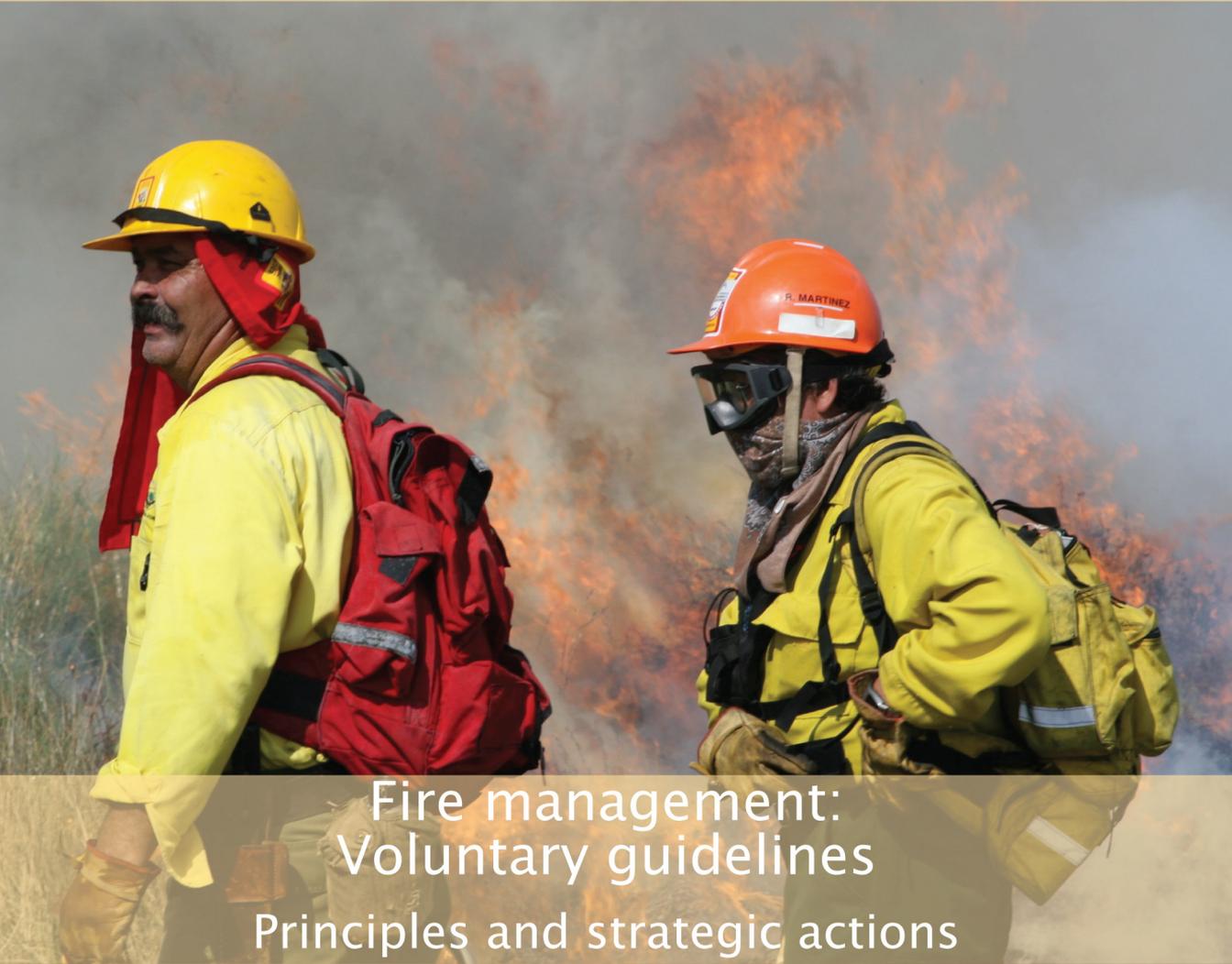




Fire Management Working Paper FM17E



Fire management:  
Voluntary guidelines  
Principles and strategic actions



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The purpose of these papers is to provide early information on ongoing activities and programmes and to stimulate discussion.

Comments and feedback are welcome.

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# Forestry Department

Food and Agriculture Organization of the United Nations

Fire Management Working Papers

**Fire management**

**Voluntary guidelines**

**Principles and strategic actions**



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## Foreword

UNFCCC, UNCCD, CBD and UNFF recognize the critical role of fire – on the one hand, in maintaining fire dependent ecosystems, but on the other, in causing deforestation, forest degradation and destruction of livelihoods, biodiversity and infrastructure. Following the recommendations of the 3<sup>rd</sup> International Wildland Fire Summit, Sydney, Australia, October 2003; the Ministerial Meeting on Sustainable Forest Management, March 2005; and the Committee on Forestry, also March 2005, FAO has been coordinating a multistakeholder process to prepare a global strategy to enhance international cooperation in fire management, including: voluntary guidelines; global assessment of fire management; and review of international cooperation in fire management.

These non-binding, voluntary guidelines set out a framework of priority principles that will aid in the formulation of policy, legal, regulatory and other enabling conditions and strategic actions for more holistic approaches to fire management. They have been tailored primarily for land-use policy makers, planners and managers in fire management, including states, the private sector and non-governmental organizations. The guidelines for fire management cover the positive and negative social, cultural, environmental and economic impacts of natural and planned fires in forests, woodlands, rangelands, grasslands, agricultural and rural/urban landscapes. The fire management scope includes early warning, prevention, preparedness (international, national, subnational and community), safe and effective initial attack on incidences of fire and landscape restoration following it.

The voluntary guidelines provide an international framework, outline cross-sectoral issues, detail the principles and attributes needed to balance the social, cultural, environmental and economic dimensions of fire management and to prescribe key actions for the planning and management of fires. This framework supports achievement of the Millennium Development Goals: particularly Goal 1 to eradicate extreme poverty and hunger; Goal 7 to ensure environmental sustainability; and Goal 8 to develop a global partnership for development.

Preparation of the guidelines involved a core technical group and expert consultations with selected Member Governments, the private sector and non-governmental and intergovernmental organizations. The voluntary guidelines (formerly known as the fire management code) were presented and discussed at the Regional Forestry Commissions and regional wildland fire management meetings in 2006. The draft has been available on the Internet since July 2006 and invitations were made to all countries to consider the contents and format

and provide feedback. This final draft of the voluntary guidelines has been prepared in view of their feedback and recommendations.

The present voluntary guidelines represent a final draft for consideration and appropriate action by the Eighteenth Session of the Committee on Forestry (COFO) in March 2007 and the 4<sup>th</sup> International Wildland Fire Conference, May 2007. It is anticipated that further international collaboration and partnerships will be necessary in order to strengthen country capacity to translate the principles and strategic actions into policies and practices.

FAO encourages Member Countries and organizations involved in the various aspects of fire management to commit to implementation of the principles and strategic actions as outlined in these voluntary guidelines. FAO is available to provide technical support to assist countries in these more holistic approaches to fire management.

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The Fire Management Voluntary Guidelines were prepared over a two-year multistakeholder process involving governments, non-governmental and intergovernmental organizations and private-sector fire specialists and practitioners from around the globe. Many dedicated people and institutions gave willingly of their time and specialist expertise during the formulation and review.

Although the process was coordinated by FAO, Denny Truesdale of the United States Forest Service, USA, was the lead author, ably supported by a core team of specialists, including Johann Goldammer, Global Fire Monitoring Center, Germany; Gary Morgan, Australasian Fire Authorities Council, Australia; Patricio Sanhueza, Corporación Nacional Forestal, Chile; Brian van Wilgen, Jonkershoek Forestry Research Centre, CSIR Natural Resources and the Environment, Council for Scientific and Industrial Research, South Africa; Ricardo Vélez, Servicio Nacional contra Incendios Forestales, Dirección General de Conservación de la Naturaleza, Ministerio de Medio Ambiente, Spain; Ayn Shlisky and Robert Myers, Global Fire Initiative, The Nature Conservancy, USA; Murray Dudfield, National Rural Fire Office, New Zealand; Eric Rigolot, Institut National de la Recherche Agronomique, Unité de Recherches Forestières Méditerranéennes; and Leonid Kondrashov, Training Institute in Ecology and Nature Management, Russian Federation.

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# Acronyms and abbreviations

COFO	FAO Committee on Forestry
ICS	Incident Command System
IPCC	Intergovernmental Panel on Climate Change
ITTO	International Tropical Timber Organization
UNEP	United Nations Environment Programme
WMO	World Meteorological Organization

# 1. Introduction

The present voluntary guidelines set out a framework of legally non-binding principles and internationally accepted strategic actions. They address the cultural, social, environmental and economic dimensions of fire management at all levels. In accordance with recommendations of the International Wildland Fire Summit in October 2003, the Ministerial Meeting on Sustainable Forest Management in March 2005 and the FAO Committee on Forestry (COFO), also in March 2005, FAO has been coordinating a multistakeholder process to prepare the principles and actions as part of a global strategy for international cooperation in fire management.

The global strategy also includes: an assessment of fire and its impacts; an assessment of current networks, partnerships and other areas of cooperation among fire management entities; and a plan for implementation. Implementation is seen as a voluntary, open and inclusive process that will benefit people, resources, assets and the environment. The principles will aid in the formulation of policies, laws and regulations, while the strategic actions will enable holistic approaches to fire management.

Preparation of the guidelines involved a core technical group and expert consultations with selected member countries, private-sector associations and non-governmental and intergovernmental organizations. The draft was available on the Internet for public review and comment by all interested parties.

This section presents the international context, potential users and implementation guidance.

## 1.1 Background

The principles and strategic actions are global in scope and are provided to: all elements of civil society and the private sector; member nations of FAO and non-members; policy level and senior managers of subregional, regional and global organizations, whether governmental or non-governmental; owners and managers of forest, range, grassland and other ecosystems; and all stakeholders concerned with the protection of lives, property and resources from the effects of unwanted, damaging fires and with the use of fire to enhance ecosystems and economic benefits. Other sectors may also find the principles and strategic actions useful in their roles in society: insurance companies, advocacy groups, and specialists in communications, disaster management and public relations.

It is anticipated that the principles and strategic actions will be promoted for use in governance, education, guidance, benchmarking, cooperation and advocacy related to all aspects of fire management. Their various features will provide contexts for social, economic, cultural, environmental and political discussions at subnational, national, regional and international levels. The principles and strategic actions can serve as a checklist to strengthen policies, legal and regulatory frameworks, plans and procedures and, where these do not exist, will be a useful basis for their development and implementation.

The scope of this paper is broad, because the definition of the term 'fire' is broad. A fire in the present context is any fire burning living or dead vegetation outside of the urban or structural environment. The scope covers all planned and unplanned fires in natural forests, planted forests, protected natural areas, rangelands, grasslands, shrubs, brush and other vegetation types, including fires in peatlands, swamps, mires and fens. It also covers surface or crown fires in landscaped, planted or tended agricultural vegetation when the fire is not planned and implemented as part of an accepted agricultural technique. In this context, it also comprises a fire that burns from a wildland or other area into a rural, urban environment or cultural or historical area, with structures becoming involved.

The framework presented is applicable to planning, organization and management of a safe, effective and efficient fire management organization or governmental agency. It covers the full range of fire management activities, from prevention, early warning, detection, mobilization and suppression of unwanted and damaging fires, through appropriate use of natural or human-caused fire in maintaining ecological values and integrity of certain ecosystems, to the use of fire to reduce the accumulation of natural fuel and residues from commercial or non-commercial activities and the rehabilitation of ecosystems damaged by or dependent on fire.

A fire may burn across ecosystem boundaries or various types of lands. The techniques, policies and processes outlined are applicable to forest fires, grass fires, fires within settlements or involving scattered dwellings and other structures.

The term 'fire management' is also very broad. Fire management is the discipline of using fire to achieve land management and traditional use objectives, together with the safeguarding of life, property and resources through the prevention, detection, control, restriction and suppression of fire in forest and other vegetation in rural areas. This involves planned as well as naturally occurring fires, and includes research and technology transfer.

