



# FAO Strategy on Forest Fire Management

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## Contents

The Wildfire Context.....	2
Wildfire Management Problem Statement.....	4
FOA Fire Management Programme Justification .....	4
Fire Management in FAO.....	4
Current Fire Management Activities and Demands .....	5
Representing FAO.....	6
FAO Fire Management Strategic Objective .....	6
Goals .....	6
FAO Focus .....	6
Products.....	8
Fire Management Strategy Modality.....	8
How FAO Fire Management will do it.....	8
FAO Fire Management Partners .....	9
People .....	11
Funding .....	11
Attachment 1: A Sample of Wildfire Events and Impacts.....	12
Attachment 2: Integrated Fire Management .....	15

2019

## The Wildfire Context

Fires have been used by humans for millennia and play a critical role in many ecosystems. The use of fire for hunting, favouring preferred plants for food, fodder or fibre, clearing for agriculture and grazing, easing travel and controlling pests is well documented, historical and continues today. This is particularly the case in developing countries where people depend directly on forests and agriculture for their livelihood and food security. Fires maintain some ecosystems, such as savannas.

There are many terms used to describe or label fires and they vary depending on the landscape being burned (forest, savanna, brush, scrub, veld), the fuel type being burned (forest, chaparral, grassland), the social or cultural context (livelihoods, festivals, traditional, conflict) and perhaps regulatory framework (permit fires, illegal fires). The terms include fires, wildfires, wildland fire, forest fire, grass fire, scrub fire, brush fire, bush fire, veldt fire, rural fire, vegetation fire and so on (IUFRO 2018). The European Forest Fire Information System (EFFIS) uses “forest fire”. The Global Wildfire Information System (GWIS) uses the wider term “wildfire” (an uncontained and unwanted fire). Consistent with international terminology and for consistency FAO uses the term “wildfire” to describe any uncontrolled forest fire, grass fire, peat fire or scrub fire and the term “fire” to include all intended or prescribed vegetation fires. A “fire” may of course transition to be a “wildfire” if it escapes or becomes uncontrolled.

About 4 % of the global vegetated area is burnt every year by fires, natural, prescribed and wild. Wildfires have significant impacts on humans and on the natural environment. They affect human lives and livelihoods and result in high social and economic costs, associated not only with the damage, but also with the prevention and suppression measures put in place every year. Fires cause large increases of atmospheric emissions and pollutants, soil erosion, reduce the provision of goods and services by forests, and change land cover patterns and landscape ecosystem dynamics<sup>1</sup>. A review of extreme wildfire events between 2002 and 2013<sup>2</sup> identified that:

- Wildfires can have disastrous impacts and extreme wildfire events can be ‘disasters’ (characterised by impacts including damage and loss to built assets and infrastructure and loss of life), are globally distributed and nearly all (96%) are associated with dangerous and unusual weather conditions such as high fire danger, high winds, high temperatures, anomalous climatic conditions such as drought or abundant precipitation stimulating vegetative growth in arid regions.
- Wildfires reported as being economically or socially disastrous are concentrated in suburban areas intermixed with flammable forest in the developed world.
- The influence of weather conditions in extreme wildfire events suggests increasing vulnerability to these events with climate change

People are the cause of 90% of fires globally through a combination of poor practice, limited access to alternative approaches to fire, accidents, weak understanding of fire risk, machinery, negligence and carelessness. However, although wildfires are most often initiated by human actions, their intensity and their effects are mainly driven by fuel condition and availability, vegetation structure and meteorological and topographic conditions.

The social aspects, which are basically related to community-based fire management and community wildfire relations beyond wildland fire causes and wildland fire defence organisation, are less well known. Basic research on the social aspects of wildland fire is very limited. The existing literature is mainly applied research, in particular case-studies of certain aspects of the social dimensions of wildland fires (wildfire human causes and influencing factors; fire laws/policies/regulations; fire management; socioeconomic impacts of wildfire risk; social awareness/vulnerability/ resilience to wildfire risk, etc.).

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<sup>1</sup> Poljanšek, K., Marin Ferrer, M., De Groeve, T., Clark, I., (Eds.), 2017. Science for disaster risk management 2017: knowing better and losing less. EUR 28034 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-60679-3, doi:10.2788/842809, JRC102482.

<sup>2</sup> David M. J. S. Bowman, Grant J. Williamson, John T. Abatzoglou, Crystal A. Kolden, Mark A. Cochrane and Alistair M. S. Smith 2017 Human exposure and sensitivity to globally extreme wildfire events *Nature Ecology & Evolution*, Volume: 1 Article Number: 0058

The trend of rural to urban migration, socioeconomic and policy changes sees fewer people, less activity and altered management in rural areas in developed countries, also a trend in developing countries if it outpaces population increase. This contributes to increasing the amount and continuity of the fuels across the landscape of grasses, shrubs and forest vegetation. Seasonal dry periods, droughts and winds then dry the fuels.

The need is for research at the community level, since this is the scale at which people organise and interact. Research is needed in both technical and social spheres. It is easy to predict that developments in wildfire risk management will follow the increase in sophistication and use of digital technologies. These largely support the readiness, response and recovery phases in disaster management. Significant changes in human behaviour are needed for a decrease in ignition events for which social research will be valuable.

Notably, indigenous/traditional knowledge is known to be a rich resource that has been recognised and applied in a number of cases and continues to be explored by FAO and others. Creating opportunities for resilient and sustainable agriculture and forest management for communities and smallholders is critical, including for fire and its management. The many aspects of community traditional fire knowledge (TFK) and result in complex, sophisticated approaches to fire use that account for the seasons, changes and trends in weather, vegetation, landscape and fuels. Accessing the TFK of communities and smallholders can be accompanied as appropriate with support and capacity creation in fire management at the local scale.

Analyses of fires indicate that 90% of fires are readily contained and burn approximately 10% or less of the total area burnt. This suggests that for those fires the current planning, management and technologies are working reasonably well. That is not to say that improvements can not be made or value added. The other ~90% of the area burnt is by ~5-10% of fires. These events are the high profile wildfires reported, such as Greece and California in July 2018, and include loss of life, damage and loss to property, infrastructure and environmental impacts. These wildfires are uncontrollable as they exceed the limits of suppression. There is nothing that fire fighters can do to stop or contain such wildfires until weather or fuel conditions change.

