IAWF Position Statement on Climate Change and Wildland Fire

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

The IAWF membership spans all continents. The membership comprises a global voice and includes wildland fire managers, land managers, scientists, agency personnel and others who support IAWF's goal to achieve a more sustainable wildland fire paradigm.

I. Overview and purpose

Climate models predict drying and warming trends in many parts of the world; this is likely to exacerbate wildfire risk, the likelihood of fire, and extreme fire consequences (IPCC, 2021). In many cases, fire seasons will lengthen, become more extreme and extend into landscapes previously unaffected by wildland fires. This will increase the risk to the health and safety of firefighters, the community, the environment, industries and the economy.

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

II. Human-induced climate change and the risk

Evidence of the warming of the climate system is unequivocal and the human contribution to the climate system is clear (IPCC, 2021). Rising global average temperatures are altering global weather patterns, resulting in more frequent and intense extreme weather events such as heatwaves, droughts, and large storms. These changes will impact health, economies, livelihoods, infrastructure, and societies.
For instance, smoke from wildland fire is an unhealthy pollutant that statistically increases hospital visits for respiratory and cardiovascular symptoms, heart failure, pulmonary embolism, ischemic stroke, and death (Reid et al., 2019; Wettstein et al., 2018). In the United States, the annual economic estimate of short-term smoke exposure for 2008-2012 was between $11 billion and $20 billion, with a long-term estimate between $76 billion and $130 billion, which surpassed firefighting cost (Fann et al., 2018). For all these reasons, the 2021 World Economic Forum's Global Risk report classifies climate change as a "catastrophic risk" and an urgent threat that requires decisive action (WEF 2021).

III. Climate, weather and fire

Climate change is increasing the frequency and severity of fire weather (Flannigan et al., 2013). Fire seasons around the globe are starting earlier, resulting in longer fire seasons (Wotton and

Flannigan 1993, Jolly et al 2015; Harris and Lucas 2019). In addition to longer fire seasons, fire weather is becoming more extreme, with many regions experiencing a significant increase in the number of high fire risk days (Abatzoglou et al. 2021). The conditions behind the Australian fire season of 2019-2020 (Black Summer) were at least 30 per cent more likely to occur than a century ago due to climate change, and the risks of a similar event would rise four-fold if the increase in global temperatures exceeds 2 C (Oldenborgh et al 2020).

Warmer conditions have also been shown to result in more lightning-caused fire ignitions (Veraverbeke et al 2017, Mariani et al 2018, Chen et al 2021) due to the combination of more ignitable fuels and more thunderstorms. Along with an increased risk of ignitions, a study focusing on the United States found that for every degree of warming, a 12 per cent increase in lightning occurrence is expected (Romps et al 2014).

These trends in fire weather are likely to continue with an increase in severity driven by hotter, drier conditions (Flannigan et al., 2013). In some areas, the occurrence of extreme fire weather days is expected to triple (Clark et al 2021). There are also likely to be more dangerous fire conditions for communities and firefighters, with studies indicating climate change could amplify the conditions associated with pyrocumulous (PyroCu) and pyrocumulonimbus (PyroCb) development (Dowdy et al 2019, Di Virgilio et al 2019, Rodiguez et al., 2020), which can result in fires generating their own lightning, wind and rain, and feeding back to longer-term climate systems (Peterson et al., 2018).

IV. Fire regimes, ecosystem change and fuel management

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

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

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

The absence of fire in parts of the world has led to an increased accumulation of fuels, and weather and climate exacerbates this situation (Collins et al 2011, North et al 2015, Tubbesing et al 2019). Further, maintaining biodiversity is challenging when tolerable fire intervals for species and ecosystems are compromised, and particularly when flora and fauna are further threatened by climate changes that exceed their natural environmental constraints. Climate-

driven changes in fire regimes, compounded by other socioecological and spatiotemporal dynamics, appear likely to accelerate species extinctions and could cause collapse of ecosystems. Gradual changes in climate over geologic time scales allows organisms time and space to shift in latitude and elevation and to evolve, and gives certain species, including humans, time to adapt. Even if current climate change were slow, fragmentation of landscapes by human activities now blocks corridors that some species could use to shift their ranges. Rapid changes in climate limit the range and the time-frame of options that may be taken by society to avoid further impacts.

It is now widely accepted that vegetation management, including prescribed burning and the use of wildland fire to meet land management objectives, can mitigate the risk of negative impacts to human communities, economies, critical infrastructure, watersheds, and valuable natural and cultural resources (Robinne et al 2021). An increase in the application of prescribed burning in some regions will necessitate multiple agency interactions (e.g., wildland fire and air quality agencies), to balance the risk of poor air quality, with the risk to air quality and health, under conditions in which prescribed fire is inhibited. Social science can help advance the understanding of the barriers and opportunities to prescribed fire (Schultz et al. 2019; Ryan et al 2013), including those for landowners (Hoffman et al. 2021; Kreuter et al.2019; Toledo et al. 2014; Weir et al. 2019) and the public (McCaffrey 2006; Mierauskas and Pereira 2013; Loomis et al 2001).