## 1.2 Rationale

Over the past decade, many regions of the world have experienced a trend towards excessive fire application in land use systems and land use change – and towards more extremely severe fires. Some of the effects of fires are transboundary, for example smoke and water pollution and their impacts on human health and safety, loss of biodiversity, and site degradation at the landscape level, leading to desertification, soil erosion or flooding. The depletion of terrestrial carbon by fires burning under extreme conditions in some vegetation types, including organic terrain in peatland biomes, is one of the driving agents of the disturbance of global biogeochemical cycles, notably the global carbon cycle. This trend is documented by a wealth of scientific data on the cultural, social, economic and environmental dimensions of fire.

In many fire-dependent ecosystems, the frequency and seasonality of fire determine which species persist and which perish from the ecosystem. Fires at too-short or too-long intervals will lead to a loss of plant species and a reduction in biodiversity, not only for plants, but for animals as well, through the modification of habitats. The invasion of ecosystems by non-native plants can also lead to a significant change in fire regimes, often with negative results.

Human population growth is associated with increasing rates of conversion of natural vegetation to agricultural and pastoral systems, and with the development of residential areas, infrastructure and traffic. Land-use change is occurring in traditionally uninhabited or uncultivated areas, such as extreme mountain slopes, some coastal areas and floodplains. This is often a consequence of poverty, deforestation or vegetation conversion for short-term production of cash crops for the global market. In many regions of the world, the process is associated with the use of fire for land clearing and the increasing occurrence of uncontrolled fires. In many developed areas, on the other hand, fire intensities increase when land is abandoned or left unmanaged, resulting in an increase in potential damage to resources, property and infrastructure.

## 1.3 Objectives

The voluntary guidelines are intended to serve the following objectives:

1. establish principles in accordance with the relevant rules of international law for responsible fire management activities, taking into account all relevant biological, technological, economic, social, cultural and environmental aspects;

2. contribute to the establishment and implementation of national and subnational policies and planning mechanisms for establishing or improving the legal, regulatory and institutional framework required for responsible fire management activities;
3. provide guidance that may be used, where appropriate, in the formulation and implementation of international instruments, both binding and voluntary;
4. facilitate and promote mutual assistance and technical, financial or other forms of cooperation in fire management between agencies and donor organizations;
5. encourage and publicize the contribution of effective community-based fire management in providing food security and meeting people's livelihood needs; and
6. advocate sustainable land and resource management programmes that consider the ecologically appropriate use and management of fire, where permitted, and the suppression of unwanted, damaging fire.

Special consideration is given to social and community values and to engaging the community in fire management planning and implementation.

Any effective fire management programme must consider the ecology and fire history of the area. In many cases, maintenance of appropriate fire regimes or the reintroduction of fire is as important as preventing unwanted, damaging fires. The use and benefits of planned fire are not simply for protection and suppression.

Implementation guidance is provided for protective activities in the interface between communities and forest and other areas, with the recognition that ecological values must be considered alongside human values and cultural norms.

## **1.4 Relationship to other international instruments**

Several international instruments, conventions and agreements have relevance for fire management. The present guidelines address key subject areas of these instruments and furnish agencies and organizations with a framework for managing fire.

The principles and strategic actions are intended to be interpreted and applied in compliance with these conventions and declarations, in particular with the United Nations Framework Convention on Climate Change, United Nations Convention to Combat Desertification, Convention on Biological Diversity and United Nations Millennium Declaration. Such application would

constitute steps towards achievement of the Millennium Development Goals, particularly Goal 1: Eradicate extreme poverty and hunger; Goal 7: Ensure environmental sustainability; and Goal 8: Develop a global partnership for development. Annex 1 contains a list of supported international instruments.

Relying, as well, on many other mechanisms, codes and guidelines, the principles and strategic actions have drawn on the experience of organizations and individuals throughout the world. Several existing documents provide implementation guidance on traditional uses of fire in prevention plans. Some examples are: the International Tropical Timber Organization's *Guidelines on fire management in tropical forests* (ITTO, 1997); the FAO *Guidelines on fire management in temperate and boreal forests* (FAO, 2002); and the Global Fire Monitoring Center's *Wildland fire management handbook for sub-Saharan Africa* (Goldammer and de Ronde, 2004). This is just a partial listing. Many countries and other organizations have handbooks, manuals and planning documents that provide information and assistance in establishing a fire management programme. There are other codes that provide a basis for laws or statutes for agencies and organizations interested in establishing the legal basis for a fire programme.

Nothing in the voluntary guidelines prejudices the rights, jurisdiction and duties of individual countries under international law as reflected in international conventions and agreements. The principles and strategic actions support and complement the fire management guidelines, policies, programmes and regulations currently in effect in many organizations, agencies and governments.

## **1.5 Implementation of the principles and strategic actions**

All entities with fire management responsibilities will benefit from collaboration when translating the principles and strategic actions into their policy, legal and regulatory frameworks; fire management strategies, programmes or plans; codes, standards or guidelines for implementation or for monitoring and reporting of compliance. Such entities may include: Member Countries of FAO and non-members; relevant subnational, national, regional and global organizations, whether governmental or non-governmental; and all stakeholders concerned with the management of forests, rangelands, grasslands and protected areas and the interface between any of these and areas of human development.

Governments, international bodies and non-governmental organizations are encouraged to promote understanding of the principles and strategic actions

among those involved in resource management, forest resource protection, air and water quality, community protection and ecological restoration and rehabilitation – including, where practicable, by the introduction of processes that would promote voluntary acceptance and effective application. Although the principles and strategic actions are non-binding, governments are encouraged to adopt them in their policy, legal and institutional frameworks and in their planning and implementation standards for fire management.

FAO, in partnership with other agencies, organizations and experts, may revise the guidelines in view of developments in fire ecology and behaviour, social and psychological factors, research and experience with implementation.

## **1.6 Diversity of contexts and special requirements**

The diversity of contexts suggests a wide variation in approaches to applying and implementing the principles and strategic actions. Organizational capabilities range from countries with well-funded and resourced organizations to countries and regions without active fire programmes. Environments and fire regimes range from areas with few fires and little fire impact, to areas in which fire is a key component of ecosystem health, and to areas where fires cause considerable damage to ecosystem functions. Rural, urban, uninhabited and interface areas each have different needs and different potential.

The context in which the current fire management programmes are not safe, effective or environmentally and socially acceptable is particularly relevant. Even in developed countries, the programme chosen may not completely match the current situation. Some areas have people and communities moving into fire-prone areas, causing problems for protection from fire. In other areas, people are abandoning rural areas and leaving large tracts of unmanaged lands, which are becoming at risk for fire.

Of particular interest are areas in which fire plays an important role in the environment, either naturally playing a role in sustaining the ecosystem or providing for livelihoods through agricultural or other uses. As populations increase in these areas, the need to adopt an appropriate fire management programme becomes more important. Thus the need to protect lives, resources and property from the adverse effects of fire must be balanced against the need for the appropriate use and equilibrium of fire in the environment.

The capacity of developing countries to implement the present recommendations should be taken into account. In support of effective implementation, governments, international and non-governmental organizations, financial institutions, landowners and users should fully recognize the special circumstances and requirements of developing countries. Emphasis may be needed in the areas of financial and technical assistance, technology transfer, training and scientific cooperation, and in enhancing countries' abilities to strengthen and develop their fire management organizations and capabilities. This may be particularly important for the least developed among them – small island developing states and low forest cover countries in fragile ecosystems where damaging fires occur.

## 2. Cross-sectoral issues

In this section, cross-sectoral issues fundamental to fire management are introduced. The discussion of these issues provides an overview of the impact of fire on other sectors, as well as the impact of those sectors on the prevention, suppression and use of fire. The dilemma faced by many is that fire can be a destructive force and, conversely, be a natural and vital component in the ecology of the area – and be both at the same time.

### 2.1 Livelihoods and poverty

Within the natural environment, fire can be a normal part of the cycle of ecosystems and can ensure a healthy, sustainable source of food and resources. It is a tool and a beneficial force in improving people's lives. Fire is a key component in the agricultural practices of people in many different ecosystems. In some areas, it is managed by traditional rural communities to maintain healthy forests, ranges and grasslands that provide habitats for hunting and for the gathering of fruits, nuts, grains and other food sources. Fire may be the most economical method for improving forage for domestic and wild animals and increasing livestock production. On the other hand, it can also damage or destroy homes, food and natural resources and pollute the air. At times, the use of fire to prepare fields, reduce pests and diseases and improve forage results in disaster when these fires escape.

Clean, safe water is often a scarce natural resource. Water quality and quantity may be affected by vegetation fires in catchments. However, planned fires reduce excessive amounts of vegetation. The right level of vegetation cover, may help ensure adequate flows of quality water. In addition, the lower fuel load will reduce the risk of severe fires burning all of the vegetation and damaging soils, resulting in major water-quality degradation.

A comprehensive fire management programme can contribute positively to achieving specific features of human rights and livelihoods: poverty alleviation, food security, clean water, good health, education and participation in the economic life of the country. Protection from unwanted, damaging fires and the management of fire to benefit society can contribute to achieving these goals.

## 2.2 Fire as a tool in sustainable land use and resource management

The concept that there is ‘good fire’ should be supported and advocated. Fire can be good for habitats, for resources, for reducing threats and for maintaining cultural values. Some sectors that use fire as a tool to enhance output and facilitate land use are agriculture, forest resources management and pastoral and wildlife management. Fire has been part of the agricultural and forest practices used by societies for millennia and in many areas is still so used today. From a fire management standpoint, there is generally no difference in the use of fire for planted crops or for promoting the growth of naturally occurring sources of food for consumption by both people and livestock. The same is true of the use of fire to maintain traditional or cultural landscapes or vegetation patterns.

Fire can also be the tool of choice for land clearing and conversion. In many ecosystems, it is relatively easy to slash live vegetation and allow it to dry to the point that it will carry fire. It can then be burned, and if the purpose of the conversion is agriculture, there is an added benefit, because the fire releases stored nutrients into the soil to promote the growth and vigour of crops.

## 2.3 Impacts on human health and security

Smoke pollution due to land-use fires and wildfires is an important public health issue and involves major risks for human and environmental health. Smoke pollution generated by vegetation fires is a recurring phenomenon. It may lead to increased mortality and hospital admissions due to respiratory and cardiovascular diseases. The smoke and haze from planned or unplanned fires can also adversely impact aviation, shipping and vehicular traffic, resulting in risks to safety as well as economic losses.

Elements of vegetation cover with an environmental ‘protective function’ include above- and below-ground parts of plants, i.e. roots, the humus and grass layers, and the stems and leaves of brush and trees. Sites affected by uncharacteristic, high-severity or excessively frequent fires are subjected to excessive water runoff and erosion – processes that result in mud-, land- and rockslides, flash floods and flooding at the landscape level – as well as to wind erosion.

Improvements in human security can be based on a concept of ‘fire-adapted’ communities. The term is well established in describing communities of flora and fauna. It can also be applied to human communities, and may prove to be very useful in describing an ideal set of conditions under which people live in

harmony with the normal occurrence of fires and their impacts. However, in many parts of the world, people living in communities with high incidence of fires often have insufficient institutions and infrastructure to provide appropriate fire protection.

## **2.4 Safety considerations for firefighters and civilians**

For firefighters and fire managers, safety is a core value and cannot be compromised. It is a critical part of all activities, from planning through restoration. In fact, one of the most common reasons for establishing a fire management organization is to protect firefighters and communities from unwanted fires. Even countries with well established and highly financed fire management organizations can and do experience the devastating effects of massive fires.

Public safety is closely tied to issues of security. Uncontrolled, devastating wildfires destroy homes, businesses, schools and other types of structures throughout the world. Protecting communities and saving lives starts with community education and preparation. Perhaps the best way to save lives is to have a fire-adapted community, one in which infrastructure and buildings are constructed so as to facilitate subsequent protective actions and in which civilians are able to assist in their own protection and safety. Appropriately designed and constructed buildings offer protection to people during fires, reducing the likelihood of fire-related injuries and fatalities.

Public safety is very important, but the safety of the firefighter must be given the highest priority in the policies, procedures, plans and management philosophy of any agency or organization. Firefighter safety begins with the provision of the proper safety equipment and training to each individual in fire suppression and prescribed burning operations.