The maximum fireline intensity for working directly on the flaming front is considered to be ~4,000 kWm<sup>-1</sup>. For indirect attack, where the tactic is to work at a distance from the wildfire, limit of suppression is ~10,000 kWm<sup>-1</sup>, including all means of firefighting, ground based and aerial. Extreme wildfires always exceed these limits. For example the Pedrógão Grande wildfire, Portugal June 2017, with 65 fatalities, and 458 structures destroyed burned with fireline intensities from 20,000 to 60,000 kWm<sup>-1</sup> and a rate of spread of 65 m/min<sup>3</sup>.

The dominant approach to fires in the history of developed countries has been to suppress them and undertake prohibition of fire use. In developing countries the tendency is to adopt the same approach. However, fires are a landscape problem. They are not a problem resulting from insufficient or inadequate means of suppression but from the situation of fuel continuity and accumulation of fuels from vegetation. Altered landscapes have made the population increasingly vulnerable. The pressures and influences that lead to the contributing factors for wildfire disasters being in place need to be analysed, articulated and clearly described.

Based on an analysis of the benefits arising from avoided losses, mitigation and prevention measures are widely considered more cost-effective than post disaster interventions. An increase in mitigation investment has occurred in some European countries, but the lack of public and therefore political interest in prevention and mitigation remains a problem.

Strong knowledge on disaster risks are important for countries that wish to undertake risk assessments, assess risk management capabilities and record loss and damage data on disasters. Addressing the root causes of wildfire risks and increasing the resilience of livelihoods and food systems to lessen the impacts of wildfires can also include effective fire adaptation measures with co-benefits for climate change mitigation.

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<sup>3</sup> Tedim, F. et al 2018. Concept Paper - Defining Extreme Wildfire Events: Difficulties, Challenges, and Impacts. Fire 2018, 1, 9; doi:10.3390/fire1010009

FAO's wildfire work includes lessons learned from wildfire risk reduction and emergency response to current hazards and support for long-term climate change adaptation and mitigation efforts. Key to successfully integrating ecology, society and fire management technologies is effective analysis of the situation. What is the ecological role, impact, social, cultural and economic context in which fires are occurring? Who is starting fires and why? What are the fuels in the area and how does fire behave in them? What are the contributing factors and underlying causes of the fire problem, such as land tenure issues, illegal logging, invasive species or climate change?

Wildfire governance schemes are urgently needed in order to obtain consensus between the different stakeholders to create collective willingness and favour the effectiveness of wildfire and fire management systems. It is important to identify the institutions/administrations that are relevant for the implementation of actions related to wildfire risk assessment/mitigation.

An approach is needed to systematically analyse the fire problem, identify the needs and select the appropriate strategies, planning tools and tactics to meet the requirements, monitor their implementation and enable continuous improvement, adaptation, reduce vulnerability and underpin resilience. A strong interaction between science and policy to build a strong knowledge of disaster risk; make efficient use of data to better understand the economic impacts of disasters; and adequate preventive policies to reduce the risks of disasters are set out in the UN Sendai Framework for Disaster Risk Reduction.

During the process of considering the disastrous wildfires in Portugal and Europe of 2017 one fire manager stated

*I don't want more resources I want a better landscape.*

This is the focus needed.

## Wildfire Management Problem Statement

The negative social, and ecological impacts and economic costs of wildfires on landscapes continue to escalate. In developing countries wildfires impact on food security, sustainability of agriculture and forestry and increase vulnerability of communities, particularly the poor. While developed countries experience significant loss of life, infrastructure and asset damage and loss and very expensive wildfire suppression costs, including firefighter deaths (Attachment 1), wildfires will have implications for achieving the Sustainable Development Goals.

## FOA Fire Management Programme Justification

### Fire Management in FAO

FAO has long had a programme on wildfire management and has unique global to local reach, experience, technical capacity and networks among the many disciplines and sectors across which fires impact. It has contributed an invaluable body of work on fire management including a series of publications and programs; services to its member countries; and engagement in joint initiatives with many other international organisations, multi-lateral agencies, development partners, NGOs and INGOs and networks.

### FAO Goals

FAO envisions a world free from hunger and malnutrition, where food and agriculture contribute to improving the living standards of all, especially the poorest, in an economically, socially and environmentally sustainable manner. Achieving FAO's goals to end hunger and poverty is focused on five priorities, the FAO Strategic Objectives. In respect of fire and its management they are:

1. HELP ELIMINATE HUNGER, FOOD INSECURITY AND MALNUTRITION; forests are sources of food, fiber, energy and environmental services and there is a need to develop and share analytical tools for fire management practices that increase agricultural productivity and conserve natural resources.

2. MAKE AGRICULTURE, FORESTRY AND FISHERIES MORE PRODUCTIVE AND SUSTAINABLE; through assisting countries collect relevant fire related data for use in decision-making for evidence-based fire management policies and practices while ensuring the natural resource base is sustained.
3. REDUCE RURAL POVERTY; supporting the fire management required for the rural poor to gain access to those resources and services they need
4. ENABLE INCLUSIVE AND EFFICIENT AGRICULTURAL AND FOOD SYSTEMS; that reduce the risk of damaging fires and improve management of prescribed, planned and natural fires.
5. INCREASE THE RESILIENCE OF LIVELIHOODS FROM DISASTERS; by helping countries plan to reduce risks from natural and human-caused fires through developing and sharing strategies to reduce the impact of fires on livelihoods, documenting and sharing knowledge about the implementation of successful fire risk reduction measures, help to ensure that fire response plans are coordinated at all levels and document and share knowledge about successful fire readiness and response actions.

