are so critically important. Enhancing leadership skills helps reduce incidents which helps to reduce firefighter fatalities.

The class was held in a high-ceiling garage-converted into classroom display room. Here, the walls were shoulder to shoulder with crew shirts from across the nation. As wall space filled up, shirts were tacked to ceiling. Racks behind our class area sported the latest Foundation wear. Our instructors prepared for the class while students arrived, one came the long haul from the Sonoma area in California.

Instructors Kevin Conant and Dr. Brian Crandall led our group with the objective of the training, the "why" of what we were to partake in for the day, helping us understand the day's flow.

The class was created to fill the gap existing in nationally recognized standards for fire service company officers/crew bosses (NFPA 1021) by recognizing the attributes which make an effective leader.

The Attributes of Leading training provides a practical platform for small crew training. Focused around a set of six core values:

* Developing competence,
* Building grit,
* Being well,
* Exercising self-regulation,
* Demonstrating humility, and
* Developing trust.

Each topic has an accompanying video which the group watches, reflects upon individually, then shares within the group on actions that can be taken. A work sheet steps participants through a discussion after the video is observed. The video is in a storytelling format and provides positive examples of good leading actions. The kicker to the worksheet is an accountability line that commits the user to revisit the leadership topic at a later date, thereby ensuring that the training be not simply talk, but talk which turns into action, action which starts to make change.

For a small crew in an office/kitchen-based location, this is very excellent training. The videos are high-quality and engaging. Excellent cinematography shows a fire station from Ohio, structural firefighters next to their structural equipment in department or casual gear, and casual-clad fire folks seated in their homes in Montana. The lessons bridge both the structural and wildland fire world, however, the videos do not. And the reliance on structure-department visuals may make getting buy-in from a wildland crew might be difficult. Although these videos are iPhone-friendly, most wildland operations are cell-phone challenged, making field-training challenging if not impossible. This excellent learning tool would be best used before the wildland fire season begins in an office, rather than field setting.

No one said good leadership is easy and the accountability piece is where the work begins. Doesn't it always? The six core values are indeed paths to building strong leadership. The story-telling technique is powerful; I still recall stories from the videos we watched that training day. The accountability piece is where the rubber meets the road. Leaders who hope to bring those up around them will be tasked to ensure follow-up on these discussions is turned into action and accountability.

The temptation to watch all of the six core-value videos is real. Success will be difficult with this approach. Although NFFF or the class guidelines do not provide direction on how to logistically conduct this training, the class might best be conducted in small bites. Leaders must have the discipline to follow the process and maintain follow-through and accountability with their crews. Consider a plan to watch one video with one crew every two months. Follow-up with actions on a weekly or bi-weekly basis.

Attributes of Leading is an excellent tool and will produce positive change when used correctly. As you, a leader, consider implementing this tool, your leadership will be challenged. You will be tasked with the accountability of the process. From one leader to the other, start out small and slow and commit to your crews on the most very important accountability piece of this leadership training.

For more information, see Article on "Attributes of Leading": https://www.firehouse.com/leadership/news/20995433/nfff-attributes-of-leading-pilot-program-focuses-on-leader-actions.

NFFF/Everyone Goes Home - Training Site: "Attributes of Leading": https://www.everyonegoeshome.com/training/attributes-of-leading/

A short video sample of the training can be found, with required registration, at: https://www.youtube.com/watch?v=BCyq_Dtojgs.

ABOUT THE **AUTHOR**

KATHY CLAY is Fire Marshal and Battalion Chief for Jackson Hole Fire, Wyoming, USA, and an IAWF board member since 2013. She serves the fire world promoting fire and injury prevention, works with new and existing structures to ensure code compliance, investigates structure and wildland fires, provides command on emergency incidents, and maintains EMT certification for medical first response.

Don’t get caught with your pumps down!

A pump failure at a critical time out in the field can result in devastating losses. Consequently, WATERAX is tirelessly dedicated to providing the highest quality Genuine pump parts. The care and precision taken in producing these parts ensures the reliability that has made WATERAX pumps the benchmark of excellence in forest firefighting.

GET FREE SHIPPING
ON ALL ORDERS OF $200 AND MORE

Visit the exclusive WATERAX Online Store and shop for all your genuine parts in one place.

SHOP.WATERAX.COM

WATERAX
WE MOVE WATER

MARK-3®

When you're here, there's no room for compromise. You can trust the MARK-3® to move water.

ASK FOR THE REAL MCCOY: the MARK-3®, recognized across the firefighting industry as the ultimate lightweight, portable pump.

WATERAX.COM

WATERAX
WE MOVE WATER