Safety training includes education in the local weather and terrain, as well as in the flammability of fuels. Firefighters must also be trained to recognize the characteristics of fire behaviour, such as intensities, spread rates and when a smouldering fire can re-ignite and begin to spread. Crews need to understand how to monitor fires and to estimate potential changes in order to avoid becoming trapped by an unanticipated change in spread or intensity.

## 2.5 Sustainable ecosystems and environmental impacts

Maintaining sustainable, properly functioning ecosystems should be a goal for all fire management programmes. In many instances, attention is paid to the damage and destruction of fires and not to the underlying ecological or social causes. Ecosystems have evolved over time with different fire regimes. Some fire-dependent, healthy, sustainable ecosystems experience fast-moving, high-intensity fires that can nonetheless cause substantial damage to structures and resources. The same types of fires may occur in fire-sensitive ecosystems and cause damage to ecosystem health, and it is important to understand the difference and to focus restoration activities on achieving a healthy balance between ecosystem health and public safety.

This type of ecosystem management requires a landscape-scale approach to planning, managing and restoring ecosystems, and not simply a focus on small-scale site impacts. A broad view balances impacts and losses, both economic and non-economic. Such losses may be difficult to quantify, but they should be recognized and considered at an appropriate scale.

No single type or frequency of fire is right for all ecosystems or landscapes. A fire-sensitive or fire-intolerant area may need complete protection from human-caused fires. Fire-dependent ecosystems, on the other hand, need some type and frequency of fire – achieved either through the natural fire cycle or the use of planned fires. In some areas, a variety of fire occurrences, intensities and extent will be needed in order to promote biodiversity and a range of habitats. Invasive and/or alien plants can complicate the management and use of fire. The effects of an otherwise appropriate fire regime need to be considered carefully in the management of ecosystems invaded by unwanted, invasive plants in order to avoid negative impacts.

The inappropriate use of fire at the wrong frequency or intensity will lead to a loss of plant species, a change or reduction in vegetation structure and, in some cases, a corresponding loss of animal species. With human demographic changes and population migrations, the most effective and safest type of fire may be planned fire managed for a specific, desired result. However, if the natural occurrence of fire can be used safely, this may be the most economical approach.

## 2.6 Carbon and climate change

The Intergovernmental Panel on Climate Change – of the World Meteorological Organization (WMO) and the United Nations Environment

Programme (UNEP) – has recently concluded that "the global average surface temperature has increased over the 20th Century by 0.6 °C, lower atmosphere temperatures are rising, snow cover and sea ice extent have decreased, sea levels are rising, atmospheric greenhouse gas concentrations continue to increase due to human activities, and global temperatures and sea levels will continue to rise under all modelling scenarios" (IPCC, 2001). Numerous general circulation models project a global mean temperature increase of from 1.6 to 5.4 °C by 2100 – a change much more rapid than any experienced in the past 10 000 years. The frequency and severity of extreme weather and climate events are also projected to increase and will lead to an alteration of fire regimes. Most importantly, more frequent droughts may result in increasing occurrences of high-severity wildfires, with consequences for vegetation cover loss, desertification and reduced terrestrial carbon sequestration.

The 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change calls for the "protection and enhancement of sinks and reservoirs of greenhouse gases", and requires all countries to monitor and understand the major factors influencing the exchange of carbon between the biosphere and the atmosphere. Both land-use fires and wildfires in all ecosystems are affecting carbon pools and global carbon cycling. At the same time, climate change affects the duration and severity of dry seasons, thus having an impact on the incidence and severity of fires. The principles and strategic actions support national and international capacity for appropriate, proactive fire management responses as they relate to mitigating the effects of climate change on fire regimes and carbon pools and vice versa.

## **2.7 Knowledge management**

Knowledge management is an important but often neglected part of fire management. Most organizations have a system for storing information or historical documents, but few have a comprehensive programme for knowledge management. A comprehensive information- and data-collection system goes beyond the minimum requirements for maintaining legal and financial information to gathering, understanding and using aboriginal, traditional and local knowledge in conjunction with scientific and research results. Such a system is capable of guiding the appropriate use of the latest technological methods.

In fire-dependent or adapted ecosystems, traditional knowledge may provide a wealth of information that cannot be discovered by the current generation of fire practitioners over the course of one career or lifetime. Traditional lore and

knowledge are passed down through many generations and may reflect a cycle of environmental conditions that occurs over hundreds of years.

Knowledge management also refers to the collection and use of statistics, reports, reviews, evaluations and other types of management systems common within business, government and other organizations in modern society. With the introduction of computing and communications systems, the exchange of information and knowledge is becoming easier and more effective. The challenge for the modern manager is to effectively use these new systems to strengthen the organization, improve safety conditions and blend new knowledge and scientific discoveries with traditional lore and knowledge. When that is done well, both the ecological and the social systems benefit.

## 2.8 Science and technology

Fundamental fire science is of a multidisciplinary nature and includes a number of classical disciplines ranging from social sciences to ecology, physics and chemistry. Cultural and anthropological fire history and geography, humanities, arts and social and economic sciences are addressing the human role in shaping the global environment by fire. Interdisciplinary research aims to better understand complex processes such as fire/atmosphere/climate interactions. Support for continuing research and integration across these fields is critical if the fire community is to advance with new knowledge, tools and technologies.

Much research has been done over the years, and the transfer of scientific knowledge through vocational education is vital to understanding and practising advanced fire management. Public education is essential, in particular in wildfire prevention and ecologically sound and safe burning techniques.

The transfer of knowledge from the research community to private citizens can be accomplished through public awareness programmes. Such a transfer should teach the ecological or environmental effects of fire, how to design fire-adapted communities and how to respond during emergencies. If the transfer is to be successful, information has to be available in a language generally understood in the community. Much of the literature will need to be translated into local languages and adapted to the local social, economic and ecological situation.

## **2.9 Education, training and public awareness**

Education and training form a bridge between research or technical knowledge and the effective application of policy and procedures. They are needed within organizations and for external partners and members of the community. An effective programme of community engagement in fire management and safety can help prevent unwanted fires, build the trust of the community in the fire management programme and inform citizens of their responsibilities in using fire wisely and carefully.

Education is often regarded as being related to formal university studies, but it should also include community-based education. A community-based programme will inform citizens on the technology of fire management, but can also gain by learning from the traditional knowledge of the community. This two-way flow of traditions and knowledge will be beneficial to all.

The training and qualification components of fire management provide the information and knowledge necessary to implement a safe and effective programme. The training developed should consider environmental conditions and the local fire regime, and should be available to all members of the fire management organization. The training programme for volunteers and members of the community – who are not full-time employees or only respond to an occasional incident – needs to be of the same quality and to emphasize clearly the need for safety and caution in the face of an uncommon event.

The public will be more aware of the fire situation if they are part of the total programme. A public that is knowledgeable about the role and uses of fire and the need for the community to participate in the protection of life, property and resources will be an effective partner in the total fire management programme. Public awareness has to be followed by public involvement in implementing fire management programmes.

## **2.10 Legal, policy, institutional and financial frameworks**

Government actions are based on policies, laws and jurisdictional authority. This is also true for fire management programmes. The actions of the agency's or landowner's officials – who suppress fires, conduct fuel treatment activities or prevent civilians from engaging in dangerous or risky actions – will not be effective if they are not following a clear legal, institutional and policy framework.

The legal framework is the underlying basis of a fire management programme. In general, the directive that establishes a purpose or objective for an area, such as forestry, cultural landscape preservation or development, will be the primary one, with fire management directives secondary to the primary objective. The agency or landowner responsible for carrying out the primary objective should develop and implement a fire management programme that takes into account the role of fire, the need for protection and the impact of fire on adjacent areas, communities and civilians.

Policies are needed to explain how laws will be interpreted, and to what degree. By clearly stating and implementing the policy, the agency or landowner will be better positioned to explain the need for planned fire and to maintain the support of the community. If the policy is not clear, it will be difficult to implement and maintain a programme.

In forest and rural areas where the use of fire is an important tool for land and resource management, or where fire is a critical feature in fire-dependent ecosystems, a legislative mandate is needed so that fire use can continue. This legal framework provides accountability for fire management and guarantees that managers use fire responsibly. Land managers, landowners and fire suppression agencies need to work cooperatively to ensure that protection and use are properly balanced.

The institutional framework can be defined as all the processes and procedures an agency or landowner has developed and implemented to carry out the programme. An effective and efficient programme can be said to be 'institutionalized' when the framework is so ingrained into the thoughts, actions and goals of the members of the organization that it is accepted and promoted at all levels.

An adequate and continuing source of funding is needed. Much of the work of fire management takes place before a fire starts. Relying on emergency funding during fire crises will not develop the properly trained and equipped organization needed to safely and effectively respond. Financial support is determined by the fire regime, the amount of fire and the economic values at risk from fires, all considered within the context of the resources available locally. In almost all situations, funding an effective fire management programme will be less expensive than the cost of reacting to emergencies and suffering the economic losses of homes, structures, resources and livelihoods.

## 2.11 Cooperation and partnerships

Proposals for rules, procedures and standards for international cooperation in fire management are being developed by a range of interested partners. These include the United Nations and other international organizations, government agencies, academia and representatives and organizations of civil society, e.g. non-governmental organizations and the private sector. These constitute first steps towards the establishment of internationally negotiated and agreed standards.

Two recent efforts among many others are worth noting. The expansion of the regional wildland fire networks – supported and sponsored by the Global Wildland Fire Network of the United Nations International Strategy for Disaster Reduction – aims to facilitate dialogue and cooperation among countries. The guiding principles developed for fire management, international agreements, community-based fire management – and the international recognition of the Incident Command System (ICS – see Annex 2) – during the International Wildland Fire Summit in Sydney in 2003 are the foundation for many of the present principles and strategic actions.

Cooperation, at all levels, is used by all types of agencies and organizations to address fire management workload cost-effectively. While not universally true, it is certainly common that the responsibility for fire management is shared by agencies or organizations within a community, state/province or country boundary. In some systems, one agency/organization will have responsibility for all types of ownerships and lands, and the need for cooperation and coordination will occur at the boundary. This may be countrywide, and the boundary for cooperation will be an international boundary. Or jurisdictions may be by city, county, parish, district or other designation, and there will be a need for interagency coordination at jurisdictional boundaries within the country.

Another example is a comprehensive, pre-fire-season cooperative agreement that provides for a full range of cooperative activities. Agencies, within or across country boundaries, will agree on when, where and to what extent resources will be exchanged or sent in assistance. These agreements usually have provisions for reimbursement and may even have provisions under which personnel from an assisting agency detect, attack and suppress a fire without any resources from the home jurisdiction being involved at any point during the operation. An agreement such as this can only be effective if all parties agree on the qualifications of the personnel and the methods of operation, for example the use of a common operating system such as ICS.

Perhaps the most critical factor is that the agency administrators have confidence in the ability of all partner agencies to follow procedures, conduct operations and adequately monitor, evaluate and comply with all aspects of the agreement. If those conditions can be met, this type of agreement will prove, over time, to be an effective, cost-efficient and productive operational agreement. Leaders entering into any type of agreement should consider forming a council, oversight committee or other formalized group to oversee the various aspects of the agreement and meet regularly to review performance, suggest and implement improvements, and ensure compliance with all performance requirements.

Cooperation and partnerships are important in all aspects of fire, not just in suppression. Mutual assistance agreements are the most common in local and international use, but many comprehensive arrangements provide for all types of fire management exchanges and cooperation, including joint planning and implementation of projects, training, technology exchange and research.

## 3. Principles

The principles address various dimensions of fire management. This section summarizes specific aspects that should be considered for each. Although the principles are grouped as social and cultural, economic, environmental, institutional and enhanced fire management capacity, they are closely interlinked. Some aspects are listed under more than one principle to reinforce these linkages.