## FAO Programmes

Wildfires threaten the successful implementation of important programmes of FAO and its partners including:

- Sustainable management of natural and planted forests
- Forest and Landscape Restoration (FLR)
- UN-REDD and climate change adaptation
- Forest & Farm Facility (FFF) and community forestry
- Dryland management programme and the project “Action Against Desertification”

The targets for landscape restoration through FLR, AAD and other programmes are massive. The field work of these critical initiatives can be undone in a day by wildfires. The process of restoring the landscape increases the potential for fire by increasing vegetation cover that creates fuel build up and fuel continuity. This will need to be considered and efforts made to develop preventative, resilient systems that will reduce risks and need less restoration after damaging wildfires. Including fire management in day-to-day work through inclusion in plans, standard operating procedures, monitoring (precursor conditions), policies and laws will be required. FAO’s fire management program needs to link with these initiatives of FAO and its partners to provide the technical, planning, policy and network engagement required to support and strengthen their understanding and response to fire risks.

## Current Fire Management Activities and Demands

### Strategic Program 5 - Increase the resilience of livelihoods to threats and crises

Under the SP5 will:

1. Continue the development of a global burned area reporting system to provide updated and timely global and regional statistics on burned areas in forests and other land cover classes.
2. Carry out a Cost Benefit Analysis of fire management – initially undertaking data collection in 2018 then detailed Cost Benefit Analysis in 2019, to be carried out by the Climate Change and Resilience team in discussion and consultation with SP5 colleagues, FAO Statistics and partnering with decentralised offices. .

### Existing Projects and Programmes

The following FAO initiatives, programmes and projects require fire technical and fire management input and support:

- Action Against Desertification
- Forest Landscape Restoration
- Global Peatland Initiative
- Global Forest Resources Assessment
- Potentially also Farm and Farm Facility, Social Forestry and FLEGT

## Ad Hoc Requests

There are ad hoc requests received from countries, FAO Regional and Country offices and partners. At present there are requests for project design support, technical input, support, resources, funding, guidance or technical review relating to; India, Algeria, Indonesia, Myanmar, Botswana, Tanzania, a GEF project in DRC, a GEF project in The Gambia and Nepal and a GCF proposal in Armenia.

## Representing FAO

There are requirements for FAO to be represented at various meetings, on international groups and entities, such as:

- Expert Group on Forest Fires of the European Commission
- International Liaison Group of the International Wildland Fire Conference
- Fire Management Working Group of the North American Forestry Commission

## FAO Fire Management Strategic Objective

The FAO approach to fire management is simultaneously country-driven and global. FAO must approach the full fire management scope and scale, by engaging with regional and global agendas and bridging short and long-term timeframes; and look to strengthen international understanding of the realities, principles, requirements and experience of wildland fire management to:

- Enable communities, local agencies, and national organizations to implement effective, efficient, and appropriate fire management programmes; to
- Reduce the detrimental impact of fires on hunger and food security, poverty and health, natural resources and landscapes, and the global environment, atmosphere and climate; by
- Accessing clear, soundly based descriptions of fire management requirements and applying the approach of Review and analysis, Risk Reduction, Readiness, Response and Recovery (the 5Rs); through
- Access to data, analytical tools, successful examples of policies, plans and processes that constitute good integrated fire management practice.

## Goals

1. Stimulate understanding and encourage acceptance of the concept of Integrated Fire Management as a comprehensive, balanced system including Research and analysis, Risk Reduction, Readiness to fight wildfires including monitoring and early warning early action, Responding to wildfires and Recovery efforts for communities, assets and landscapes from wildfires (the 5Rs).
2. Identify or develop and then highlight systems and processes to collect and analyse high quality data in support of Research and analysis for identification of critical areas for Risk Reduction, and Readiness approaches for early warning and monitoring of damaging wildfire situations.
3. Identify and then enable mechanisms to distribute information, provide technical assistance and training to leverage the capabilities of local or regional groups.

## FAO Focus

Under the guidance of the Forestry Division, the Regional and Country Offices and the Regional Forestry Commissions the following will be the focus for implementation of the FAO Fire Management Strategy.

### Strengthen Country Capacities

Noting the critical role countries have in fire management a bottom-up approach will be taken to enable and support country ownership, leadership, commitment and accountability. FAO will support countries in strengthening their institutional and technical capacities for fire management in the forestry and agricultural sectors.

The emphasis on analysis outlined in this strategy will be applied to existing and pending FAO Fire Management tasks, TCPs and projects:

- Facilitation of the collection and flow of data to and within countries
- Support for fire management planning including through enhanced analysis of data
- Characterization with actors and stakeholders of the appropriate approaches for Integrated Fire Management for the individual country
- Attention and engagement to include smallholders/communities especially when fire is predominantly on their lands or they are helping reduce fire risks and contribute to readiness and response for fires, such as through CBFIM.
- Guide countries to develop and adopt wildfire Risk Reduction and preventive approaches as a cost effective way to deal with the damage and loss of extreme wildfire events.
- Facilitate and enable exchange of research outputs, models, best practice, systems for Integrated Fire Management and experience between countries so those with limited experience or understanding learn from those with more experience, by stimulating South-South cooperation.

### Improved Use of Fire Data

What constitutes good practice in “Integrated Fire Management” is well described (Attachment 2), however many countries do not have systems in place to support the implementation of these practices in policy and at field level.

Data on fire incidence, land area and biomass burned is weak in many countries and incomplete globally. The combination of existing data sets, remote sensing data, historical information and emerging data sets and methods applied at national level will vastly improve understanding by countries of their wildfires, providing independent and verifiable assessment of where fires occur (fire detection – hotspots) and the landscapes, vegetation and communities impacted (burned area). This step of **Research** and analysis of fires is essential in planning for **Risk Reduction**, **Readiness** to fight wildfires, **Response** to wildfires and **Recovery** of the restoration of landscapes, livelihoods and assets impacted by wildfires.

An additional focus for FAO will be on supporting collaboration and engagement among the remote sensing service providers, researchers and fire and land managers to enable the flow of data and information to countries and facilitate continuous improvement. This might be done through a Workshop of experts, experienced users and fire managers to:

- Consider the products and services (Early Warning, Manuals, SOPs, References, Training materials et al) and modalities (web sites, data delivery, Open Foris, SEPAL, workshops, training, meetings, South-South cooperation, regional networks, twinning and so on).
- Strengthen existing relationships and create new linkages to facilitate coordinated and joint action.