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

V. Wildfire management

Globally, wildfire managers strive to and are expected to reduce risk to communities, protect assets and critical infrastructure, and ensure the safety of firefighters. Managers are expected to accomplish these goals even while fire seasons are lengthening, there are more lightning-caused fires, more flammable environments, and fire weather conditions are becoming more extreme; all these variables are expected to worsen under climate change. Furthermore, there is a more complex wildland urban interface (WUI), (Radeloff et al. 2005; Hammer et al. 2009; Solangaarachchi et al. 2012; Johnston and Flannigan 2018), including differences in flammability and fire transmission in urban areas compared with areas that are mainly rural. Fire incident management in turn becomes more complex as more jurisdictions are affected and costs rise (Nowell and Steelman 2019; Thompson et al. 2019). Globally, those with the fire

expertise face intense public scrutiny for their decisions, as well as uncertainty from changes in responsibilities and exhaustion from constant fires.

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

- **Weather** – changes in the frequency, severity and complexity of extreme weather that directly lead to cascading wildland fire extremes, extended fire seasons, and related events (e.g., post-fire debris flows, flooding).
- **Climate** – changes in the seasonality and latitudinal position of previously typical climate, and the arrival of new and different extremes, which affect both ecosystems and fire regimes.
- **Health** – increasing exposure and vulnerabilities of communities, including the impact of smoke on firefighter and public health, and an increase in health care costs associated with large and long duration wildfires.
- **Organizational complexity** – growing number of jurisdictions impacted which challenges the ability to co-ordinate among multiple local, state, provincial, federal and national responders.
- **Economic costs** – increasing suppression costs of wildfires including the primary, secondary and tertiary impacts on private and public property, infrastructure, businesses, and air quality and health.
- **Resources** – increasing pressure on land and fire management agency resourcing due to longer fire seasons, and more frequent and severe events.
- **Risks** – increasing health and safety risks for staff and volunteers, including heat stress, fatigue and mental health due to less time for recovery between severe seasons.
- **Legal** –Greater risk of litigation due to increased complexity of jurisdictional involvement and land ownership.
- **Safety** –Increased stress on community preparedness (including mitigation) and controls, such as building codes (local and regional influences) and land-use planning to respond to what is needed to keep the community safe.
- **Support systems** – supply chain vulnerabilities creating shortages of equipment and logistical support to land and fire managers.
- **Ecosystem damage** – adverse outcomes to ecosystem flora, fauna, and services, due to climate-change driven variations in fire regimes, temperature, and rainfall.
- **Water** – threats to water supplies (both for domestic use and firefighting) and post-fire effects (e.g., impact on water yield and quality, debris flows).

The planet faces more extreme, more frequent and longer fire seasons (Jain 2021), which will affect service delivery unless clear adaptation plans are created and implemented. Fire and land management organizations, government departments, and jurisdictions have an obligation to reduce their contribution to greenhouse gas emissions, therefore mitigation plans also need to be developed by all levels of government and businesses.

VI. Calls to action

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

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

- Identify ecosystems most at risk to large, high severity wildfire
    - Prioritize landscapes that are at the greatest risk for treatments and mitigation measures to withstand future change in fire regimes in accordance with climate, land and resource management objectives.
- Identify and enhance fire-adapted communities
    - Develop public understanding of the overarching long-term benefits of fire on the landscape to mitigate potential risks, and the necessity for prescribed, controlled and Indigenous burning, as well as wildfire, based on both qualitative and quantitative cost-benefit analyses.
- Foster safe and effective interagency wildfire response
    - Formulate and implement safe, effective, efficient risk-based wildland fire management decisions, in co-ordination with multiple agencies across all jurisdictions.

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

1. Increase prescribed burning

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

The IAWF adopts an ecosystem approach to create greater effectiveness and efficiency in treatments over larger landscapes, regardless of jurisdiction. The IAWF acknowledges and supports the role that Indigenous peoples have in undertaking cultural and traditional burning for a range of purposes associated with caring for land, including promoting revegetation, producing food and game, and maintaining spiritual connection to the land. IAWF encourages land and fire managers and Indigenous Peoples to be better engaged and learn from each other about the application of fire.

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

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

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

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

3 Reimagine and invest in the wildland fire management workforce and systems

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

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

unsustainable, and the fire management community needs a more nuanced approach that does a better job of working with fire and ecosystems rather than working against them.

As wildfire and smoke impacts grow in their complexity, so does their management. IAWF will advocate for adaptation of the current wildland fire governance and management systems to adapt to the changing conditions under climate change. As wildfires grow in size, they cover more jurisdictions, necessitating the co-operation and collaboration of local, state, provincial, and national responders from the public, private and non-profit sectors. Safe and more effective fire management means creating fire management structures that can take into consideration this growing response network of personnel and adapt to accommodate these integrated responses.

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

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

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

5 Create opportunities for continuous improvement and adaptive management

IAWF supports the need for more nimble adaptation among our community to the rapidly changing conditions we face. IAWF will provide opportunities for our community to gather the diverse stakeholders invested in creating a more sustainable wildland fire paradigm so that we can reflect on, reconsider, challenge and adapt our current policies, processes, and procedures to the evolving realities under climate change.

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

VII. Our commitment

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

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

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

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

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