### 3.1 Social and cultural

#### Principle 1: Sustainable livelihoods

**The appropriate use and management of fire will promote sustainable livelihoods.**

Aspects of the principle include but are not limited to:

- actively suppressing unplanned fires that threaten assets and sustainable livelihoods;
- allowing and promoting the appropriate management and responsible use of fire for sustainable silviculture, agriculture, livestock and watershed management and biodiversity conservation, while balancing these with the need to protect civilians, communities, organizations and governments from the unwanted and harmful effects of fire;
- actively planning and undertaking fuel reduction programmes as cost-effective methods for fire prevention and reduced fire risk;
- promoting the use of planned fire across broad landscapes to restore or maintain natural fire regimes, facilitate land management and reduce the risk of large-scale, destructive wildfires;
- allowing natural fires to burn within an appropriate range of frequency, season and intensity in fire-dependent ecosystems for economic and social benefits, as well as for maintaining habitats and reducing the cost of suppressing unwanted fires;
- promoting effective monitoring and evaluation of the impacts of planned and unplanned fires.

## Principle 2: Human health and security

**Human health and security will be improved by minimizing the adverse effects of fire.**

Aspects of the principle include but are not limited to:

- providing for firefighter, fire manager and public safety in all fire activities;
- maintaining and supporting an effective fire prevention programme that minimizes the number and impacts of unwanted, destructive fires;
- developing or adapting an existing fire danger rating system, in conjunction with reliable weather forecasting, to provide hazard and risk assessments to agencies, landowners and communities;
- utilizing early detection and warning systems to reduce the health and security impacts of wildfire;
- providing education and training to at-risk communities and to communities of interest;
- conducting community-based risk-reduction activities during all stages of fire management activity: pre-fire, during fire events and post-fire;
- balancing the negative and positive effects of fire on communities when utilizing fire as a land management tool;
- empowering communities to accept responsibility for the management of fire and its effects on their health, safety and welfare.

## Principle 3: Traditional uses of fire

**The traditional uses of fire on the lands of indigenous peoples and traditional rural communities should remain as a practice for those communities and be adapted to the current environment.**

Aspects of the principle include but are not limited to:

- continuing the traditional use of fire provided that any potential negative impacts on communities and resources can be prevented or mitigated;
- gathering and maintaining the traditional lore and knowledge of indigenous and traditional peoples and integrating their practices into a modern fire management programme;
- maintaining a range of landscapes and environments that provide diversity of habitats, species, resources and opportunities for recreation, commerce, community enjoyment and cultural and religious practices.

## 3.2 Economic

### Principle 4: Protecting lives and assets

**The destructive impacts of unplanned fires on lives, property and resources should be minimized, if not totally prevented.**

Aspects of the principle include but are not limited to:

- minimizing or preventing the likelihood of unwanted, damaging fire through knowledge, training, participatory planning and preparation, and appropriate suppression and mitigation systems;
- responding promptly and safely to unwanted and unplanned fires;
- actively managing fire to protect lives, property and resources during fire suppression, including the use of fire as a suppressive agent;
- operating in an environmentally sensitive manner while suppressing fires and restoring altered or damaged lands in order to lessen severe, long-term impacts;
- influencing the planning, construction and location of new buildings and adjacent vegetation to minimize the risk of damage from fires, and discouraging inappropriate development in fire-prone ecosystems;
- influencing the planning and implementation of fire-prone activities in agriculture, forestry and other industries in order to minimize the risk of damage from unplanned fires to lives, property and resources;
- allocating resources based on the probability of ignition and expected fire behaviour, and balancing the costs of fire prevention, preparedness and suppression.

### Principle 5: Economic impact

**An effective and efficient fire management programme requires a balance between the benefits society receives from the use of fire and the costs, damages or undesirable impacts caused by unwanted fire.**

Aspects of the principle include but are not limited to:

- fully accounting for ecosystem benefits, costs and economic outputs from the use of fire for resource management and the public good;
- identifying the benefits of mitigating the unwanted effects or damages to lands and resources from unwanted fires;

- developing and implementing all fire management strategies and fire-use programmes in order to maximize both the ecological and environmental benefits and the economic return;
- developing methodologies and standards for quantifying positive and negative fire effects and assessing fire damage, including effects on non-economic or non-commodity values, as well as on other social and environmental values.

### 3.3 Environmental

#### Principle 6: Interactions between climate change and fire

**The interactions of climate change with vegetation cover and fire regimes should be understood and appropriately considered in the planning and implementation of fire use.**

Aspects of the principle include but are not limited to:

- defining the impacts of regional climate change on ecosystem properties and fire regimes;
- modifying fire management plans and policies to take into account observed and anticipated changes in fuel and vegetation type, burning conditions and additional fire risk as a result of climate change;
- utilizing forest and other fuels for energy production, with the dual goals of reducing the threat from fire and the consumption of fossil fuels;
- maximizing the storage of carbon in ecosystems – especially during restoration of degraded ecosystems – without increasing the likelihood of unwanted fire risk and promoting the regeneration of carbon sinks;
- minimizing greenhouse gas emissions that occur as a result of large-scale, unwanted fire by restoring and maintaining ecologically appropriate fire regimes;
- minimizing and mitigating the short- and long-term consequences of fire-induced vegetation depletion, such as soil erosion, landslides, floods, waterway pollution and desertification.

#### Principle 7: Fire effects on ecosystems

**Fire should be managed in an environmentally responsible manner to ensure properly functioning and sustainable ecosystems into the future.**

Aspects of the principle include but are not limited to:

- maintaining or restoring appropriate fire regimes to enhance the vigour and diversity of populations of species and communities of native flora and fauna in fire-dependent ecosystems;
- protecting fire-sensitive ecosystems;
- recognizing that strategically placed, planned burning with some short-term negative environmental impacts may be necessary for long-term landscape and community asset protection;
- applying principles of environmental management and care to the prevention of environmental disturbances resulting from fire management activities;
- planning fire preparedness and suppression operations within a holistic landscape view that considers archaeological, historical, cultural and traditional heritage values;
- promoting the re-establishment of ecological processes, with the restoration of native flora and fauna that may have been compromised, damaged or eliminated by fire suppression actions;
- minimizing and preventing the introduction and spread of pest or invasive plants and animals, plant diseases, insect pests and biological contaminants after fires or fire suppression activities;
- conducting planned burns in a manner that minimizes the spread of unwanted alien species and promotes or re-establishes natural or other preferred species.

## 3.4 Institutional

### Principle 8: Legislation and governance

**All fire management activities should be based on a legal framework and supported by clear policy and procedures.**

Aspects of the principle include but are not limited to:

- using the principles and strategic actions as a basis for developing and implementing national or local legislation;
- implementing all aspects of the principles and strategic actions appropriate in each fire regime;
- developing guidelines for planned burning that fit within the legal framework and policies;
- recognizing that implementation of the strategic actions may impact on, or be impacted by, other sectors, such as forestry, agriculture, conservation and protection of the environment, air-quality management, climatology, hydrology and broader land-use management, and emphasizing coordination with those sectors.

## Principle 9: Multistakeholder approach

**Successful fire management requires participatory approaches to leadership and management that are appropriately shared by public and private landholders, the fire services and communities of interest.**

Aspects of the principle include but are not limited to:

- minimizing the incidence of unwanted, human-caused fires;
- meeting integrated land management objectives such as safety and environmental and resource management;
- recognizing the leadership role of land managers in fire and other land-use issues;
- ensuring a coordinated approach to effective fire management in areas where multiple organizations and stakeholders have responsibilities and interests in the fire programme;
- recognizing and using the knowledge, leadership and expertise of local citizens and community groups;
- involving community members at the local, subnational, national, regional and international level to ensure that processes are open and accessible to people of different backgrounds and cultures (especially indigenous and traditional rural communities);
- encouraging cross-sectoral participation in the development and implementation of plans, including community members, land managers, fire agencies, emergency services, enforcement and medical agencies, non-governmental organizations and the media;
- acknowledging that fire management plans and fire occurrence at the local level can have international and global impacts on the environment;
- understanding the different backgrounds and roles of the urban, structural fire services and the land management and rural fire services, and utilizing each of them to the best advantage, based on the strengths of each;
- training and equipping volunteer groups, community members and rural workers in order to enhance their role and effectiveness in fire management activities.

### 3.5 Enhanced fire management capacity

## Principle 10: Cooperation

**Few nations and no single agencies or communities have the ability to manage every situation. As fires routinely affect multiple**

## **jurisdictions, agencies should develop cooperative arrangements to mitigate transboundary impacts.**

Aspects of the principle include but are not limited to:

- encouraging the use of common terminology, systems and standards to enhance international cooperation;
- promoting an ongoing exchange of knowledge, technology and resources to facilitate rapid international response to fires;
- participating in international organizations, networks, fora and activities to enhance domestic and international capacity and rapid international response;
- using available guidelines and examples of successfully implemented agreements as a framework for the development of binding and non-binding international instruments.

## **Principle 11: Knowledge transfer**

### **Access to and appropriate application of knowledge are essential in all fire management activities.**

Aspects of the principle include but are not limited to:

- engaging in quality scientific research for the creation of new knowledge and confirming the utility of firefighters' practical knowledge in order to support the creation or improvement of policies, regulations, guidelines and practices;
- developing a two-way flow of information so that local knowledge of the environment and the historical uses of fire can be considered and used by managers and researchers;
- providing appropriate knowledge and skills development for personnel involved in fire activities to render them competent for their roles and tasks;
- incorporating effective communication and providing community education on fire management issues in order to enhance community preparedness and response;
- collecting traditional, local knowledge and using that knowledge in appropriate aspects of the fire management programme;
- communicating to members of local communities and communities of interest that properly applied and managed fire can result in positive ecological, cultural and economic benefits;
- translating scientific, research and technical materials and making them accessible, at the appropriate technical level, to local managers, firefighters and communities.

## 4. Strategic actions

The strategic actions are intended to assist planners and managers, landholders, local groups and communities of interest in the holistic management of fire. They can also be used as a checklist to assess organizational capacity.

### 4.1 Fire and resource management planning

Fire and resource management planning should be based on a legal, institutional and policy framework. This framework provides the basis and structure for strategic and tactical planning and implementation actions.

The legal framework comprises broad, multisectoral resource management plans. These plans elaborate the management, protection and restoration of land and resources. Generally, a resource management plan does not determine the use or designation of an area, but sets out the activities and procedures that will be used to fulfill the legislative, institutional or individual mandate.

A fire management plan is one level below the resource management plan, although it is possible to develop the former without the latter in place. The fire management plan should address all actions listed within this section. In some situations, it may be best to develop individual plans for selected sections, such as fire prevention or the use of planned fire. However inclusive the fire management plan is, safety should be a principal component.

In areas in which the climate is marked by wide variation, planning for extreme events is important. Resource allocation, prioritization and community engagement during periods of severe fire danger are keys to protecting civilians and assets.

Strategic actions for fire and resource management planning include but are not limited to:

- 4.1.1 All fire management plans and activities should be based on a clear and comprehensive policy, legal and institutional framework.
- 4.1.2 Plans should be prepared at an appropriate level of detail for every aspect of fire management, including use, prevention, fuel management, detection, initial attack, large-fire suppression and restoration.
- 4.1.3 A policy should be established that sets the safety of firefighters, fire managers and the public as the highest priority.

4.1.4 In areas where multiple agencies or organizations have fire management responsibilities, a process should be developed to determine, in advance of a fire, who will assume the lead role and duties.

4.1.5 Resource management plans should include analysis of the actions that increase or decrease the risk and hazards affecting fire behaviour, fire damage or benefit, as well as impacts on the safety of firefighters, fire managers and the public.

4.1.6 Plans should be based on the types of ecosystems, potential fire effects, fire regimes, and social, economic and environmental values.

4.1.7 Plans should provide for infrequent but potentially damaging events and should include analysis, planning and identification of the resources and potential operational actions required.

4.1.8 Plans should be based on climate, realistic weather forecasts and the effect on fire behaviour and suppression effectiveness and should include maps indicating forecast fire danger.

4.1.9 Organizations, agencies, governments and communities should develop a process for involving local communities, communities of interest and others when preparing resource and fire management plans, including their involvement when fire threatens.

4.1.10 Plans should provide for a system of monitoring and evaluation, including a feedback process for amending or adapting the plans based on evaluations or changing conditions.