### Compilation and Review of Materials

In the fire management work of FAO and others there are already a range of guides and tools. To strengthen country capacities and support the efforts of FLR, AAD and others, FAO Fire Management will create a comprehensive compilation of relevant, critical and pivotal materials on fire management and make it available, through;

- Seeking options for creating an accessible repository for the history and the body of knowledge and past work (projects, interventions, research etc) related to fire management and ensure it is available online.
- Review and consider for adaptation and enhancement of the existing FAO guides and tools on fire management and scan for others (USFS, Canada, AFAC, ITTO, IUFRO, JRC, EC ENVIRONMENT, World Bank, ASEAN, CGIAR);
- Develop new codes of practice, guidelines, standards and other documents that support countries in addressing fire management and wildfires more effectively.
- Characterise fire management pilots and approaches that have worked and can be scaled up and identifying options that did not work (so as not to repeat them);

- Support, contribute to or convene multi-country technical and policy exchanges to address emerging wildfire issues and advance understanding and adoption of best fire management practices among countries with an emphasis on South-South cooperation;
- Identifying areas for improvement, further analysis, operational or basic research and field implementation
- Include the description and linkage to the products through an update of the SFM Toolbox.

## Products

Drawing on the large body of work that FAO, partners and others have produced over decades and as a result of the FAO Focus the following may be prepared:

1. Fire data sets for pilot countries and a cost benefit analysis of fire management
2. Fire Management Fact Sheet(s) on the various aspects that need to be clear, understood and readily accessible, including: Fire behaviour and fuels, Limits of suppression, Fire numbers and sizes and trends, Characteristics of damaging wildfires
3. Fire as a symptom not the problem; setting out the contributing characteristics and underlying causes including land use change, increased fuel, fuel continuity
4. Guidance on wildfire prevention and fire management at community level, the recognition, reinvigoration and application of traditional fire knowledge.
5. Review of existing fire management texts to create a reference, guide and perhaps an online fire management analysis and planning process framed on the 5Rs.

## Fire Management Strategy Modality

### How FAO Fire Management will do it

FAO's technical capacity in forest fire management, forest resource assessment, disaster risk reduction and its network of regional and country offices is ideally placed to connect, collaborate, advise on and to facilitate integrated fire management where it is needed. The organization has a global technical mandate as a UN agency and is well placed to systematically engage at global to regional to local levels with fire management entities, institutions, multi-laterals and other actors. Interventions and guidance supported by FAO will always be evidence-based and apply sound science. Based on its history of partnership, engagement, communication and interaction FAO will:

1. Through participating in meetings, provision of materials, contributing and commentary on planning, policy, projects and publications, work in partnership with a wide range of institutions, including international and regional organizations, universities, governments, civil society, the private sector and grassroots organizations, including;
  - a. Maintain, deepen and leverage strategic partnerships using existing technical and institutional relationships with the key actors such as the North American and Near East and North Africa Regional Forestry Commissions, European Commission DG Environment Land Use and Management, IUFRO, Silva Mediterranea Working Group 1 on Fire Management, RECOFTC, CIFOR, World Bank and GOFC-GOLD in pursuit of country appropriate fire management elements, systems, approaches, tools and guidance and enabling policy dialogue at global, regional and country levels;
  - b. Interact with UN Environment who are working with insurance companies on disasters including wildfires and damage and loss
  - c. Continue to engage in international and regional fora such as the International Wildland Fire Conference, the International Fire Science Conference, Mediterranean Forest Week, International Association of Wildland Fire, the International Wildland Fire Safety Summit, the Expert Group on Forest Fires of the EC and the Global Fire Monitoring Centre to ensure knowledge of current and emerging initiative, ideas and needs and to ensure FAO can represent the contexts and requirements of member countries in those fora.

- d. Reconnect or connect as feasible and necessary with UNISDR, OCHA, ASEAN, World Health Organization (WHO) and WMO. UNEP, UNDP, UN Habitat, development partners, academia and research, the private sector and civil society organizations, to pursue effective partnerships on relevant issues as required in support of country and regional needs.
2. Respond to member country requests for assistance by supporting the application of Research and analysis for the identification of the national contexts and needs for Risk Reduction and the other fire management elements and strengthen country capacities and activities in:
  - a. The collection and flow of data to and within the country
  - b. Identification of the appropriate approaches to integrate fire management
  - c. Fire management planning including through enhanced analysis of data and stakeholder engagement
  - d. Implementation of fire management plans
3. Enable the collecting, analyzing and monitoring of fire data and information to support policy decisions, through facilitating the improved use of field, historical and remote sensing data to:
  - a. Assess the extent and damage of wildfires and to help focus efforts and resources on the critical areas where intervention and investment are needed for Risk Reduction;
  - b. Raise awareness of the importance of wildfire management to the achievement of global objectives such as the Sustainable Development Goals and the UNFCCC Paris Agreement.
  - c. Work with partners (World Bank, EC, Multi-laterals and donors) to engage with policy makers through information briefs, policy products, support and input to high level meetings and contribution to key policy discussions on aspects of wildfire management (COFO, IPCC, UNFCCC, CBD, and others).
4. Support FAO organisation-wide efforts for comprehensive consideration of fire management:
  - a. Contribute to FAO Strategic Program 5 – Increase the Resilience of Livelihoods to Threats and Crises with a focus on application of remote sensing and Risk Reduction supported by cost benefit analyses.
  - b. Support cross-cutting Themes and Programs including the efforts of FLR, AAD and others in developing preventative, resilient systems of restoration; make available and adapt FAO guides and tools on fire management and scan for the materials others (USFS, Canada, AFAC et al); input to Silva Mediterranea on fire.
5. Develop summary briefs, information products and guidance materials, including on a website, for outreach to raise awareness in developing countries more broadly. Seek opportunities for engagement with countries that are not represented in the existing bodies, do not attend meetings or events and have not sought assistance on fire management.
  - a. Use these materials as a base for building capacity and making available ongoing opportunities for improved understanding and higher learning in fire management.