## **4.2 Fire management in natural or protected areas and reserves**

Fire management actions can be applied to all types of forests and woodlands and to areas designated for production, conservation, cultural activities or as protected areas and reserves. The same general approach to fire management planning should be followed in all areas. However, the specific management objectives for each environment must be taken into account and, as a result, the operational standards and actions may vary.

The key consideration in these areas is formulation of strategic actions for the management and protection of each area. Endangered or threatened species, indigenous values and sacred sites, water reserves for communities, and scenic and recreational areas all have social, economic or non-economic values that must be considered in the development of fire management plans.

Protected areas may require special consideration in the planning for fire suppression actions, and fire personnel may be required to use specialized tactics and suppression techniques in these areas. In many sensitive areas, the

use of heavy, mechanized equipment can be damaging to the environment and can disturb the special values of the area more than the effects of a fire. In all cases, a balance should be reached in the right amount and kind of fire, the right types of prevention and response and the impacts on the area and on adjacent areas.

Strategic actions for fire management in natural or protected areas and reserves include but are not limited to:

4.2.1 Fire plans and guidelines should identify the unique character of and objectives for the area, considering the role that fire plays in restoring or maintaining that special character.

4.2.2 In areas that require periodic fire to restore or maintain the character of the area, the likelihood that fire will impact other resources, communities and people outside the area should be taken into account.

4.2.3 Consideration should be given to using appropriate fire management actions that will not adversely impact surrounding areas, assets or sustainable livelihoods.

4.2.4 Plans, guidelines and operational procedures should be developed with a view to mitigating any unwanted or damaging impacts from planned burning in these areas.

4.2.5 Care should be taken to ensure that invasive plants or diseases are not introduced through fire suppression actions and the use of fire equipment and machinery.

4.2.6 When fires occur in fire-intolerant areas, or when a particular fire incident is uncharacteristically severe or damaging, suppression tactics should be planned and implemented with a view to mitigating damaging effects on the protected area from crews, equipment and suppression actions.

4.2.7 Where fire-dependent natural areas or reserves are located adjacent to valuable commercial or agricultural areas, detailed plans should be developed to ensure that the unique character and value of the areas can be maintained, while limiting the impact on adjacent areas.

### **4.3 Fire awareness and education**

Fire awareness and educational activities can be very effective in involving the community and other groups in a fire management programme and in engaging the community as a responsible partner. A well-informed public will be more likely to use fire carefully and to adhere to policy and legal boundaries. It can assist in the prevention, detection and reporting of fires, work with fire personnel to control unwanted fires, and provide a source of local and traditional knowledge.

A programme of awareness and education can be provided to schoolchildren through a structured set of lessons and learning objectives. Other programmes should be developed for adults and communities to educate and to communicate changes in policy or in the understanding of the role of fire and the impact of unplanned fires on ecosystems and resources. Successful media campaigns, based on sound technical knowledge and research, have used print media, radio and television to spread a message of fire prevention and the proper use of fire, as well as to warn of situations of elevated fire danger in which extreme fires might occur.

Strategic actions for fire awareness and education include but are not limited to:

4.3.1 Fire awareness and educational programmes should be developed and targeted to specific audiences and communities.

4.3.2 Programmes should be sensitive to the cultural and social norms of the community, including the application of fires to agricultural, forestry, biodiversity and traditional uses or to other basic needs.

4.3.3 Fire awareness and educational materials should be gender sensitive and should reflect local literacy levels, including oral presentation where printed material or local language barriers limit effective communication.

4.3.4 Age-appropriate information and educational materials should be developed cooperatively by technical experts and educational specialists and provided to all levels, introducing ecological and fire management concepts into local schools.

4.3.5 Primary and secondary schools, universities, non-governmental organizations and other institutions should be encouraged to develop locally and ecologically appropriate fire management programmes for teachers and other educators, based on local conditions and beliefs.

## 4.4 Fire prevention

Fire prevention may be the most cost-effective and efficient mitigation programme an agency or community can implement. Preventing unwanted, damaging fires is always less costly than suppressing them. Prevention programmes that are accepted and promoted within the community not only reduce costs and resource damage, but also promote understanding of the role and impact of fire in the ecosystem.

Fire prevention applies to human-caused ignitions and requires a combination of community education, effective prevention programmes and enforcement of laws or regulations. In fire-dependent ecosystems and cultural areas, allowing some fires to burn within defined parameters may be beneficial,

although letting human-caused fires burn with the objective of benefiting the ecosystem may complicate attempts to enforce prevention regulations.

In many parts of the world, planned fire is included as a component of fire prevention. It can have a very significant and beneficial impact on reducing fire severity and damage and it assists firefighters in suppressing fires. It also has many benefits for ecosystem sustainability, maintenance and restoration. In order to emphasize the role fire plays in sustaining and restoring ecosystems, planned fire is addressed in section 4.13.

Strategic actions for fire prevention include but are not limited to:

4.4.1 In areas in which objectives require minimizing the number of fires and the area burned, a comprehensive prevention plan should be developed.

4.4.2 Prevention plans should take into account traditional uses of fire, be based on laws or regulations restricting fires and involve local community leaders and organizations.

4.4.3 Data should be collected on a monthly and annual basis on frequency, specific causes and locations of human-caused fires, reasons for starting the fires, and area burned in order to establish an effective prevention programme.

4.4.4 Fire prevention programmes should include information on the need to use and manage fire in certain situations.

## 4.5 Fire danger rating and early warning systems

Fire danger rating systems have long been used to determine the level of fire danger and provide early warning of the potential for serious fires. Rating systems use basic daily weather data to calculate wildfire potential. By using forecasts, early warning can be provided many days in advance of a significant fire event.

Locally generated early warning information may be more useful in that it reflects local weather characteristics and vegetation conditions. Active involvement of local communities in collecting fire-weather information and disseminating warnings will create ownership and increase local responsibility and the efficiency of the early warning system.

Forest and land management agencies, landowners and communities benefit from an early warning system that identifies critical periods of extreme fire danger in advance of their occurrence. Such early warning, particularly if delivered with high spatial and temporal resolution that incorporates measures of uncertainty and the likelihood of extreme conditions, allows fire managers

to implement fire prevention, detection and preparedness plans before fire problems begin.

Strategic actions for fire danger rating and early warning systems include but are not limited to:

4.5.1 Countries or organizations should establish a fire danger rating system or adapt an existing system to the local environment, based on land cover, vegetation and daily weather data.

4.5.2 Countries or regions should install a national or regional early warning system, using existing, demonstrated science and technologies and based on a local fire danger rating system.

4.5.3 An information network should be developed to provide reliable early warning of fire danger quickly to local authorities, landowners and communities and to take advantage of established community networks.

## **4.6 Fire preparedness, including technical training**

Fire preparedness covers detection and response to fires. Preparedness includes training, equipping and staffing prior to the start of a fire. An effective fire preparedness programme should be based on fire and resource management planning and should take into account year-to-year variations in funding, weather and human activities. Properly trained and equipped personnel at the proper locations will increase the effectiveness of any programme.

Training is a key part of preparedness and readiness. The safety of firefighters is dependent on their understanding of fire characteristics and the local weather. Training in the effective use of equipment and fire suppression techniques is also important, while for supervisors and managers, training can help them better understand and effectively deploy a complex range of resources.

Providing proper equipment to firefighters is basic. Personal protective equipment such as helmets, gloves, fire-resistant clothing and safety boots should be considered an essential requirement of the programme. The tools used must enter within the financial resources of the programme, but they should be appropriate to the customs of the firefighters and effective in the local ecosystem.

Strategic actions for fire preparedness include but are not limited to:

4.6.1 Preparedness plans should include all activities to be undertaken prior to the start of a fire.

- 4.6.2 Safety considerations, both for firefighters and the public, should be a key component of any preparedness plan.
- 4.6.3 Plans and implementation should be based on an effective and cost-efficient mix of resources and organizations.
- 4.6.4 Plans should take ecological considerations into account, such as the impact of suppression actions on the environment and the role of fire in the ecosystem or in cultural areas.
- 4.6.5 Plans should include processes and procedures to assess risk and hazard and to determine appropriate response and mitigation actions.
- 4.6.6 Plans should be based on predicted fire risk, and staffing and availability levels identified that correspond to the level of risk.
- 4.6.7 Plans should assess the capabilities of remote communities and individuals living in outlying areas to protect their own assets and assist fire services in all phases of fire management.
- 4.6.8 All training should be appropriate to local ecological, social and political conditions and should be delivered to the same standard for full-time, paid, volunteer or other rural workers for the expected fire characteristics.

## 4.7 Pre-fire-season activities

Additional activities need to be undertaken prior to the beginning of the fire season. These could be characterized as preparedness actions, but are differentiated from the previous section, which generally deals with actions to prepare resources. These pre-fire-season activities involve cooperative action with collaborators, contractors and other groups or organizations in support of the fire management programme. In many areas in which there is no clearly defined fire season, these activities will take place prior to predicted periods of elevated fire danger.

In many situations, entering into a formal agreement will provide a clear understanding of the roles and responsibilities of all partners. The agreement can take the form of an enforceable contract or it may be a memorandum of understanding that states the general areas in which cooperation and coordination will take place.

The holding of annual meetings can be specified in the agreement. This can be a very effective method of communication, ensuring that all parties receive consistent information and come to agreement. The annual meeting can be expanded to include exercises and simulations, test communications equipment and practise fire suppression techniques. Using a planned, cooperative approach will guarantee that consistent, complete information is

provided to all personnel. See Annex 3 for an overview of items to be considered in preparing an agreement.

Strategic actions for pre-fire-season activities include but are not limited to:

4.7.1 All parties to an agreement should hold an annual pre-fire-season meeting to review the agreement and discuss changes and improvements to the annual operating plan.

4.7.2 Civilians, collaborators and other affected members of the public should be informed of plans and procedures that provide for or enhance public safety.

4.7.3 Arrangements with landowners should be established if access through their property might be required for fire management activities, including fire detection.

4.7.4 Agreements should be concluded with utilities, transportation agencies and other sectors that might be damaged by fire or fire suppression actions. These should include actions to be taken by the collaborators in support of the fire suppression effort or to protect firefighters and the public.

## 4.8 Fire detection, communications and dispatching

Fire detection is an important part of an effective fire management programme. It can be accomplished in a variety of ways: satellite imagery, fire observation towers, aerial surveillance, lightning detection systems, or monitoring and reporting of fires by the local population. When local residents understand the risk and damage from unwanted, severe fires and participate in a community-based fire management programme, they are a very effective part of the overall system.

Once fires are detected, effective communications are needed to provide firefighters and managers with information on the location, size and burning conditions. Dispatch centres, equipped to operate with backup energy sources, receive information on fire ignitions and locations, alert fire suppression personnel and dispatch them to individual fires. Dispatchers provide regular communications to firefighters on changes in weather forecasts, fire behaviour, strategy and incident command structure. They monitor the fire situation and receive orders from the incident controller or commander for additional and backup resources.

Communication with the public is needed to inform them of the fire status and of threats to the community. Local media – radio, television and the press – as well as other traditional methods and emerging technologies of information dissemination need to be part of the total communications plan.

Strategic actions for fire detection, communications and dispatching include but are not limited to:

- 4.8.1 A robust fire detection system should use an appropriate combination of remote sensing, established land- or water-based locations, aerial routes and private citizen and rural community networks.
- 4.8.2 A public communications system should be in place for the reporting of fires by private citizens and agency personnel and for alerting managers, supervisors, landowners and citizens.
- 4.8.3 A dispatch and communications system should be in place to determine the appropriate response to a reported fire, mobilize and support initial-attack and backup fire suppression resources, and provide appropriate information to responders, volunteers, landowners and others involved in the incident response.
- 4.8.4 A communications plan should be developed and translated into local languages to inform the public of threats and potential severe conditions and to provide prevention messages.

## 4.9 Initial attack/action

The initial attack is the first phase of fire suppression. The success of the entire fire management programme may be reflected in the success or failure of this phase of any fire. If the initial attack is successful, most other programme elements will also be successful. Without planning, policies, prevention, fuel management, community involvement and detection, the initial-attack phase will not succeed.