## FAO Fire Management Partners

### Link Internally

The role of FAO Regions and Country offices is critical and a core comparative advantage of the organisation. The decentralised offices will be informed about FAO Fire Management through communication, briefs and face to face briefings when feasible during missions by the Forest Officer Fire Management. This two-way communication will also involve the identification of fire management needs, requests and requirement for review and analysis of fire put forward by countries or noted by FAO officers and projects. Active two-way interaction, including linkage by FOA Fire Management between country offices and regions will enable South-South cooperation where experience, approaches, solutions and techniques can be shared and developed jointly.

Maintain and strengthen the internal linkages with the FAO FRA, FAOSTAT and FAO UN-REDD teams and Climate Change and Biodiversity division to create coherence and understanding of the fire related potential for their work and facilitate the collaboration and application of their expertise with relevant external actors and for countries. Enable the consideration of fire related use of the data and systems they access, the processes they develop and the partners they interact with (GEOS, GFOI, JRC, WRI, Google and others).

Continue to contribute to the Strategic Objectives and add value by including an integrated approach to fire management beginning with data and analysis then progressing to using the guidance contained in past FAO work on fire management guidelines, legal and regulatory guidelines for fire laws and community based fire management.

### [Link Externally](#)

There are a number of global networks with whom FAO Fire Management will maintain contact or reinvigorate relationships to undertake actions. FAO can utilize its global technical mandate under the UN, 130 Country Offices and regional presence to enable partners to strengthen their understanding, extend their reach, participate effectively and refine their focus through facilitated contact and collaboration guided by FAO. In having relationships with the expertise, resources and capacity of our partners, FAO can guide the analysis of appropriate solutions in the right places at the right time, tailoring to country needs and overcoming FAO's limitation in respect of staff and resources. FAO will leverage its capacity by enabling partnerships in fire management for member countries. In particular:

- Silva Mediterranea Fire Working Group, which has the objectives of
  - Maintaining the contacts of the FFWG network updated at the Website (<http://www.fao.org/forestry/silva-mediterranea/88924/en/>).
  - Reinforcing the collaboration with the Forest Fire Expert Group of the European Commission.
  - Collaborate with other Mediterranean countries as well as Australia, Chile, State of California.
- North American Forest Commission's Fire Management Working Group and other Regional Forest Commissions as relevant
- Expert Group on Forest Fires of the European Commission
- The GOFC/GOLD-Fire Mapping and Monitoring Theme Group
- The European Forest Fire Information System (EFFIS) operated by the Joint Research Centre (JRC) supports the services in charge of the protection of forests against fires in the EU countries and provides the European Commission services and the European Parliament with updated and reliable information on wildland fires in Europe.
- UNISDR Global Wildland Fire Network and Wildland Fire Advisory Group
- The Global Fire Monitoring Center (GFMC) - an institution of the Max Planck Institute for Chemistry, located on the campus of Freiburg University, Germany. GFMC is serving as coordinator and facilitator of the UNISDR Global Wildland Fire Network and Wildland Fire Advisory Group. GFMC provides a global portal for wildland fire documentation, information and monitoring. The national to global wildland fire products of the GFMC are generated by a worldwide network of cooperating institutions.
- Regional organisations such as:
  - Association of South East Asian Nations – ASEAN
  - Asian Disaster Preparedness Centre
  - Southern African Development Community (SADC)
  - Commission des Forêts d'Afrique Centrale (COMIFAC)
  - East African Community (EAC)
  - Organización del Tratado de Cooperación Amazónica (OTCA)

## People

Currently the FAO has only a single Forest Officer for fire management. The Forest Officers in the regions provide a link for input and support for the country context but none have specific technical skills or experience in fire management.

An analysis of the skill set, competencies and experience required to undertake different aspects of the fire management cycle is being prepared to ensure that the Fire Management Framework is consistently the basis and guidance for FAO engagement with countries, agencies and institutions. The analysis will be used to inform the ToR for the next round of consultant recruitment to rosters and to identify institutions and organisations that may be able to provide input, services and support on fire management under the direction of FAO.

## Funding

The profile of wildfire events globally fluctuates and in recent years has been quite high (Attachment 1). The dramatic coverage, human impacts, landscape and climate change implications have not translated into a set of sensible investments in fire management by donors nor sustained interest by multi-lateral organisations.

In 2010 FAO initiated the preparation of a proposal for a multi-donor trust fund “Smart Fire” programme: Managing Landscapes & Fires in a Changing Climate”. The proposal was presented to COFO in 2010 as part of the Heads of Forestry Dialogue, which noted the call to adapt fire management to additionally consider; more integrated, inter-sectoral approaches to fire management across land-uses on the landscape, greater focus on people and fire adapted communities, adoption of community based fire management approaches and greater public awareness and greater access to and sharing of information on fire management, among other things. The proposal was revised with the final version dated February 2012 but was not picked up or supported at that time. The proposal, based on the Fire Management Framework, remains valid and could be used in part or as a whole with minor revision.

The Forest Officer Fire Management has and will continue to accumulate TSS and is being engaged by the World Bank for a diagnostic review of fire management in Indonesia through TCIB. These activities will generate some funding that can be applied to fire management requests and country needs.

Meetings with institutions and organisations that cover fire management, fire research and fire training in the last quarter of 2018 suggests the possibility of collaboration on proposals for joint projects and programs. Discussions are being held with the European Forest Institute, Pau Costa Foundation, Università degli Studi di Firenze, Escola Nacional de Bombeiros of Spain, CESEFOR - Castilla y León Wood & Forest Service Center, VALABRE - École D’Application de Sécurité Civile of France and the Regione Toscana (RT).