Initial-attack strategies and tactics should be designed to fit the local situation. Strategies based on local conditions, objectives for the area and budgets will determine the number, type, kind and location of a mix of resources: crews, engines, aircraft and other mechanized equipment. The fire management plan will provide firefighters with instructions on how fires are to be fought, whether some are to be allowed to burn to benefit the environment and resources, and what tactics and strategies should be used to protect ecosystems.

Tactics employed for an individual fire should follow policies for the area and be part of the fire management plan. Each action should be based on expected fire behaviour and the difficulty encountered in controlling the fire, as well as on the availability and effectiveness of local forces. Not only is this strategically important, it is critical to the safety of the firefighters and the general public.

There are several ways to provide for an initial-attack capability. Individuals, either by choice or because of the lack of any other fire protection service, can take on the responsibility using their own assets. Groups or agencies can be formed, funded, staffed and equipped by a government or other organization. Members of local communities can be established as a response group and be trained to be the first responders to fires. This can be an effective and efficient system. Volunteers may be part of an organization with a small core of permanently employed staff that perform maintenance and readiness activities. No matter how the initial-attack crews are provided, adequate training and planning should be part of a programme in which safety is the first consideration in all plans and actions. These crews and resources should use an operational system, such as ICS, that is flexible and can expand to manage fires that become larger and more complex (Annex 2).

Strategic actions for initial attack/action include but are not limited to:

- 4.9.1 The initial-attack organization should be properly trained, equipped, supported and staffed to meet local requirements.
- 4.9.2 All initial-attack actions should be based on the resource, cultural, economic and ecological objectives and policies for the area, including the appropriate use of tactics and equipment.
- 4.9.3 The initial-attack organization should utilize local resources, if possible, in order to build support within the community for fire management policies and plans and to gain from local knowledge and experience.
- 4.9.4 The initial-attack organization should have access to communications systems to receive timely information on fire starts, locations and status from official sources and from the public.
- 4.9.5 The initial-attack organization should be trained and prepared for the transition activities required when fires escape and become larger, requiring large-fire suppression strategies and tactics to be formulated and applied across the incident.
- 4.9.6 Based on the requirements of the legislative framework, the initial-attack organization should be prepared for non-fire activities, such as protecting private citizens and directing evacuation, and should be trained in rescue and emergency medical procedures.
- 4.9.7 The initial-attack organization should be trained to collect data and prepare evaluations and reports in order to improve organizational effectiveness and to work with the media in keeping citizens informed.

## 4.10 Large-fire suppression and management

In many ecosystems, fires tend to become large due to an increase in fire intensity and rate of spread or area involved. When initial-attack resources are unable to contain the fire, a transition from initial to extended attack occurs as the fire continues to burn. A low-intensity, slow-spreading fire that is easily suppressed can transform itself quickly when environmental or meteorological conditions change. Initial-attack resources may be unable to manage the fire due to inexperience and lack of training, or simply because they are few in number and are overwhelmed by the magnitude of the fire.

Management of large fires can be very different during the transition from the initial- to the extended-attack phase of fire suppression. A 'large-fire event' is not defined so much by the size of the fire as by the duration and complexity. A fire in grasses and light fuel can spread to a relatively large size very quickly, but the suppression techniques may not be different from those of a very small fire. A fire that burns out quickly and does not exceed the capability of the initial- or extended-attack organization may not require a change in strategy or tactics.

While the complexity of the situation may require that fire suppression personnel shift from the initial or extended attack to a large-fire event, the agency should attempt to develop a system that does not require a complete change in management and organization. ICS was specifically developed to be used on any type of incident at any level of complexity and is an effective fire management tool.

At this point in a large-fire response, crews and supervisors may be challenged to use unfamiliar strategies and tactics and to implement a logistics and planning organization at a new and larger scale. All of this will be further complicated if communities and resources are threatened or destroyed and people are forced to evacuate.

Strategic actions for large-fire suppression and management include but are not limited to:

4.10.1 Plans and procedures should be established for large-fire suppression based on expected size, duration and complexity.

4.10.2 An extensive process should be in place to gather intelligence and information on all aspects of a large fire in order to ensure effective planning, strategy formulation and community involvement.

4.10.3 A versatile and expandable management system, such as ICS, should be used to manage fires of all sizes and complexities in order to minimize confusion and risk during transition periods.

4.10.4 Pre-fire-season agreements should be prepared that provide for assistance during large fires when local resources are fully committed.

4.10.5 A process of review, evaluation and training should be in place so that personnel recognize the conditions under which a large fire is likely to occur and ascertain that prompt and adequate steps are taken in anticipation of the event.

4.10.6 Plans should contain provisions for evaluating large fires to determine if some or all of the fire can be managed in a manner that benefits the ecosystem, reduces the risk to fire suppression personnel and minimizes costs.

4.10.7 Plans should include risk analysis of the probability and consequences of failure in meeting plan objectives.

## 4.11 Managing multiple incidents

Some of the most difficult and complicated situations occur when multiple fires start simultaneously or when additional fires are discovered before the initial ones are brought under control. This situation is further complicated when the fires occur across several jurisdictions with different legislative or institutional management objectives. These cross-boundary incidents can impact local jurisdictions as well as national boundaries.

During periods of multiple fires, fire suppression resources may be depleted, requiring managers to allocate resources based on priorities and potential threats. Often the priorities for protection are widely varied, which makes it difficult to determine where fire suppression resources should be deployed. Moreover, these decisions are often made without access to adequate information. Setting up procedures in advance reduces the risks to health and safety and the potential damage to resources and communities.

In addition to preplanning these actions, an effective way to manage priority-setting during multiple incidents is to have established a coordinating group beforehand composed of senior managers from the agencies and organizations involved, including community groups. This group will meet during the emergency to set priorities and agree on critical areas of concern. However, it should also meet throughout the year to confer on all aspects of interagency or international concerns, such as standards, objectives, priorities and procedures for coordination and mutual assistance during emergencies.

Another important factor would be agreement to use ICS and to expand its scope as the number of fires increases and the impact expands to more jurisdictions. The ability to continue the same management structure at any level of complexity is important in critical periods.

Strategic actions for managing multiple incidents include but are not limited to:

4.11.1 Prior to the start of the fire season, plans should be developed that provide for the management, resource-allocation, prioritization and other transboundary actions required during multiple incidents.

4.11.2 A group of senior management personnel representing each jurisdiction involved should be established to decide protection and resource-allocation priorities through coordinated management direction and policy implementation.

4.11.3 Consideration should be given to the possibility that additional fires will start and to the allocating of suppression resources so as to reduce the potential of additional large and damaging fires occurring in critical areas.

4.11.4 Through the use of ICS in all jurisdictions and in response to any type of fire or other emergency, the agencies, groups and other organizations involved will acquire the experience to effectively use the system in transboundary and multiple fire situations.

## 4.12 Fuel management

In this section, 'fuel management' refers to all methods of fuel treatment and alteration for any purpose: fire risk reduction, community protection, ecosystem restoration and debris removal following logging or another activity. Mechanical treatments are those methods of moving, altering the arrangement, compacting or any other manipulation of the fuel by either mechanized equipment or using crews to accomplish the work manually. Any activity that changes the arrangement or composition of the fuel should be considered in the fuel treatment programme. The application of chemicals and resource management activities such as grazing and timber harvesting will change the fuel bed. These actions should be planned and implemented in full consideration of the potential to change fire intensity, spread and potential damage.

One other example in which fuel treatment activities can be an important part of a programme is in those areas in which homes and other buildings are adjacent to fire-prone vegetation. Homeowners can use a variety of methods to remove brush and debris from areas around homes – including carefully planned and implemented fires. Removing this combustible material will increase the chances that homes and communities will survive a fire. While

fuel treatment activities may not reduce the occurrence of a fire, they will almost certainly reduce the intensity and thus increase the effectiveness of fire suppression tactics.

Strategic actions for fuel management include but are not limited to:

4.12.1 A fuel management programme should be part of a complete fire management programme.

4.12.2 A fire management programme should include fuel treatment activities to facilitate effective fire suppression and protection of communities and resources.

4.12.3 A fuel reduction programme should consider the potential uses of debris and vegetation and, where appropriate, encourage local communities to use wood for fuel and perhaps grasses and shrubs for grazing or other community needs.

4.12.4 Plans to use mechanized equipment should assess the potential damage from the equipment and seek to mitigate this potential or ensure that the benefits outweigh the potential risks.

## 4.13 Planned fire

‘Planned fire’ is the deliberate use of fire to meet specific management objectives. The fuel can be live or dead. Some areas categorize planned burning done to protect communities as a prevention activity. While that is a valid description of that situation, all types of planned fire are covered in this section.

Planned fires are a very effective way to remove unwanted vegetation for a variety of objectives. Fire as a tool for agriculture, forestry, animal husbandry and land clearing is well established and commonly practised throughout the world. It is also important in maintaining healthy fire-dependent ecosystems. In these ecosystems, natural fire has a beneficial role and should be encouraged or managed as part of the total fire management programme.

The ecosystems and cultural areas in which fire is common can be very resilient to its effects. Flora may be rejuvenated by fire, rather than being displaced or destroyed, and consequently the fauna that depend on it as well. If the goal is to maintain or restore sustainable ecosystems and cultural areas, then a programme to allow burning for restoration and rehabilitation should be part of the overall fire management plan.

A critical part of any planned burning programme is mitigating the effects of smoke. An effective smoke management programme will be crucial in areas with legal mandates to provide clean air and protect citizens from respiratory

threats. Partnership with the weather forecasting service may be important, since the service can issue forecasts specifically designed to provide guidance on the likely airshed impacts from specific burns. Such advice would assist the manager conducting the burn.

Strategic actions for planned fire include but are not limited to:

4.13.1 Impacts on human health and air quality should be considered when conducting planned burns.

4.13.2 Prior to the reintroduction of fire, plans should include consideration of the impacts of long-term fire exclusion on resources, vegetation and ecosystem and human health.

4.13.3 Based on the complexity and potential risk, planned burns should be undertaken only after plans have been developed that consider operational procedures for safe work practices, predicted environmental effects and the expected fire behaviour needed to produce the predicted effects.

4.13.4 The results of the burns should be monitored and recorded and used to revise operating plans, procedures, environmental parameters and contingency plans.

4.13.5 A contingency plan should address the potential of fires to escape and damage resources, property, habitats and communities or to threaten the safety of agency personnel or private citizens.

## **4.14 Burned area restoration and rehabilitation**

There are immediate rehabilitation actions that can be undertaken in conjunction with fire suppression actions. A fire line constructed along a steep slope may be very prone to erosion and further damage if immediate steps to interrupt the flow of water are delayed. Fire suppression actions may damage the environment and may need to be avoided. Many actions that are effective in stopping a fire can severely impact other resources, such as soils, wetlands, habitats and vegetation. The impacts are often long term or can promote the spread of disease, weeds and other exotic pests.

Replanting and reseeding of sensitive areas can stop an invasion by exotic and invasive species that would take advantage of a large expanse of exposed soil. In this case, the presence of the exotic species in the ecosystem may require actions that are unnecessary in areas without this species.

Engaging suppression crews in rehabilitation activities can have the advantage of teaching them which suppression techniques are most damaging to the ecosystem and, in some cases, make possible the implementation of mitigation measures in conjunction with suppression actions. For example, a

crew using hand tools to construct fire lines can construct water bars along the fire line at the time of initial construction, which will reduce the potential for erosion.

In planted or natural forests in which commercial activities are planned, economic considerations may dictate an aggressive salvage and removal programme for damaged timber or other products and an extensive reforestation plan. In the context of the management plan for the area, economics may be the overriding consideration when communities are dependent on forests as a source of revenue and livelihoods.

Strategic actions for burned area restoration and rehabilitation include but are not limited to:

4.14.1 Every burned-area rehabilitation and restoration plan should be based on the planned or natural fire regime for the area and should include actions that facilitate a restored, healthy sustainable ecosystem or cultural area.

4.14.2 Every fire suppression plan should consider the need for immediate corrective action that will mitigate further damage resulting from the suppression, such as constructing fire breaks or other disturbance activity.

4.14.3 Where natural processes are not expected to provide adequate regeneration, rehabilitation plans should be developed that use plants, trees and grasses native to the ecosystem and that will not cause damage or unexpected consequences.

4.14.4 Care should be taken to ensure that seed sources are reasonably free from contaminants such as seeds of invasive species.

## 4.15 Monitoring and assessment

Monitoring and assessment are important at several levels. Monitoring of the effects of both fires and suppression activities is needed in order to achieve a balance between stopping the fire and protecting the resource. Monitoring the effectiveness of the fire organization will help managers determine if the programme is working. Cost/benefit assessments are useful in assessing the effectiveness of various types of resources.

Effective monitoring and assessment of the prevention programme can reduce the occurrence of specifically identified types of fires and the costs of suppression.

Strategic actions for monitoring and assessment include but are not limited to:

4.15.1 A comprehensive plan for monitoring and assessing all aspects of the fire management programme should be implemented.

4.15.2 A safety programme, including analysis of near-miss incidents, accident reports and a review of lessons learned, should be implemented and monitored to reduce the risk to firefighters, fire managers and the public.

4.15.3 Information and data from the fire prevention programme should be used to develop a monitoring system that measures the effectiveness of fire prevention efforts.

4.15.4 A programme should be implemented to monitor the ecological effects of fire and of suppression methods and it should include cooperation with universities, other research organizations and local communities.

## Bibliography

The following bibliography does not intend to provide an all-embracing list of sources. Rather it aims to facilitate the search for literature on fire ecology, history, management and related fields such as atmospheric chemistry, climatology and remote sensing. The list includes major monographs, sourcebooks and several peer-reviewed journal publications, with references to a broad secondary literature, and well as Internet portals facilitating a literature search.

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## Web portals on international cooperation in fire management

### General

[www.fire.uni-freiburg.de/](http://www.fire.uni-freiburg.de/)

### Glossaries

[www.fire.uni-freiburg.de/literature/glossary.htm](http://www.fire.uni-freiburg.de/literature/glossary.htm)

### Fire management guidelines

[www.fire.uni-freiburg.de/literature/Fire management.htm](http://www.fire.uni-freiburg.de/literature/Fire%20management.htm)

**International Association of Wildland Fire**

[www.iawfonline.org/](http://www.iawfonline.org/)

**Online publications, libraries and bibliographies**

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**U.S. fire information systems and software products**

[www.fire.org/](http://www.fire.org/)

**The Nature Conservancy Fire Initiative**

[www.tncfire.org/](http://www.tncfire.org/)

**Global Wildland Fire Monitoring Center (GFMC)**

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**Global Wildland Fire Summit**

[www.fire.uni-freiburg.de/summit-2003/introduction.htm](http://www.fire.uni-freiburg.de/summit-2003/introduction.htm)

**Global Wildland Fire Network**

[www.fire.uni-freiburg.de/GlobalNetworks/globalNet.html](http://www.fire.uni-freiburg.de/GlobalNetworks/globalNet.html)

**United Nations role in international cooperation in fire management**

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**International agreements for assistance in fire emergencies**

[www.fire.uni-freiburg.de/emergency/int\\_agree.htm](http://www.fire.uni-freiburg.de/emergency/int_agree.htm)



## Annexes

### Annex 1: Conventions, agreements and declarations

#### Conventions

- United Nations Framework Convention on Climate Change (UNFCCC);
- United Nations Convention to Combat Desertification (UNCCD);
- Convention on Biological Diversity (CBD);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1975);
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)
- Ramsar Convention on Wetlands (Ramsar, Islamic Republic of Iran, 1971);
- Other applicable rules of international law, including the respective obligations of governments pursuant to international agreements to which they are party.

#### United Nations declarations and statements

- Millennium Declaration (United Nations General Assembly, New York, 2000) to uphold human dignity, equity, poverty eradication, protection of the common environment, human rights, democracy, gender equality, good governance and the formation of a global partnership for development;
- Millennium Development Goals (MDGs – in the Millennium Declaration, New York, 2000), in particular Goal 1: Eradicate extreme poverty and hunger; Goal 3: Promote gender equality and empower women; Goal 7: Ensure environmental sustainability; and Goal 8: Develop a global partnership for development;
- Rio Declaration on Environment and Development and Agenda 21, adopted by the United Nations Conference on Environment and Development (UNCED – Rio de Janeiro, 1992), in particular Chapter 11 of Agenda 21 on combating deforestation;
- Intergovernmental Panel on Forests (IPF – 1995–1997) and Intergovernmental Forum on Forests (IFF – 1997–2000) proposals for action and the United Nations Forum on Forests (UNFF) recommendations (2000 to present);
- Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests (Forest Principles – UNCED, Rio de Janeiro, 1992)
- The Tehran Process (Tehran, 1999) on sustainable forest management in low forest cover countries (LFCCs);

- World Summit on Sustainable Development (WSSD, Johannesburg, 2002), in particular the Johannesburg Declaration on Sustainable Development, Commitment to Sustainable Development, paragraph 19: Fight against natural disasters; and the Plan of Implementation, Chapter IV: Protecting and managing the natural resource base of economic and social development;
- World Conference on Natural Disaster Reduction (Yokohama, Japan, 1994) and World Conference on Disaster Reduction (Kobe, Hyogo, Japan, 2005); Yokohama Strategy and Plan of Action for a Safer World (1994) and Hyogo Framework for Action (2005), both providing a framework of strategic and systematic approaches to reducing vulnerability to and risk of hazards.

## **Targeted declarations addressing fire research, management and policies**

The GFMC Web site for the 3<sup>rd</sup> International Wildland Fire Summit<sup>1</sup> includes the outputs of the summit, all preceding targeted decisions, recommendations and outputs of earlier international conferences and other background materials, notably:

- Recommendations of the fire community at the World Conference for Natural Disaster Reduction (Yokohama, Japan, 23–27 May 1994) (event within the United Nations International Decade for Natural Disaster Reduction)
- Declaration of the 1995 Chapman Conference on Biomass Burning and Global Change (Williamsburg, Virginia, USA, 13–17 March 1995) (sponsored by the American Geophysical Union)
- ECE/FAO/ILO Conference on Forest, Fire, and Global Change (Shushenskoe, Russian Federation, 4–9 August 1996)
- Second International Wildland Fire Conference (Vancouver, Canada, 25–30 May 1997) (hosted by the Forest Protection Branch, British Columbia Forest Service)

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<sup>1</sup> Fire Management and Sustainable Development: Strengthening international cooperation to reduce the negative impacts of wildfires on humanity and the global environment (Sydney, Australia, 8 October 2003 – [www.fire.uni-freiburg.de/summit-2003/introduction.htm](http://www.fire.uni-freiburg.de/summit-2003/introduction.htm)).

## Annex 2: Incident Command System

This annex is a condensed and modified version of Paper 3, The Incident Management System, adopted by the International Wildland Fire Summit (Sydney, Australia, 2005).<sup>2</sup>

The complexity of incident management, coupled with the growing need for multiagency involvement at incidents, has increased the need for a standard, interagency incident management system, not only within countries/states, but increasingly internationally. It is becoming ever more important to base international agreements on a common incident management system.

The Incident Command System (ICS) may need to be adapted to suit a particular country's existing political, administrative or cultural systems, customs and values. Where the primary purpose is to enhance emergency management within a country, such adaptations are not only beneficial, but may be essential to the adoption of the system. Given that ICS is a proven model in many countries, and given that training materials are freely available, there is considerable benefit to be gained by its adoption.

The ICS framework is an effective forum in which interagency emergency management issues can be addressed. By establishing a unified command of the respective agency/organizational representatives at a single interagency incident command location, the following advantages are achieved:

- One set of objectives is developed for the entire incident.
- A collective approach is taken to developing strategies to achieve incident objectives.
- Information flow and coordination are improved between all jurisdictions and agencies involved in the incident.
- All agencies with responsibility for the incident have an understanding of each other's priorities and restrictions.
- No agency's authority or legal requirements are compromised or neglected.
- Each agency is fully aware of the plan, actions and constraints of other agencies.
- The combined effects of all agencies are optimized as they perform their respective assignments under a single Incident action plan.

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<sup>2</sup> Dudfield, M. and Latapie, B. 2003. Outcomes of the International Wildland Fire Summit, Sydney, Australia, 8 October 2003, Part IV: Strategic Paper, Incident Command System (ICS). *International Forest Fire News*, 29: 15–19 (available at [www.fire.uni-freiburg.de/iffn/iffn\\_29/IWFS-3-Paper-3.pdf](http://www.fire.uni-freiburg.de/iffn/iffn_29/IWFS-3-Paper-3.pdf)).

- Duplication of effort is reduced or eliminated, thus reducing costs and the chance of frustration and/or conflict.

The ICS structure is based on the following principles:

- Common terminology: ICS terminology is standard and is consistent among all agencies involved.
- Modular organization: ICS structure can be scaled up to multiple layers that are implemented to meet the complexity and extent of the incident.
- Integrated communications: ICS requires a common communications plan, standard operating procedures, clear text, common frequencies and common terminology.
- Consolidated incident action plans: action plans describe response goals, operational objectives and support activities.
- Manageable span of control: a 'manageable span' is defined as the number of individuals or functions one person can manage effectively. In ICS, the span of control for any person falls within a range of three to seven resources, with five being the optimum.
- Designated incident facilities: these have clearly defined functions to assist in the effective management of the incident.
- Comprehensive resource management: the total resource is managed across all organizations deployed at an incident, including the maximizing of personnel safety.

The ICS incident organization structure is built around four major components:

- control – management of the incident;
- planning – collection and analysis of incident information and planning of response activities;
- operations – direction of resources in combating the incident;
- logistics – provision of facilities, services and materials required to combat the incident.

These four components are the foundation upon which ICS organization is built. They apply during a routine emergency, when preparing for a major event, or when managing a response to a major disaster. The ICS structure can be expanded or contracted to manage any type and size of incident.

## Conclusions

Safety, effectiveness and efficiency are achievable when a seamless integration of agencies is possible for a local-level incident as well as for international deployment to assist a country in need. A globally implemented ICS will improve firefighter safety, efficiency and effectiveness in management response. ICS provides the model for command, control and coordination of an emergency response. It is a means of coordinating the efforts of agencies as they work towards the common goal of stabilizing an incident and protecting

life, property and the environment. It also reduces the risk of agency overlap and potential confusion at an emergency owing to poor understanding and inadequate coordination.

It is critical that a common global incident management system is adopted, enabling any assistance to function quickly and effectively. ICS is the tool that can achieve that goal.

## Annex 3: International agreements template

This annex is a condensed and modified version of Paper 2, International Wildland Fire Management Cooperation Agreements Template, adopted by the International Wildland Fire Summit (Sydney, Australia, 2005).<sup>3</sup> It is an outline of issues to be considered when countries are developing international cooperative agreements. There may be other areas, as well, that need definition and consideration. The template is drawn from an annex of FAO (2004).<sup>4</sup> This FAO document provides excellent reference materials, which should be reviewed prior to entering into international agreements.

### Outline for international cooperative agreements

1. Parties to the agreement
  - includes governmental and non-governmental agencies and organizations at a variety of levels;
2. Purpose
  - defines areas and forms of cooperation;
  - defines the scope of the cooperation;
3. Definition of terms
  - defines terms used in the agreement;
4. Expenses and costs
  - defines how personnel costs will be set for payments;
  - defines how equipment cost use will be set;
  - sets the procedures, amount and criteria for reimbursement of costs;
  - Under certain agreements, all parties may agree to assist each other on a mutual aid, non-reimbursable basis.

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<sup>3</sup> Frey, T. and Vélez-Muñoz, R. 2003. Outcomes of the International Wildland Fire Summit, Sydney, Australia, 8 October 2003, Part III: Strategic Paper, International Wildland Fire Management Agreements Template. *International Forest Fire News*, 29: 10–14, (available at [www.fire.uni-freiburg.de/iffn/iffn\\_29/IWFS-2-Paper-2.pdf](http://www.fire.uni-freiburg.de/iffn/iffn_29/IWFS-2-Paper-2.pdf)).