## Attachment 1: A Sample of Wildfire Events and Impacts<sup>4</sup>

Wildfires continue to have significant impacts globally, with lives being lost; physical assets, forests, land production and productivity being threatened; landscapes being degraded and livelihoods disrupted. Climate change is exacerbating the risk of wildfires, including the following:

### ALGERIA

Forest fires have long affected Algeria and from 1985 to 2014, over 57 000 fires burned nearly 1.1 million hectares. Though fires are generally small, average fire size less than 20 hectares, impacts on local people, their livelihoods and food security can be significant. FAO on a project with the Algerian Direction Générale des Forêts will seek to understand why, when, where and how fires start and their impacts on people, ecology and infrastructure of the country to develop a comprehensive programme in fire management.

### CANADA – MAY 2016

In May 2016, wildfires forced the biggest evacuation in the history of Alberta, Canada. Over 85 000 people evacuated Fort McMurray due to wildfires driven by strong winds and an extended dry period burning approximately 590,000 hectares. About 2400 homes and structures were destroyed.

### CHILE

#### 2017

Wildfires burned in the Chilean port city of Valparaiso, forcing authorities to evacuate hundreds of people. At least 19 people were hurt, 100 homes damaged and 50 hectares of woodland burned by the wildfire on the outskirts of the historic city. On January 20, 2017, the Government of Chile declared a state of emergency and requested international assistance to combat wildfires that took place in the regions of Biobio, La Araucania, Los Lagos, Maule, Metropolitana, O'Higgins, and Valparaiso. The damage resulted in a significant loss of commercial forests that could affect domestic wood supplies. Chile's Wood Products Association (CORMA - Corporacion Chilena de la Madera) estimated losses at US\$350 million due to the wildfires. The Chilean Agriculture Association (SNA-Sociedad Nacional de Agricultura) estimated total losses for the sector at US\$20 million including 400 ha of olive trees, 100 ha of vineyards and additional loss of damaged storage houses, packing plants, and fences. Farmers were impacted through the loss of animals, farmland, and/or feed.

#### 2014

The city has been badly impacted by wildfires in the past. The Valparaiso wildfire 12th April 2014 burned 95,450 hectares, 28.2 hectares of housing with 2930 houses and 15,000 people affected. Initially isolated houses were burned but the wildfire entered the edge of the city where informal housing had been built and then burned through the urban environment.

### Greece

#### 2018

A wildfire that started near Mount Penteli in late July 2018, east of Athens, burned rapidly into Mati, a coastal town, driven by very strong winds, reported to be gusting up to 120km/hr. There were over 90 killed in the wildfires, with widespread losses of houses and infrastructure and over 300 cars burnt. The fire conditions were extreme and initial factors noted in the event includes the lack of access and egress (escape routes) for those in the area, illegal dwellings and no warnings or alarms given by authorities. Review and report preparation on the wildfire is not complete but there have been statements of more than 3000 illegal houses along the coast including on state land. Also noted was that the wildfire could not be contained under the conditions.

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<sup>4</sup> Note that in many (all?) cases developing country data and information is sparse and often inconsistent. There are few systems in place for fire recording, reporting and analysis. Consequently damage and impact figures and assessments are most readily available for developed but not developing countries.

## 2007

Greece experienced damaging wildfire events in the past, such as in 2007 when 84 people lost their lives, including several fire fighters. High temperatures, including of over 40 °C and severe drought combined to see over 3,000 forest fires recorded. A total of 270,000 hectares of forest, olive groves and farmland were burned in the wildfires, which was at the time described as the worst wildfire season on record.

## Indonesia – June – October 2015<sup>5</sup>

Indonesia has a long history of fires repeated year after year, since 1983 with periodically very bad wildfire years associated with a strengthened El Nino. Fires are becoming more frequent, extensive and severe as temperatures rise and rainfall patterns are changing with some areas becoming seasonally drier. Indonesia has particular challenges with large areas of peatland that have been degraded and made drier due to drainage canals. These are more susceptible to ignition and when they do burn the fires can burn slowly for weeks or months are very hard to control or extinguish. There was an especially devastating fire season in 2015 that burnt 2.6 million hectares between June and October. The population, including in neighbouring ASEAN countries, suffer health impacts from smoke, transport and economic disruption. The World Bank estimates the cost to Indonesia of more than USD 16.1 billion from the wildfires in 2015 alone. The GHG emissions of the wildfires are estimated at ~1,750 million metric tons of carbon dioxide equivalent (MtCO<sub>2e</sub>) nearly the same as the 1,800 million tonnes estimated from the whole Indonesian economy annually. Indonesia has committed to a 29 % reduction in GHG emissions but wildfires like those in 2015 will make reaching this target impossible.

## Portugal 2017

A series of four wildfires across central Portugal started in the afternoon of 17 June 2017 within minutes of each other. The wildfires began in the Pedrógão Grande municipality before spreading dramatically. During the night of 17–18 June, a total of 156 wildfires were recorded across the country, particularly in mountainous areas 200 km north-northeast of Lisbon. Dry thunderstorms preceded the event and may have ignited some fires. A heat wave preceded the wildfires, with many areas of Portugal seeing very high temperatures in excess of 40 °C.

At least 66 people died nationwide in the wildfires, the largest loss of life due to wildfires in Portugal's history, with ~204 people injured, including 13 firefighters. A total of 4~5,000 hectares of land was burned by the wildfires to end June.

Then in October 2017 a series of more than 7,900 forest wildfires affected Northern Portugal and Northwestern Spain. The wildfires claimed the lives of 49 individuals, with dozens more injured. The first wildfires started around October 13 in Galicia and by October 15, 2017, winds increased and helped fan wildfires in both Portugal and Spain due in part to hurricane Ophelia passing between the Azores and the peninsula. In Portugal, on the worst day, firefighters battled over 440 wildfires.

## Spain – May & December 2015

In May 2015 more than 1,350 residents were evacuated in Spain's north-eastern region of Aragon. The wildfire burned approximately 8,000 hectares of forest. More than 120 forest wildfires occurred in December 2015. Spain's forestry association said the unusually high temperatures did not explain the origin of the wildfires, and that "cattle farming interests" could be responsible. Areas of "very high ecological value" were burnt.