<sup>4</sup> FAO. 2004. *Legal frameworks for forest fire management: international agreements and national legislation*. Follow-up report to FAO/ITTO International Expert Meeting on Forest Fire Management, March 2001. Forest Protection Working Papers, Working Paper FFM/3/E. Rome (available at [www.fao.org/forestry/site/firemanagement/en/](http://www.fao.org/forestry/site/firemanagement/en/) or [www.fire.uni-freiburg.de/emergency/int\\_agree.htm](http://www.fire.uni-freiburg.de/emergency/int_agree.htm)). (unpublished)

## 5. Information and coordination

- defines the protocols and methods for coordinating and exchanging information;
- defines the types, amount and timing of information exchange;
- sets the notification procedures for emergencies or for other significant events;
- defines methods of coordination and under what organizational structure the work will take place;

## 6. Liabilities, claims and compensation

- lists and defines how and when the cross-waivers and exemptions are used;
- lists and defines those areas or circumstances in which the exemptions do not apply;
- outlines remediation for third-party damage;
- defines the protocols and procedures for medical assistance and possible evacuation of injured personnel;
- defines the timing, levels and limitations of compensation for injury or death;
- defines privileges and immunities of the assisting personnel;

## 7. Operating plans/operational guidelines

- provides for operating plans/operational guidelines – Such plans and guidelines are a critical component of all cooperative agreements. They should be carefully crafted and reviewed by all parties to the agreement.

## 8. Border crossings

- sets protocols and procedures for border-crossing, immigration and customs procedures;

## 9. Link to disaster management plan for the receiving country

## 10. General provisions

- entry into force of the agreement – defines when agreement is activated;
- specifies how long the agreement will remain in force;
- defines how countries or organizations can withdraw from the agreement;
- defines under what circumstances the agreement will terminate;
- provides understandings and interpretations for countries and organizations concerning the circumstances and limitations under which each party is entering into the agreement;

- defines the method of dispute resolution;
- defines when and how amendments to the agreement may be submitted, reviewed and acted upon;

11. Standard operational procedures

12. Other provisions

- provides the opportunity for any country, agency or organization signing this agreement to define other areas of cooperation;

13. Participating countries/agencies/organizations signature page

- It is important that all potential participants review and confirm their authorities to sign such an agreement.

## Annex 4: Glossary

Many of the terms are from FAO and GFMC (2003),<sup>5</sup> with some additions or modifications to the original definitions.

### **Community-based fire management (CBFiM)**

Fire management approach based on the inclusion of local communities in the proper application of fire, fire prevention, and in preparedness and suppression of wildfires. CBFiM approaches can play a significant role in fire management, especially in most parts of the world where human-based ignitions are the primary source of wildfires that affect livelihood, health and security of people. The activities and knowledge that communities generally practise and apply are primarily those associated with prevention. They include planning and supervision of activities, joint action for prescribed fire and fire monitoring and response, applying sanctions, and providing support to individuals to enhance their fire management tasks.

### **Fire danger**

A general term used to express an assessment of both fixed and variable factors of the fire environment that determine the ease of ignition, rate of spread, difficulty of control and fire impact – often expressed as an index.

### **Fire danger rating**

A component of a fire management system that integrates the effects of selected fire danger factors into one or more qualitative or numerical indices of current protection needs.

### **Fire-dependent ecosystems**

Fire is essential in maintaining predominant ecosystem composition, structure, function and extent. If fire is removed, or if a fire regime is altered beyond its historical range of variability, the ecosystem changes to something else; dependent species and their habitats decline or disappear. Vegetation is fire-prone and highly flammable. Ecosystem structure and plant architecture facilitate fire spread. Boundaries between fire-dependent and fire-independent ecosystems are largely determined by the relative continuity of burnable fuels or probability of fire-enabling climatic conditions.

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<sup>5</sup> FAO and GFMC. 2003. *FAO wildland fire management terminology*, 1986, updated jointly with GFMC (available at [www.fire.uni-freiburg.de/literature/glossary.htm](http://www.fire.uni-freiburg.de/literature/glossary.htm)).

## **Fire hazard**

(1) A fuel complex, defined by volume, type, condition, arrangement and location, that determines the degree both of ease of ignition and of fire suppression difficulty; (2) a measure of that part of the fire danger contributed by the fuels available for burning. Fire hazard is worked out from their relative amount, type and condition, particularly their moisture content.

## **Fire-independent ecosystems**

Fires characteristically would not occur because of a lack of fuel and/or ignition sources. Fire regimes can be altered by a change in fuels (e.g. invasive species) or ecologically inappropriate human-caused ignitions.

## **Fire management**

All activities required for the protection of burnable forest and other vegetation values from fire, and the use of fire to meet land management goals and objectives. It involves the strategic integration of such factors as knowledge of fire regimes, probable fire effects, values at risk, level of forest protection required, cost of fire-related activities, and prescribed fire technology into multiple-use planning, decision-making and day-to-day activities to accomplish stated resource management objectives.

## **Fire management plan**

(1) A statement, for a specific area, of fire policy and prescribed action; (2) the systematic, technological, and administrative management process of determining the organization, facilities, resources and procedures required to protect people, property and forest areas from fire and to use fire to accomplish forest management and other land-use objectives (cf. fire prevention plan or fire campaign, presuppression planning, pre-attack plan, fire suppression plan, end-of-season appraisal).

## **Fire prevention**

All measures in fire management, fuel management, forest management, forest utilization and concerning the land users and the general public, including law enforcement, that may result in the prevention of outbreak of fires or the reduction of fire severity and spread.

## **Fire protection**

All actions taken to limit the adverse environmental, social, political, cultural and economic effects of fire.

## **Fire regime**

The patterns of fire occurrence, size and severity – and sometimes vegetation and fire effects as well – in a given area or ecosystem. It integrates various fire characteristics. A natural fire regime is the total pattern of fires over time that is characteristic of a natural region or ecosystem. The classification of fire regimes includes variations in ignition, fire intensity and behaviour, typical fire size, fire return intervals and ecological effects.

## **Fire season**

(1) Period(s) of the year during which fires are likely to occur and affect resources sufficiently to warrant organized fire management activities; (2) a legally enacted time during which burning activities are regulated by state or local authority.

## **Fire-sensitive ecosystems**

Ecosystem structure and composition tend to inhibit ignition and fire spread. The majority of species generally lack adaptations to respond positively to fire. Fire can influence ecosystem structure, relative abundance of species and/or limit ecosystem extent, or may occur naturally very infrequently or during extreme climatic events. Fire may create habitats for key species by creating gaps, regeneration niches or by initiating or affecting succession. If fires are too frequent or too large, they can be damaging and cause ecosystem shifts to more fire-prone vegetation. Some fire-sensitive ecosystems are also known as fire-influenced, particularly those adjacent to fire-dependent ecosystems.

## **Fire suppression**

All activities concerned with controlling and extinguishing a fire following its detection (synonyms: fire control, firefighting).

## **Fuel**

All combustible organic material in forests and other vegetation types, including agricultural biomass such as grass, branches and wood, infrastructure in rural or urban areas, which create heat during the combustion process.

## **Fuel management**

Act or practice of controlling flammability and reducing resistance to control of fuels through mechanical, chemical, biological or manual means, or by fire, in support of land management objectives.

## **Fuel reduction**

Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition, potential fire intensity and/or to lessen potential damage and resistance to control.

## **Incident Command System (ICS)**

A standardized, on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

## **Planned fire**

This term is synonymous with prescribed fire and has the same definition. A planned fire is a management-ignited fire or a wildfire that burns within prescription, i.e. the fire is confined to a predetermined area and produces the fire behaviour and characteristics required to attain planned fire treatment and/or resource management objectives. The act or procedure of setting a prescribed fire is called prescribed burning (cf. prescribed burning, prescribed fire).

## **Prescribed burning**

Controlled application of fire to vegetation in either their natural or modified state, under specified environmental conditions, which allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to attain planned resource management objectives (cf. prescribed fire). Note: this term has replaced the earlier term 'controlled burning'.

## **Prescribed fire**

A management-ignited fire or a wildfire that burns within prescription, i.e. the fire is confined to a predetermined area and produces the fire behaviour and fire characteristics required to attain planned fire treatment and/or resource management objectives. The act or procedure of setting a prescribed fire is called prescribed burning (cf. prescribed burning, planned fire).

## **Prescription**

Written statement defining the objectives to be attained as well as the conditions of temperature, humidity, wind direction and speed, fuel moisture and soil moisture under which a fire will be allowed to burn. A prescription is

generally expressed as acceptable ranges of the prescription elements and the limit of the geographic area to be covered.

### **Rehabilitation**

The activities necessary to repair damage or disturbance caused by wildfire or the wildfire suppression activity (cf. restoration).

### **Restoration**

Restoration of biophysical capacity of ecosystems to previous (desired) conditions. Restoration includes rehabilitation measures after fire or prescribed burning where certain fire effects are desired (cf. rehabilitation).

### **Risk**

(1) The probability of fire initiation due to the presence and activity of a causative agent; (2) a causative agent.

### **Smoke management**

The application of knowledge of fire behaviour and meteorological processes to minimize air-quality degradation during prescribed fires.

### **Wildfire**

Any unplanned and uncontrolled wildland fire that, regardless of ignition source, may require suppression response or other action according to agency policy.

## Annex 5: Publications available on fire management

### Fire Management Working Papers: Thematic Paper series

*Note:* In code “Working Paper FM/xx”, “x” indicates the WP series number and a suffix E, F or S indicates: E = English, F = French, R = Russian, S = Spanish. No suffix indicates E only.

**Available at the Fire Management Web site: [www.fao.org/forestry/site/35853/en](http://www.fao.org/forestry/site/35853/en)**

Working Paper FPF/1E	<i>Guidelines on Fire Management in Temperate and Boreal Forests.</i> November 2002.
Working Paper FM/2E	<i>International Wildland Fire Management Agreements Template.</i> Tom Frey, Ricardo Vélez Muñoz. January 2004.
Working Paper FM/3E	<i>Legal Frameworks for Forest Fire Management: International Agreements and National Legislation.</i> Fernando Fernández Arriaga, Frédéric St-Martin, Tom Frey, Ricardo Vélez Muñoz. March 2004.
Working Paper FM/4E	<i>Community-Based Fire Management in Spain.</i> Ricardo Vélez Muñoz. April 2005.
Working Paper FM/5E	<i>Report on Fires in the South American Region.</i> María Isabel Manta Nolasco. March 2006.
Working Paper FM/6E	<i>Report on Fires in the North East Asian Region.</i> Leonid Kondrashov. March 2006.
Working Paper FM/7E	<i>Report on Fires in the Baltic Region and adjacent countries.</i> Ilkka Vanha-Majamaa. March 2006.
Working Paper FM/8E	<i>Report on Fires in the Mediterranean Region.</i> A.P. Dimitrakopoulos and I.D. Mitsopoulos. March 2006.
Working Paper FM/9E	<i>Report on Fires in the Sub-Saharan Africa (SSA) Region.</i> Alexander Held. March 2006.
Working Paper FM/10E	<i>Report on Fires in the South East Asian Region.</i> B.J. Shields, R.W. Smith and D. Ganz. March 2006.

- Working Paper FM/11E *Report on Fires in the Balkan Region.* N. Nikolov. March 2006.
- Working Paper FM/12E *Report on Fires in the Caribbean and Mesoamerican Regions.* A.M.J. Robbins. March 2006.
- Working Paper FM/13E *Report on Fires in the Australasian Region.* P.F. Moore. March 2006.
- Working Paper FM/14E *Report on Fires in the South Asian Region.* A.M. Benndorf and J.G. Goldammer. March 2006.
- Working Paper FM/15E *Report on Fires in the North American Region.* R. Martínez, B.J. Stocks and D. Truesdale. March 2006.
- Working Paper FM/16E *Report on Fires in the Central Asian Region and adjacent countries.* Johann G. Goldammer. March 2006.
- Working Paper FM/17E, F, R, S *Fire Management: Principles and Strategic Actions. Voluntary Guidelines for Fire Management.* Forest Resources Development Service. December, 2006