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<sup>5</sup> Material from the publication: World Bank, December 2015 INDONESIA ECONOMIC QUARTERLY Reforming amid uncertainty

## Sweden 2018

Northern Europe and particularly Sweden has had a long period of high temperatures, including the warmest May and warmest July ever recorded, with very little rainfall in 2018. Forest wildfires started across Sweden in May and some continue to burn though rain fell in late July. Denmark, Finland and Norway have also had wildfires. In Sweden over 25,000 hectares have been burnt by more than 50 wildfires and fire suppression support has been provided by many other countries under the umbrella of the European Union civil protection processes.

## Tanzania

Analysis of 11 years of Moderate Resolution Imaging Spectroradiometer (MODIS) satellite data for Tanzania showed that 10 to 14 percent of the national land area is burned each year, or approximately 11 million hectares in a country of 88 million hectares.

## United States

Since 1970 there has been a 400 percent increase in fire frequency and a 650 percent increase in the amount of land burned in the conifer forests of the western United States of America. The number of large wildfires in the USA has nearly doubled since the 1980s.

## CALIFORNIA 2018

The 2018 California wildfires, commenced in June and over 4,500 wildfires have burned an estimated 179,000 hectares to date (1<sup>st</sup> August 2018). Commentary from climate scientists suggests that the wildfires in the state will increase due to dryness and temperatures increasing wildfire risk that is being influenced by climate change.

## CALIFORNIA 2017

The 2017 California wildfire season was described as the most destructive wildfire season on record. Over 9,000 wildfires burned 559,035 hectares with 43 people killed and 10,000 structures reported damaged or destroyed. Rain in early 2017 contributed to grass and vegetation growth and some of the most destructive wildfires burned in the period from October to December. There was significant loss of infrastructure and vineyards in the wine growing areas with the total cost of the wildfires estimated at ~US\$180 billion including US\$700 million spend on fire fighting.

## SEPTEMBER – OCTOBER 2015 CALIFORNIA<sup>6</sup>

The Valley Fire started on 12 September and burnt over 20,000 hectares with over 10,000 residents evacuated. Some small towns were largely destroyed including approximately 1,300 homes and 70 businesses. This wildfire at the time was the third most destructive wildfire in California history, in terms of total structures burned. In 2015 in California 364,000 hectares were burned with overall losses of US\$ 1,400 million and four fatalities. The ten most destructive wildfires in US history in terms of numbers of buildings damaged or destroyed have all occurred since 1990 with six of them since 2000 and two of the 10 both occurring in 2015.

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<sup>6</sup> MunichRe February 2016 issue of Topics GEO - Natural catastrophes 2015 Analyses, assessments, positions

## Attachment 2: Integrated Fire Management

Fire management cannot be viewed as just a response to a threatening wildfire, firefighting is a last resort and an indication that analysis and addressing fire related risks may not have been adequately addressed. In most cases no overall fire management framework has been considered that breaks down the requirements systematically. Approaches to fire management should place greater emphasis on addressing underlying causes and seek long-term, sustainable solutions. A framework for fire management that assists in systematic assessing, planning and managing for fires has evolved over time; the 5Rs:

1. REVIEW - Analysis of the fire issue and identification of options for positive change;
2. RISK REDUCTION - Prevention – focusing resources on the underlying causes of fires;
3. READINESS – Preparing to fight wildfires including monitoring conditions, fuel state and activities taking place on the landscape;
4. RESPONSE – Ensuring appropriate responses to unwanted damaging wildfires;
5. RECOVERY – Community welfare, Repairing infrastructure and Restoration of wildfire-damaged landscapes.

Fire management is also not only about addressing fires in forests. Wildfires burn across forested landscapes and also woodlands, brush or bush, grass, or any type of vegetation including fields, agricultural and pasture areas, which contain built infrastructure. All wildfires that are uncontrolled, unmanaged or damaging in any sort of environment outside of cities and structures should be considered.

People are the cause of 90% of fires globally through a combination of poor practice, limited alternatives, accidents, weak understanding of fire risk, low levels of useful historical, operational and forecasting data and sensible early warning. The balance needs to be firmly in favour of investment in understanding and risk reduction for resilience to trigger early action. However, fire management includes naturally occurring fires and planned or prescribed fires that play a useful, positive role in landscapes, such as for resource, cultural, or ecosystem management. In areas where fires are part of the natural or cultural cycle, they must be planned and managed within the scope and context of the landscape system.

Key stakeholders, especially local communities, need to be involved in fire management planning. Resources need to be redirected to support fire data collection and analysis, perhaps research, which improves the understanding of fire causes, identifies existing management practices that encourage harmful fires and promoting management systems that take advantage of well-established fire use; such as through Community Based Fire Management (CBFiM).

Response to fire is best when the management, response, and support are from local or national agencies and resources. When response is delayed, wildfires that could be easily managed and suppressed become too large, too severe, and too complex for any response, no matter how technically advanced or well financed the agencies are. The basis is for the development, support and assistance to local stakeholders and organizations so that they are the primary solution to local fire problems and become the cornerstone of fire management.

Data on fire incidence, land area and biomass burned is weak in many countries and incomplete globally. While what constitutes good practice in Integrated Fire Management is well established, many countries do not have systems in place to support the implementation of these practices at policy and field level. When wildfire events have 'profile' it is because they attract media attention through being visible, dramatic and (usually) damaging. This means one or more of the following – human fatalities, dramatic visuals of big flames, large burned areas, damage to buildings and firefighting (especially aeroplanes). This high profile can, and has, lead countries and donors to sometimes assume the fire "problem" was due to a lack of Response capability (firefighting) and hence an investment in training, equipment, machinery and emergency management systems was the solution. Each country needs response capacity.

However IF suppression solved the wildfire “problem” then the massive budgets spent in many developed countries would have fixed the wildfire “problem”. The impacts listed in Attachment 1, a small subset of wildfire damage, suggests firefighting has not solved the wildfire “problem”. Emerging economies and developing countries are likely to find the financial, social and ecological costs of an approach that is dominated by high cost firefighting a significant economic challenge.

For the management of fire to be credible and sensible, it must be based on understanding of the context of countries, science, collective experience (history, local understanding, past projects and programmes) and clearly presented. Sound fire management is unexciting. It involves routine, repeated and mainly non-dramatic tasks that are the priority actions of the Sendai Framework:

- understanding the (wildfire) disaster risk,
- strengthening (wildfire) disaster risk governance to manage (wildfire) disaster risk,
- investing in (wildfire) disaster risk reduction for resilience
- enhancing (wildfire) disaster preparedness for effective response and to “Build Back Better” (manage risk reduction) in recovery, rehabilitation and reconstruction.

These same priority actions have been described in the Fire Management Framework developed in 2000 and evolved since, the 5Rs.

This Strategy cannot be successful without the committed participation of groups and organizations with an interest and role in fire management. Governmental and non-government organizations and agencies, and academic institutions, the Regional Forestry Commissions of FAO and in Regional Wildland Fire Networks operating collectively, including under the UNISDR Global Wildland Fire Network, are playing an increasing role in facilitating cooperation in fire management between neighbouring countries and the development of local to national capacity in fire management.

## A Framework for Fire Management<sup>7</sup>

System Tools	System Process Components				
<ul style="list-style-type: none"> <li>• Maps (vegetation, topography, tenure, assets, roads, ignition distribution etc)</li> <li>• Fire behaviour prediction tools</li> <li>• Spatial databases</li> <li>• Demographic information</li> <li>• Cultural &amp; Social Context of fire</li> <li>• Ecological response to fire (fire histories, fire effects information, fire regimes)</li> </ul>	<p><b><u>REVIEW - ANALYSIS OF THE FIRE PROBLEM</u></b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; vertical-align: top;"> <b>1. Fire Likelihood</b>  <b>2. Consequence of</b>  <div style="text-align: center;">↓</div>                     Economic                      Social                      Environmental                 </td> <td style="width: 33%; vertical-align: top;"> <b>Ignition history</b>  <b>Fire on</b>  <div style="text-align: center;">↓</div>                     Intensity                      Spread Rate                      Duration                 </td> <td style="width: 33%; vertical-align: top;"> <b>Assets</b>  <div style="text-align: center;">↓</div>                     Value                      Vulnerability                 </td> </tr> </table> <p><b>3. Ecological context of fire</b></p>	<b>1. Fire Likelihood</b> <b>2. Consequence of</b> <div style="text-align: center;">↓</div> Economic Social Environmental	<b>Ignition history</b> <b>Fire on</b> <div style="text-align: center;">↓</div> Intensity Spread Rate Duration	<b>Assets</b> <div style="text-align: center;">↓</div> Value Vulnerability	System
<b>1. Fire Likelihood</b> <b>2. Consequence of</b> <div style="text-align: center;">↓</div> Economic Social Environmental	<b>Ignition history</b> <b>Fire on</b> <div style="text-align: center;">↓</div> Intensity Spread Rate Duration	<b>Assets</b> <div style="text-align: center;">↓</div> Value Vulnerability			
<ul style="list-style-type: none"> <li>• Fire use laws/regulations, enforcement</li> <li>• Planning controls</li> <li>• Education programs</li> <li>• Fire behaviour guides, ignition &amp; control resources, planning &amp; reporting tools.</li> <li>• Firebreak construction guides</li> <li>• Building construction codes</li> <li>• Ecological fire training</li> <li>• Fire use education</li> </ul>	<p><b><u>RISK REDUCTION - PREVENTION</u></b></p> <p><b>1. Ignition Reduction Strategies</b></p> <ul style="list-style-type: none"> <li>- Regulate fire use, educate fire users, technology improvements, development planning controls</li> </ul> <p><b>2. Impact Mitigation Strategies</b></p> <ul style="list-style-type: none"> <li>- Fuel reduction (e.g. by burning, grazing &amp; other means)</li> <li>- Reduce asset vulnerability (e.g. construction standards)</li> <li>- Establish/maintain containment features (e.g. fuel breaks)</li> </ul> <p><b>3. Fire Use Strategies</b></p> <ul style="list-style-type: none"> <li>- Ecosystem maintenance</li> <li>- Fire regime restoration</li> </ul>	Improvement			
<ul style="list-style-type: none"> <li>• Climate, weather monitoring &amp; prediction</li> <li>• Fire Danger Rating system.</li> <li>• FDR public notification means.</li> <li>• Detection/suppression needs assessment.</li> <li>• Fire detection, suppression &amp; communications resources.</li> <li>• Fire training systems and tools</li> </ul>	<p><b><u>READINESS - PREPAREDNESS TO FIGHT WILDFIRES</u></b></p> <p><b>1. Strategies</b></p> <ul style="list-style-type: none"> <li>- Early Warning/Predictive systems</li> <li>- Community warning mechanisms</li> <li>- Detection and response infrastructure</li> <li>- Communications systems</li> <li>- Mobilisation &amp; co-ordination plans</li> <li>- Response triggers and levels</li> <li>- Competent wildfire control staff</li> </ul>	Monitoring			
<ul style="list-style-type: none"> <li>• Response mobilisation plans</li> <li>• Operational responsibilities &amp; procedures.</li> <li>• Strategic information access tools</li> <li>• Decision support tools</li> <li>• Operational management systems</li> </ul>	<p><b><u>RESPONSE - WILDFIRE FIGHTING OPERATIONS</u></b></p> <p><b>1. Detection and Reporting</b></p> <p><b>2. First Response</b></p> <p><b>3. Containment and Control</b></p> <p><b>4. Mop Up and Patrol</b></p> <p><b>5. Command and Control</b></p>	& Review			
<ul style="list-style-type: none"> <li>• Damage assessment tools</li> <li>• Recovery assistance plans</li> </ul>	<p><b><u>RECOVERY POST WILDFIRE</u></b></p> <p><b>1. Community Welfare assistance</b></p> <p><b>2. Economic loss reduction (e.g. salvage logging and replanting, infrastructure repair)</b></p> <p><b>3. Environmental repair</b></p>				

<sup>7</sup> Developed by Metis Associates in 2000, presented World Forestry Congress, Quebec 2003 and evolved since.